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REAL Effective Exchange Rate, Revealed Comparative Advantage and Global Trade Potential of Pakistan

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Abstract: One of the key objectives of this research is to assess Pakistan trade potential based on panel data of 47 nations for the period 1995-2020. The Gravity model's short coefficients and Bound Cointegration long run are then used to determine a country's global trade potential among Low, Middle, and High Income Countries. Panel estimation has several benefits over cross section and time series data because it accounts for individual variation. The findings of cross-section and time-series studies that are not controlled for heterogeneity may consider skewed. Panel data, on the other hand, have greater variability, more degrees of freedom, and less multicollinearity across the explanatory factors, resulting in a higher estimate of econometric efficiency. Despite the fact that all three variables are statistically significant and have the expected signs, the GDP coefficient is substantially less than in the original model i.e., in the absence of per capita GDP. The rationale is self-evident. Between the explanatory variables, Gross Domestic Product and GDP per capita, Distance, Population and real effective exchange rate. The estimated results revealed from Gravity Model that overall regression specification in short run is robust and estimated coefficients are not spurious. Moreover, the long run coefficients are convergence in all cases and meaningful association observed among these nations with bilateral trade activities in Pakistan.

Keywords: Real Effective Exchange Rate, Balassa Revealed Comparative Advantage, Global Trade Potential, Pakistan

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1. Introduction

Foreign trade is one of the most dynamic factors to influence the process of economic development of any country. Exports and Imports are equally important to boost economic development (Frankel, 1998; Tripathi and Leitao, 2013). Trade plays an important role in the overall development efforts and economic growth of an economy (Eaton and Kortum, 2002; Crawford and Fiorentino, 2005). This may be considered, indeed, an important instrument for boosting the industrialization process of the economy while, higher foreign exchange reserves are also crucial for sustained economic development (Anderson, 1979; Anderson and Wincoop, 2003; Didier and Hoarau, 2013). Any country needs all kinds of raw materials, semi-finished and capital goods to enhance its production and, to enlarge export growth if these goods are not produced domestically (Bhagwati and Panagariya, 1996; Cernat, 2001). The trade's share depends upon the persistent and growing trade surpluses. The trade deficit has been one of the major economic issues for Pakistan for many decades. An empirical study by McCartney, M. (2011) concludes that Pakistan's exports increased significantly during Korean War in 1952-53. Secondly, Z.A Bhutto's government devalued Pakistani Rupees by 131% to protect domestic producers & exporters by imposing trade barriers on imports.

In the current era of trade and globalization, Pakistan's trading activities have been boosted up to 150 economies of the world. Pakistan's current GDP is USD 270.7 billion with 2.83% economic growth (SBP, 2020). Pakistan's exports & imports share in the world trade is 0.125% and 0.287% respectively. Per capita trade is 198 USD and the current account deficit is 2.07% of GDP (WTO, 2020). Pakistan is the 5th most populated country with a population growth rate is 2.1% (UNDP, 2020). The major contributing sectors are services, industry, and agriculture with the share of GDP of 58.60%, 20.77%, and 19.03% respectively (PBS, 2020). The importance of trade is well established historic phenomenon. It is due to resource diversification across the regions. Some regions are rich in resources whether they are agricultural or hidden treasures. The most important valuable resource is capital whether it is human or physical (Ahmad and Ahmad, 2005; Ross, 2004). This variation in the distribution of resources leads to trade among the regions. Economies exchange their excess resources with other economies to accumulate the resource in which they are deficient. The concepts of imports and exports are the same terminologies in the exchange of resources. With the emergence of technology and development economies tends to specialize in the resources they are abundant. In this race of generating more resources to increase their income economies try to produce more and more products with the help of locally available resources (Wheeler, 2001; Ahmadi and Mohebbi, 2012). But in some cases, this race results in negative income and a lower value of output. Many economies do not achieve their export revenue targets. This led to great loss and a negative trade balance. This situation developed the interest of researchers to evaluate the situation based on datasets and to suggest the best strategies to adopt the best trade policies (Zhang *et al.,* 2014).

After investigation, the trade economist developed the comparative advantage theory that suggests that economies should specialize in such resources in which they have a comparative advantage. For this purpose economists developed the revealed comparative advantage index that is used in international trade for the calculation of whether the economy has a relative advantage or disadvantage in certain goods and services as demonstrated by trade flows (Vollrath, 1991).

The real exchange rate (REER) is an important macroeconomic relative price that plays an important role in the broad allocation of resources in the production and spending behavior in an economy.

REER is a measure of competitiveness as a determining factor and influencing the efficiency of the export sector (Caballero and Corbo, 1989). Due to the allocation and competitive role of REER, developing and emerging economies are supported by the International Monetary Fund to keep real REER close. The actual equilibrium exchange rate (EREER), which is defined as the value of the REER corresponding to the concurrent exchange rate to access to internal and external equilibrium (Hyder and Mahboob, 2006).

The continuous deviation of the real REER from the EREER is known as the misalignment of the exchange rate (Edwards, 1988; Siddique et al. 2020). In the case of inconsistent exchange rates, the REER does not comply with the allocation role and does not provide an appropriate signal to directly allocate resources (Aitken, 1973; Montiel, 2003). On the other hand, an undervalued exchange rate can put pressure on inflation. In addition, keeping the real exchange rate close to equilibrium levels protects the country from currency and banking crises and the enormous cost to the real economy caused by the impact of the balance sheet. There is consensus in economic documents that significant discrepancies in real exchange rates were one of the main causes of the 1998 Asian crisis (Haque and Montiel, 1998b; Alpay et al., 2011). The real effective exchange rate is a ratio P_{tn} to P_t, where, P_{tn} and P_t known as non-tradeable and tradeable goods and can be represented as $e= P_{tn} / P_t$. It is one of the most common indexes to use purchasing power parity phenomenon to predict currency approximation (Henry et. al., 2003). It is also developed to regulate local exchange rate of trading variation in related prices. The latest formulation of REER is as follow:

$$e= (r/r^*)\,(p/p^*)$$

Where, ‘r’ and “r*’ represent the local and trading partner’s exchange rate respectively whereas, ‘P’ and ‘P^*’ are the local and international price of particular basket of commodities.

This study aims to estimate the global trade potential of Pakistan on differences in income across the various income groups of the economies using the gravity model. Moreover, Using panel data estimates, the current study tries to examine Pakistan's total trade potential with its conventional partners as well as other important nations. This analysis allows the countries to evaluate the comparative advantage in trade through the revealed comparative advantage (RCA) index developed by Bela Balassa (1965). Additionally, this study is novel in the various ways that most of the researchers estimated the trade potential of Pakistan with selected borders sharing countries, some tried to find out the trade potential with Pakistan’s major trading partners e.g. USA, China, UAE (Wani et al., 2016; Gull and Yaseen, 2011; Abbas and Waheed, 2017). Some of the researchers found the exports potential among regional integrated organizations e.g. SAARC, SAFTA (Hanif, 2018) but up to the researcher’s knowledge, no prior study has tried to examine Pakistan’s trade potential in the selected countries based on differences in income groups (Low, Middle and High income economies). Secondly, to explore the dynamic and static sector of Pakistan at the HS-2 digit level of products by using Balassa (1965) revealed comparative advantage index to estimate the untapped trade potential of Pakistan. Thirdly, to suggest effective policy implications to enhance Pakistan’s trade potential among selected income group countries. In the end, all the above practices lead to recommend helpful economic policies related trade supportive arrangements to achieve the optimum level of trade potential of Pakistan based on the results of advanced trade sector evaluation approaches.

This paper consists on the following sections. Section two and three represent literature review and data source with methodological technique. Section four elaborates the results and estimation and discusses the results followed by conclusion and recommendations.

2. Literature Review

Riaz and Jensen (2012) explored the comparative advantage of Pakistan in agriculture sector exports by developing the spatial patterns of revealed comparative advantage. This study was designed to evaluate the claim that Pakistan is underperforming in terms of agricultural export rather than huge potential. Moreover, the study identified potential in bilateral trade, particularly with neighbors. In the end, the method revealed the top export markets for Pakistan's key exports and threw light on the sorts of agricultural goods that had the potential to penetrate developed-country markets. Trade among neighboring countries is more efficient and cost-effective as compared to the trade among far distanced countries. Pakistan, India, and Bangladesh despite geopolitical differences and still competing on different economic somehow similar specialties.

Shahzad (2015) analyzed the data o three neighboring countries Pakistan, Bangladesh, and India for assessing the revealed comparative advantage in two ways, static and dynamic. The static analysis was based on 2010 and the dynamic analysis was based on four decades 1980 to 2010. The study found that Pakistan was leading in terms of revealed comparative advantage in the textile sector over both neighboring countries. Though Pakistan had gained the comparative advantage in textile since 1980 with a declining percentage this result was obtained from the dynamic revealed comparative advantage. In the case of Bangladesh, this country since 1980 had gained a comparative advantage in clothing.

Using OLS, Lee et al. (2008) empirically confirmed the Marshall Learner hypothesis by looking at factors of export in Malaysia from 1975 to 2013. Many researchers agree that there is a positive substantial association between the changeable real exchange rate and Malaysian export performance (An, and Iyigun, 2004; Akhtar et al., 2008; Iqbal et al., 2010; Ahmad et al., 2012; Taneja et al., 2011; Arize et al., 2017 Ahmed et. al, 2012; Shahbaz and Rahman, 2012; Kang et al., 2016). Some research, such as (Dar et al., 2016), suggest that the real exchange rate has a negative substantial impact on export performance. Tadese's (2015) controversial findings indicated negligible results in both the long and short term.

Abbas and Waheed (2017) investigated the competitiveness of Pakistan in agriculture and industrial products. The analysis was done using the revealed comparative advantage index. The data from 2003 to 2014 was employed for the analysis of the selected sectors. The findings of the study revealed that Pakistan had a comparative advantage in raw products of the agricultural sector instead of end-user products. The raw cotton was at the top of all the raw products in terms of comparative advantage. In the case of the industrial sector, the textile products had a significant comparative advantage over the other industrial products. The study also revealed that the case of capital-intensive products is not favorable. Pakistan had a comparative disadvantage in the case of capital-intensive products. The results of Panel regression analysis revealed that growth in domestic productivity and depreciation in the real exchange rate affected positively the international competitiveness of sectors under discussion.

McCartney, (2021) used the comparative advantage term to describe a situation when one had a distinct advantage over a country's competitiveness is influenced by the growth of business fields, business efficiency, natural catastrophes, human resource capabilities, and climate. As a result, the country's economic competitiveness is a top concern for policymakers.

In the recent study, Siddique et al., (2020) evaluate the impact of Balassa RCA on trade balance (TB) of Pakistan by applying non-linear ARDL for the period of 1980 to 2018. The findings reveal that Pakistan world aggregated income, and selected RCA indices such as vegetables, hides and skin and textile at HS-2 digit level of products have positively and significantly correlated with TB and may helpful to improve deficit trade balance of Pakistan during the estimated period whereas, the real effective exchange rate (REER) has insignificant impact on TB of Pakistan due to a comparatively low quality products, high inflation and unfavorable cost of production in the presence of gigantic economies like China, India, Taiwan, Malaysia and others in the region.

Similarly, revealed comparative advantage (RCA), the real effective exchange rate is the main variable in determining the trade balance. Yeats, (1998) used quarterly data for the period 1973-to-1988 and employed the cointegration analysis. The study revealed that in the long-run real effective exchange rate and trade balances were cointegrated. The study argued the methodology as the close substitute for testing the Marshall-Lerner condition.

Omojimite and Akpokodje, (2010) investigate the link between exchange rate and trade balance in the Nigeria. They discovered that the nominal exchange rate does not affect the trade balance, however, real money does. They contend that the significance of the exchange rate is affecting the trade balance has been overstated. Moreover, Anwar T (2004) analyzed the 31-year data from 1980 to 2011 to check the relationship among trade balance, real effective exchange rate, income, and money supply in the long-run and short-run in the case of Pakistan. The study employed a bound testing technique to cointegration which was settled inside an ARDL framework for the investigation of the possible presence of relationships in the above-mentioned variables and criteria. The results of the study revealed that trade in Pakistan trade balance behavior in long run was highly influenced by the real effective exchange rate, money supply, and income. Moreover, the impact of real effective exchange rate and income was significant on the trade balance in the short run as equated to the money supply.

Didier and Hoarau, (2013) looked at the influence of country-level determinants on agriculture businesses' export competitiveness in developing economies. To investigate export competitiveness, the RCA index was utilized. The influence of country-level factors on export competitiveness, such as wages, irrigated land area, food price index, domestic consumption, and currency rate, is determined using regression and factor analysis. The results revealed that irrigated land area and exchange rate have a favorable influence on export competitiveness, but labor costs and domestic consumer demand have a negative impact.

Memon et al. (2014) discovered Pakistan, India, and China's demonstrated comparative advantage in the manufacturing industry from 2003 to 2012. They discovered that many goods require consideration to remain competitive in the world economic market. The study aimed to detect the altering patterns of comparative advantage for Pakistani industries and the policy recommendations for trade. They constructed the RCA outlines of different industrial products for Pakistan. The study identified the Pakistani industries that had improved but were still battling for international competitiveness and others that had lost their competitiveness over time. According to the study, these businesses had the potential to develop, which would assist to improve Pakistan's poor trade balance. The study proposed that it was needed to protect 18 industries, which were termed as vulnerable industries, upon liberating trade with India.

Several studies have been conducted in Pakistan to assess export competitiveness in various industries, including agriculture. RCA was used by Quddus and Mustafa (2011) to investigate the factors that influence export competitiveness. The study's findings revealed that while Pakistan is not a large international trade participant, it does have significant RCA in textiles, garments, vegetables, and the hides and skins industry.

3. Data Source and Econometric Technique

This research study takes into account more than 47 trade destinations of Pakistan's exports volume. Pakistan's overall exports volume comprises more than 85% of its total exports in the world while, at least 90% of Pakistan's imports come from these selected countries (SBP, 2020). The annual data is obtained from various sources for the period of 1995 to 2020. For example, data on GDP, GDP per-capita, exports and imports are taken from WDI database of the World Bank. Data on Pakistan's trade destinations or partner countries has been gathered from (WITS, 2020) of IMF, while, the data on distance (in Km) between capitals of the partner countries is collected from (CEPII, 2020). All the values are such as the value of exports, imports, GDP and GDP per capita are represented in million US dollar while, population size is taken in million only (data of sample countries and selected commodities at HS-2 digit level of products are provided.

For two periods, from 1995 to 2020, the panel structure is developed to address fluctuations in trade for these high-income nations trading partners. Panel estimation has several benefits over cross section and time series data because it accounts for individual variation. The findings of cross-section and time-series studies that are not controlled for heterogeneity are skewed. Panel data, on the other hand, have greater variability, more degrees of freedom, and less multicollinearity across the explanatory factors, resulting in a higher estimate of econometric efficiency. Furthermore, panel data detects an influence that is imperceptible in cross-section and time series data (Bhattacharyya and Banerjee 2006). Previously, single-year cross-sectional data or data time series were used to test the gravity model. Due to the absence of control for heterogeneity, these approaches may be influenced by misspecification, resulting in a biased assumption of bilateral volume trade (Mussa, 2019). Panel data are utilized to apply the gravity model since panel data are typically used for data cross sections and temporal data series (Egger, 2002). The natural depiction of two-sided trade flows using the gravity equation with a three-way specification is expressed as follows, according to Matyas (1997 and 1998).

$$y = D_{N\alpha} + D_{\gamma J} + D_{\lambda T} + Z_{\beta} + \varepsilon \ldots\ldots \qquad 3.1$$

Whereas; $y = is\ vector\ of\ dependent\ variable, z = is\ the\ matrix\ of\ explanatory\ variables$

$D_N D_J D_T = are\ dummy\ variable\ matrices, \gamma = Target\ Country\ Effect, \lambda = Time\ Effect, \beta = parameter\ vector\ for\ explanatory\ varaibles,$

$$\varepsilon = Error\ Term$$

There were no temporal effects found when the cross section data was used for one year $\lambda = 0$. When a time series is employed, the impacts for a given pair of nations are covered, implying that $\alpha = \gamma = 0$.

There are no restrictions when using panel data, which may account for both country and temporal effects. Pool estimation, fixed effect, and random effect may be used to assess panel estimation (Anson et al, 2005), the following estimates pool function:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} \ldots \ldots \ldots \ldots . \beta_n X_{nit} + \varepsilon_{it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3.2$$

Where I denotes the cross-sectional unit, t is the time period, and the error term is normally distributed with a mean of zero and a constant variance. With one overarching notion, it was anticipated that pooled would have a single fixed slope coefficient. The error component in a pooled estimate represents the difference between individuals across time.

Individual and temporal effects are accounted for in fixed effects models by allowing the intercept to change for each individual and time period while the slope coefficient remains constant:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots . . \beta_n X_{nit} + \varepsilon_{it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . 3.3$$

It's common to suppose that is independent and uniformly distributed among people, with a temporal mean of zero and variance σ^2, and that all $X_{it}$are independent of all error factors. The variable dummy idea allows for individual and time-dependent intercept variability. One of the issues with the fixed model is that it may fail to detect time invariant effects, such as distance. This variable, however, is not included in the estimation. Fixed estimation, on the other hand, may result in inefficient and biased estimates. The panel data were estimated using random effect estimation. Random effects were used to treat the intercept as a random variable, whereas the people in the sample were recruited from a wider population. The following regression model no. 3.4.4.

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \beta_n X_{nit} + w_{it} \ldots \ldots \ldots \ldots \ldots . 3.4$$

Whereas, $w_{it} = \varepsilon_{it} + \mu_{it}, \varepsilon_i \sim N(0, \sigma_\varepsilon^2) \mu_{it} \sim N(0, \sigma_\mu^2)$, $E(\varepsilon_i, \mu_{it}) = 0, E(\varepsilon_i, \varepsilon_j) = 0 (i \neq j)$

$$E(\mu_{it}, \mu_{is}) = E(\mu_{it}, \mu_{it}) = E(\mu_{it}, \mu_{is}) = 0 (i \neq j, t \neq s)$$

3.1 Panel Unit root Test

This research investigates the immigrant's effect at macro level with panel data; the problem of nonstationary in relevant variables may occur. The first step is to determine if relevant variables are stationary or not. The nonstationary data series are not appropriate for econometric models, because the estimated results are invalid and give spurious results. There are number of popular tests based upon asymptotic assumptions for time series data and cross sectional data.

There is frequently used structure of panel unit root test named as Augmented Dickey Fuller (ADF) regression.

$$\Delta y_{it} = a_i d_{it} + \rho_i y_{it-1} + \sum_{l=1}^{p_i} \emptyset_{il} \Delta y_{it-l} + \varepsilon_{it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . 3.1.1$$

Where d_{it} is the deterministic part "constant and trend". Whereas $\rho_i = 0$ mean variables *I* are non-stationary, while $\rho_i < 0$ means that variables are stationary around the deterministic part.

3.2 Levin-Lin-Chu Test

Levin, Lin and Chu (2002), proposed panel unit root test, with following hypothesis.

H_0: Panels contain unit roots, while, H_1: Panels are stationary

The null hypothesis is $\rho_i = 0$. Levin, Lin and Chu test assume a common ρ_i across the panels, the limitation of this test is that it cannot allow for some panel variables being stationary and some panel variables being non-stationary. The asymptotic theory and necessary condition must hold for LLC test which is $\sqrt{N_T}/T \rightarrow 0$, which requires that the number of time periods grow more quickly than the number of panels, so that ratio of panels to time periods tends to zero. In this research, we take the lags of relevant variables and use in ADF regression. According to Levin, Lin and Chu (2002), the panel variables performs well in case of $10 < N < 250$ and $5 < T < 250$.

3.3 Im Pesaran Shin Test

The IPS test doesn't have a limitation like that of LLC test. IPS test is valid if heterogeneity exists in unbalanced panel variables. The assumptions of this test are that T is same for all cross-sections and IPS test is only applicable for unbalanced panel data. IPS test requires $\frac{N}{T} \rightarrow 0$ for $N \rightarrow \infty$.

H_0: All panels contain unit roots, H_1: There are some panels are stationary

The null hypothesis is $\rho_i = 0$. This study has relaxed the assumption of LLC test, and allowed some panel variables being stationary.

3.4 Johansen Cointegration

The Johansen analysis is performed to determine whether or not numerous non-stationary time series analysis are cointegrating. The Johansen test, however unlike Engle-Granger test, allows for more than one cointegrating relationships. However, because a small sample size would give incorrect findings, it is amenable to asymptotic characteristics big sample size. When you're using the test to identify cointegration of many time series, you avoid the problems that arise when inconsistencies are carried on to the next generation. Therefore, trace tests and maximum eigenvalue tests are the two primary types of Johansen's test.

$$y_t = A_1 y_{t-1} + \cdots A_p y_{t-p} + Bx_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.1.2$$

Whereas, y_t is k vector of non-stationary variable. $x_t$is a d vector of deterministic variables. $\varepsilon_t$is a vector of innovations.

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.1.3$$

$$\Pi = \sum_{i=1}^{p} A_i - I, \Gamma_i = -\sum_{i=1}^{p} A_j \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.1.4$$

The Granger theorem is the coefficient matrix $\Pi$and reduce rank $r < k$, and $k * r$matrics α and β with rank r. Such that $\Pi = \alpha\beta'$and $\beta' y_t$is $I(0)$ is the number of cointegration among each other and β is cointegrating vector.

3.5 Autoregressive Distributed Lag Model (ARDL) Approach to Bound Cointegration

A generic model for the distributed rate autoregressive technique is frequently used to describe the dynamic model. Where the endogenous variable's effect is represented by its own lag variable, as well as the lag of all external variables. Furthermore, the cointegration process allows us to assess whether or not the model's endogenous variables are cointegrated. When there are many cointegration vectors, the ARDL score is skewed. Alternative methods include (Johansen and Juselius, 1990)'s error correcting process. The following are the methodologies and applications employed in this approach:

The ADRL $(p\ , q_1\ q_2 \ldots \ldots \ldots . q_k)$ model specification as following on

$$\theta(L,p)y_t = \sum_{i=1}^{k} \beta_i(L,q_i)x_{it} + \gamma w_t + \mu_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots .3.1.5$$

$$\theta(L,p) = 1 - \theta_1 L - \theta_2 L^2 - \ldots \ldots \ldots \ldots .. - \theta_p L^p \ldots \ldots \ldots \ldots \ldots \ldots 3.1.6$$

$$\beta(L,q) = 1 - \beta_1 L - \beta_2 L^2 - \ldots \ldots \ldots \ldots .. - \beta_p L^p \ldots \ldots \ldots \ldots \ldots .3.1.7$$

$$for\ i = 1,2,3, \ldots \ldots \ldots k, = \mu_t \sim iid(0; \gamma^2) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3.1.8$$

The L is a lag operator i.e. $L^0 y_t = X_t, L^1 y_t = y_{t-1}$and $w_t$is a sx1 vector of deterministic variables. The intercept term, time trend, seasonal dummies, or exogenous variables with fixed lags i.e. $P = 0,1,2 \ldots .. m, q = 0,1,2, \ldots . m, i = 1,2, \ldots .. k$: of $(m+1)^{k+1}$ various ARDL regression model. The maximum lag order is m and selected with the help of AIC and SC for $t = m+1, m+2, \ldots \ldots \ldots n$. The simplest case of explanatory variable with linear relationship, write the regression specification as following.

$$y_t = \alpha + \beta(L)x_t + \mu_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots ..3.1.9$$

$$y_t = \alpha + \sum_{s=0}^{\infty} \beta_s x_{t-s} + \mu_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots ..3.7.6$$

The estimate infinite β coefficients with ARDL approach to truncate the lag in equation 14. The above equation 15 i.e. stationary autoregressive process and infinite moving average with controlling lag length. So that, one or more lag of endogenous variable will allow infinite lag length for small number of parameters. The choice of command length is a typical challenge in the ARDL approach. To solve this problem, the Akaike Information Criterion (AIK) or the Schwartz Information Criterion were utilized as lag selection criteria in this work. The following are the estimated findings.

Table 3.1 Autoregressive Distributed Lag (ARDL)

Lag Order Selection Criteria						
Lag	**Log L**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-88778.05	NA	9.5166	174.0883	174.1222	174.1012

1	-69207.25	38834.60	2.2650	135.8103	136.0808	135.9130
2	-66660.77	5018.078	1.6948	**130.9133***	**131.4205***	**131.1059***
3	-66446.84	418.6180*	1.2248	130.5899	131.3339	130.8724

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level); SC: Schwarz information criterion, FPE: Final prediction error

AIC: Akaike information criterion; HQ: Hannan-Quinn information criterion

The above reported results of lag selection shown in table 3.1, which applicable lag length is 2 to make Autoregressive Distributed Lag (ARDL) to Error Correction Mechanism (ECM). In a unified dynamic model, development factors are corrected and approximated. As a result, the variables of the current panel have a cointegration vector. It has become critical to study (Pesaran and Shin, 1995) and (Pesaran et al, 1996) the autoregressive distributed level (ARDL) approach to cointegration recommended by the autoregressive distributed level (ARDL) approach for long-term analysis, regardless of whether the fundamental variables are I(0), I(1) or a combination of them. The estimated parameters of the ARDL cointegration technique will generate meaningful and effective results[1]. According with identifying cointegration vectors among some of the variables, according to Johansen and Juselius (1990), the cointegration process relating autoregressive distributed layers (ARDL) to cross - sectional dependence is required. Long-term parameters are approximate in one equation with this strategy. The ARDL model is reintroduced to the vector error correction after that the main equation's cointegration vector is determined. The impact on the data solution includes both short-term dynamics ARDL and long-term relationships between variables in the same equation. So that, ARDL is a single model dynamic equation with the same form as ECM, hence reparameterization is conceivable.

3.5 Mean Group Estimators

In this study, panel data was utilized to create long-term forecasts. To estimate long-term characteristics, two estimations are used: Mean Group (MG) and Overall Mean Group (OMG). These assessors aided in the resolution of the dynamic panel heterogeneity issue. The least restrictive technique is the median group (MG) estimate, which allows all parameters to be altered freely between nations. The middle group estimator from the Autoregressive Distribution Layer (ADRL) model was used to create country-specific long-term parameters. To put it another way, the middle group estimator runs individual regressions for each country in the panel data. As a consequence, the middle group averages the coefficients of each nation, resulting in consistent long-term coefficient estimations with following ARDL:

$$Y_{it} = \alpha_i + \gamma_1 Y_{it-1} + \beta_i X_{it} + \mu_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.\dots\dots\dots.3.5.1$$

for country i, where i=1,2,......N.

[1]See Appendix-H

the long run parameter $\theta_i$for i country is:

$$\theta_t = \frac{\beta_i}{1-\gamma_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5.2$$

and the MG estimators for the whole panel will be given by:

$$\hat{\theta} = \frac{1}{N}\sum_{i=1}^{N} \theta_i \qquad \hat{\alpha} = \frac{1}{N}\sum_{i=1}^{N} \alpha_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5.3$$

3.5 Pooled Mean Group Estimator

The unrestricted specification for the ARDL system of equations for t = 1,2,.......,T, time periods and i = 1,2,.....N countries for the dependent variable Y is:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=1}^{q} \lambda_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5.4$$

Where $x_{i,t-j}$the (k × 1) is vector of explanatory variables for group i and μ_i represent fixed effect.

The model can be reparametrized as a VECM system:

$$\Delta y_{it} = \theta_i\left(y_{i,t-1} - \beta_1 x_{i,t-1}\right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \lambda_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 3.5.5$$

Whereas β_i are the long run parameters and θ_i are the equilibrium of error correction parameters.

The polled mean group restriction is that the elements of β are common across countries.

$$\Delta y_{it} = \theta_i\left(y_{i,t-1} - \beta x_{i,t-1}\right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \lambda_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 3.5.6$$

All the dynamics and the error correction mechanism terms are free to fluctuate in polled mean group. After apply symmetry assumptions, the estimated parameter of the polled mean group model are consistent and asymptotically normal for both stationary and non-stationary regressors. In the selection of lag criteria, both mean group (MG) and polled mean group (PMG) estimations required appropriate lag criteria for the individual country. The selection of lag criteria is based upon Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC).

4. Results and Discussion

This section presents the comprehensive discussion of estimated outputs of generalized method of moments. To explore the trade potential of Pakistan among different group countries, this study approximate the trade potential through three different models, which are approximate the short run coefficient as well as to further considered the long run coefficient with the help of Bound Cointegration to analyzed the trade potential. These regression models try to evaluate the real world situation in the panel of 47[2] with low, middle and high income countries.

[2] List of Countries is Appendix-I

The gravity model has had a lot of empirical success and is now being evaluated in a variety of nations. Rahman (2003) evaluated the movement of goods and services between Pakistan and its key trading partners using total export and import trade, as well as three equations. The Pakistan commerce defined by economic size, distance, and openness, as well as GDP per capita, according to his research. Blomqvist have been using the gravity model to explain the movement of commerce in Pakistan. The GDP and variable distance, in particular, were shown to have a high degree of explanation. Anaman and Al-Kharusa (2003) used the gravity model framework to establish trade persistence for the European Union (EU) and Brunei from either country's population (Brunei and EU). Tan (2003), found that EU integration led in a considerable decline in trade with the North American Free Trade Agency (NAFTA) and ASEAN. In intra-regional bilateral commerce, Thornton and Goglio (2002) demonstrated the advantages of economic scale, shared language, and physical distance for ASEAN. Martinez- Zarzoso et al. (2004) identified the commodities that benefit from export strength by classifying exports according to their geographical and economic distance sensitivity, as well as under the gravity model framework.

4.1 Table 4.1:Descriptive Statistics

	Trade Potential	GDP	GDP Per Capita	REER	Population	Distance	Import to GDP Ratio
Mean	71.24671	1.03E+12	17715.96	101.6825	1.12E+08	1992674.	0.262107
Median	56.41947	3.71E+11	9357.301	100.0000	46585067	499440.0	0.213179
Maximum	442.6200	2.14E+13	91254.03	296.3127	1.41E+09	16388510	4.785750
Minimum	0.784631	2.90E+08	203.9808	47.95269	534629.0	1050.000	0.000000
Std. Dev.	52.94351	2.37E+12	18576.61	18.79970	2.41E+08	3350714.	0.287385
Skewness	3.182711	5.167288	1.101099	2.847738	4.276758	2.355715	5.387751
Kurtosis	17.73500	33.84282	3.505329	24.32732	20.96125	8.502097	59.82685
Jarque-Bera	14234.55	58459.07	282.0530	26922.95	21866.24	2899.002	184833.5
Probability	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Sum	94473.14	1.37E+15	23491369	134831.0	1.48E+11	2.64E+09	347.5541
Sum Sq. Dev.	3713995.	7.47E+27	4.57E+11	468292.9	7.68E+19	1.49E+16	109.4320

Observations	1326	1326	1326	1326	1326	1326	1326

Source: Author's own estimates in parentheses p value

The results of descriptive statistics reported in above table 4.1 short description of coefficients that describe a data set, which might be a representation of the complete population or a sample of the population. Measures of central tendency and measures of variability are two types of descriptive statistics (spread). The mean, median, and mode are examples of central tendency measurements, whereas standard deviation, variance, minimum and maximum variables, kurtosis, and skewness is key component of descriptive statistics. The nature of data is panel of low, middle and high income class countries. These countries are closely related to geographically as well as considerable trade partner. The estimated results of measure of central tendency as well as dispersion is biased due to possible outlier exist in data[3]. To overcome this issue, apply statistical technique and further analyzed. The interesting point noted that, variation among the time in appropriate variables is meaningless. The results of Jarque-Bera test is supported because all variables not lie under the bell shaped. There are some variables such as GDP, Real Effective Exchange Rate, Population and Import to GDP Ratio is Leptokurtic distributions. Due to those having a greater positive kurtosis than a normal distribution. The kurtosis of a normal distribution is three. As a result, a leptokurtic distribution is defined as one with a kurtosis larger than others. Skewness is a distortion or asymmetry in a collection of data that deviates from the symmetrical bell curve, or normal distribution. The curve is considered to be skewed if it is displaced to the left or right. In case of this dataset no variable is skewed.

4.2 Table 4.2: Correlation Matrix

	Trade Potential	GDP	GDP Per Capita	Real Effective Exchange Rate	Population	Distance	Import to GDP Ratio
Trade Potential	1						
GDP	0.18489	1					
	(0.0000)						
GDP Per Capita	0.26814	0.33529	1				
	(0.0000)	(0.0000)					
Real Effective Exchange Rate	0.02464	0.03966	-0.03227	1			
	(0.3699)	(0.1495)	(0.2395)				
Population	-0.22685	0.36558	-0.20232	-0.10919	1		

[3]Time Series Line Chart in Appendix-A

	(0.0000)	(0.0000)	(0.0000)	(0.0001)			
Distance	-0.29646	0.37279	-0.01487	-0.24943	0.36374	1	
	(0.0000)	(0.0000)	(0.5883)	(0.0000)	(0.0000)		
Import to GDP Ratio	0.75753	0.14899	0.07948	0.04856	-0.16484	-0.26476	1
	(0.0000)	(0.0000)	(0.0038)	(0.0771)	(0.0000)	(0.0000)	

Source: Author's own estimates in parentheses p value

The correlation matrix is estimated in above table 4.2 that displays the coefficients of correlation between variables. The correlation between two variables is shown in each cell of the table. A correlation matrix can be used to summarize data, as an input to a more sophisticated study. A correlation matrix is typically "square," with the same variables displayed in the rows and columns. Below is an illustration. This graph depicts the relationship between people's reported significance of various items. The primary diagonal is a line of 1.00s that runs from top left to bottom right, indicating that each variable is always fully correlated with itself. The same correlation is presented above the main diagonal as a mirror image of those below the main diagonal in this symmetrical matrix.

In case of this study, approximated coefficient of correlation indicated that most of variables are moderate association, expect import to GDP ratio, with trade potential. The estimated coefficient of population and distance are negatively associated with trade potential. The rest of variables such as GDP, GDP per Capita and Real Effective Exchange Rate and Import ration are positively associations and statistically significant as well. Our results are consistent with the previous research studies such are (Ma, 2009; Khan and Khan, 2011)

4.3 Unit Root Test

There are two generations of tests in the panel unit root-testing framework. The first generation of panel unit root tests assumes cross-section units are cross-sectionally independent, but the second generation relaxes this assumption and permits cross-sectional dependency. In this perspective, the first and second generations of panel unit root tests may be summarized. The study variables were evaluated to see if they were stationary before analyzing the data and testing the regression model. Five parallel tests were employed to better understand the properties of the variables: Levin, Lin, and Chu (LLC), Im, Pesaran, and Shin (IPS), Fisher-ADF test, and Fisher-PP test.

Table 4.3 Unit Root Test: Series at Level

Variables Name	Levin-Lin-Chu t-rho stat	Im-Pesaran-Shin w-stat	Maddala & Wu (MW)	Decision Ho

			ADF fisher chi-square	PP fisher chi-square	
Intercepts with no trends at Level					
Trade Potential	-3.21498	-0.55787	88.5391	85.0818	*Reject*
	(0.0007)	(0.2885)	(0.6396)	(0.7334)	
GDP	0.54893	-5.34836	36.9740	28.1124	*Reject*
	(0.7085)	(0.9999)	(0.9999)	(0.9999)	
	-0.03775	4.10729	43.2170	37.3062	*Reject*
GDP Per Capita	(0.5151)	(0.9999)	(0.9999)	(0.9999)	
	-4.50526	-3.27712	27.9636	28.1112	*Accept*
	(0.0000)	(0.0005)	(0.0018)	(0.0017)	
Real Effect Exchange Rate	-3.18130	-3.38796	100.935	84.8073	*Accept*
	(0.0007)	(0.0004)	(0.0037)	(0.0594)	
Population	-5.20465	3.93112	121.617	168.560	*Reject*
	(0.0000)	(0.9999)	(0.0292)	(0.0000)	
Distance	-0.84563	1.96513	30.9336	40.4816	*Reject*
	(0.1989)	(0.9753)	(0.9316)	(0.6232)	
Import to GDP Ratio	12.8497	9.37869	40.3295	38.3136	*Reject*
	(0.9999)	(0.9999)	(0.9999)	(0.9999)	

Source: Author's own estimates in parentheses p value

The above table 4.3 is reported results of all variables at level. The estimated results indicated that GDP per capita and Real Effective Exchange rate is stationery and all other variable such Trade Potential, GDP, Population, Distance and Import GDP Ratio are is non-stationery at level.

Table 4.4 Unit Root: Series at 1st Difference

Variables Name	Levin-Lin-Chu t-rho stat	Im-Pesaran-Shin w-stat	Maddala & Wu (MW)		Decision Ho
			ADF fisher chi-square	PP fisher chi-square	
Intercepts with no trends at First Difference					
Trade Potential	-14.8266	-15.5264	422.122	684.829	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
GDP	-11.7453	-11.9421	331.105	376.953	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
	-9.96535	-11.9361	326.134	390.195	*Accept*
GDP Per Capita	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
	-4.50526	-3.27712	27.9636	28.1112	*Accept*
	(0.0000)	(0.0005)	(0.0018)	(0.0017)	
Real Effect Exchange Rate	-19.4728	-12.2533	271.971	377.459	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
Population	-8.04086	-13.2212	390.662	104.070	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
Distance	-6.45423	-7.20462	111.836	219.002	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
Import to GDP Ratio	-24.4958	-8.93617	430.339	391.130	*Accept*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Source: Author's own estimates in parentheses p value

The above table 4.4 is reported results of all variables at first difference. In case of first difference, take the natural log and then first difference of all variable. The estimated results indicated that GDP per capita and Real Effective Exchange rate Trade Potential, GDP, Population, Distance and Import GDP Ratio are stationery at first difference. The stationary time series has statistical features or moments that do not change throughout time mean and variance. These results in table 4.4, indicated that estimated linear coefficients with log and difference are realistic. The graphical visualization with the help of Correlogram also considered[4].

4.4 Cointegration Test

Granger and Engle defined the cointegrating vector technique in a paper released in 1987. Their theory said that two or more non-stationary time series data should be integrated in such a way that they cannot deviate from a long-term equilibrium. They claimed that two or more time series variables with I(1) trends might be cointegrated if a link between the variables could be demonstrated. The Pedroni, Kao, and Johansen technique was utilized to check the cointegration in this work. Pedroni (1999, 2004) proposed seven test statistics for nonstationary panels to test the null hypothesis of no cointegration. The panel might be heterogeneous in terms of short-run dynamics as well as long-run slope and intercept coefficients thanks to the seven test statistics. For the null of cointegration, Kao (1998) developed a panel cointegration test that is an extension of the LM test and the locally best unbiased invariant (LBUI) test for an MA root. For panel data, Kao (1999) investigated spurious regression and created the DF and ADF type tests. He suggested four new DF type test statistics and used Phillips & Moon's (1999) sequential limit theory to obtain their asymptotic distributions. Fisher (1932) creates a composite test based on the findings of the independent tests. Maddala and Wu (1999) provide an alternate way to testing for cointegration in panel data based on Fisher's finding, which involves integrating tests from separate cross-sections to produce a test statistic for the entire panel. The cointegration or long-term equilibrium link between model variables is accepted in all circumstances based on the results shown in the table 4.5 and table 4.6. given below.

Table 4.5: Pedroni (Engle-Granger Based)

Within Dimension: Heterogeneous intercepts without trends

Panel V-Stat	-0.6273(**0.9926**)*	***Accept***
Panel Rho-Stat	3.8121(**0.9999**)*	***Accept***
Panel PP-Stat	-0.3479 (**0.0015**)*	***Reject***
Panel ADF-Stat	-3.03925 (**0.0000**)*	***Reject***
Between Dimension: Heterogeneous intercepts without trends		
Group Rho-Stat	5.53764 (**0.9999**)*	***Accept***
Group PP-Stat	-2.74752 (**0.0030**)*	***Reject***

[4]Correlogram in Appendix-B

Group ADF	-4.31852 (0.0000)*	***Reject***
	Kao (Engle-Granger Based)	
ADF	-3.1494 (0.0194)	***Reject***
	Westerlund intercepts without trends	
Variance Ratio	5.24561(0.0000)*	***Reject***
Variance Ratio	8.4693(0.0000)**	***Reject***

*All panels are cointegrated

**Some panels are cointegrated *Source*: Author's own estimates in Parentheses p value

The above table 4.5. estimated the cointegration exit among panel or not. For that, purpose there are three various test considered. The results indicated that all panel are cointegrated among each other.

These statistics values estimated with the help of Pedroni and Kao (Engle-Granger Based). The Westerlund cointegrated test is also in favor of these two test. We successfully built robust critical values for the test statistics since these findings clearly suggest the presence of similar causes impacting the cross sectional units. We kept the short-term dynamics unchanged since the Akaike optimum lag and lead search is time-consuming when paired with bootstrapping.

The table 4.6. below shows the results of the number of cointegrating relations test. There are two sorts of test statistics that are presented. The first block (not shown above) contains the so-called trace statistics, whereas the second block (not shown above) contains the maximum eigenvalue statistics. The number of cointegrating relations under the null hypothesis is in the first column, the ordered eigenvalues are in the second column, the test statistic is in the third column, the 5 percent critical value is in the fourth column, and the p-value is in the last column for each block. The critical values for the (nonstandard distribution) come from MacKinnon-Haug-Michelis (1999), and they differ somewhat from those provided by Johansen and Juselius (1990).

Table 4.6: Johansen Fisher Panel Cointegration Test

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.

None	996.7	0.0000	884.1	0.0000
At most 1	732.2	0.0000	372.2	0.0000
At most 2	445.2	0.0000	242.9	0.0000
At most 3	248.3	0.0000	125.0	0.0000
At most 4	148.9	0.0000	86.80	0.0000
At most 5	98.19	0.0000	82.19	0.0000
At most 6	66.27	0.0008	66.27	0.0008

* Probabilities are computed using asymptotic Chi-square distribution.

According to the result, we are unable to reject null hypothesis i.e., no cointegration. In short, both Trace and Eigenvalue tests show of cointegration connection.

4.5 Gravity Model

The given below three regression model is estimated under the assumption of linear regression model.

4.5.1. Table 4.7: Regression Specification Model-I

Dep Variable (TP)	Coefficient	Std. Error	t-Statistic	Prob.
$log(GDP_{jt})(GDP_{it})$	0.475441	0.004989	-9.931362	0.0000
$log(Dist_{jt})$	-0.140791	0.023141	-6.084199	0.0000

C	6.733612	0.261657	25.73450	0.0000

R-squared	0.767129	Mean dependent var	4.140791
Adjusted R-squared	0.759411	S.D. dependent var	0.626163
S.E. of regression	0.601918	Akaike info criterion	1.824289
Sum squared resid	430.0563	Schwarz criterion	1.832836
Log likelihood	-1082.540	Hannan-Quinn criter.	1.827510
F-statistic	98.63195	Durbin-Watson stat	1.847228
Prob(F-statistic)	0.000000		

Source: Author's compilation

The estimate coefficients are realistic because overall regression model is show significant at high level of confidence interval. The expected sign of estimated coefficients are related to prior empirical studies as well as theoretical framework. The estimated parameter of GDP of both nations designated as well as trade partner is of low coefficient value with positive sing; If trade activities increased by one percent in the panel of these countries then gross domestic product increased by 0.47 percent and slope coefficient significant at high critical region. On contrary, the calculated coefficient has low and negative impact on trade activities; If trade activities increased by one percent in the panel of these countries then distance declined by 0.14 percent and slope coefficient highly significant.

These diagnostic statistics such as F stat, R-Squared and DW, describe the intensity of model. The calculated F statistics is significant and does not accept the null hypothesis. In other words, all estimated coefficients of this specification is significantly considerable and these slope parameters have predictive capability for the selected panel countries. The estimated result of R-squared is confirmed that, the independent variable capture the high variation from endogenous variables i.e. seventy six percent. Furthermore, in case of this regression model reported results of DW in favor regression model. The estimated results of our research study are similar to previous literature such as (Memon et al., 2014 ; Shaheen et al., 2013; Zeb et al, 2013).

In addition to the basic variables, we attempt to estimate the model by using the product of Pakistan's trading partners GDP as an explanatory variable. The findings, on the other hand, are not encouraging. Despite the fact that all three variables are statistically significant and have the expected signs, the GDP coefficient is substantially less than in the original model i.e., in the absence of per capita GDP. The rationale is self-evident. Between the two explanatory variables, gross GDP and GDP per capita, there is likely to be multicollinearity[5]. In concluded remarks, we are able to argue that overall regression specification is robust and estimated coefficients are not spurious.

4.5.2. Table 4.8: Regression Specification Model-II

Dep Variable (TP)	Coefficient	Std. Error	t-Statistic	Prob.
$log(GDP_{jt})$	0.544629	0.322723	4.786243	0.0000
$log(GDP_{PC})$	0.456068	0.321690	4.526302	0.0000
$log(GDP_{it})$	0.821383	0.724648	1.133492	0.0088
$log(POP_{it})$	-0.611188	0.321564	-5.010470	0.0000
$log(Dist_{it})$	-0.151558	0.009457	-16.02552	0.0000
C	5.893807	0.620554	9.497647	0.0000

R-squared	0.443092	Mean dependent var	4.125695
Adjusted R-squared	0.440788	S.D. dependent var	0.628019
S.E. of regression	0.469635	Akaike info criterion	1.331206
Sum squared resid	266.6539	Schwarz criterion	1.356403
Log likelihood	-802.7075	Hannan-Quinn criter.	1.340692
F-statistic	192.3827	Durbin-Watson stat	1.174477
Prob(F-statistic)	0.000000		

[5] Residual Analysis in Appendix-C

The estimated parameters of GDP, GDP per-capita, and GDP of destination country are significant with the expected sings. If trade activity increases by one percent GDP and GDP per capita and GDP of destination county increase by 0.54, 0.45 and 0.82 percent respectively. But on the other hand, the negative sign of distance and population parameters have inverse impact on trade potential which show 0.15 and 0.16 percent decline in trade if one percent increase in distance and population occur between the countries respectively.

These diagnostic statistics such as F stat, R-Squared and DW, describe the intensity of model. The calculated F statistics is significant and does not accept the null hypothesis. The estimated result of R-squared is confirmed that, the predictor variable capture the high variation from endogenous variables i.e. seventy six percent. Furthermore, these estimated values considerably verified with the help of Durbin Watson test, i.e. the problem of autocorrelation at first is presence or not. In case of this regression model reported results of DW in favor regression model. The problem among explanatory variables, such as gross GDP and GDP per capita, there is likely to be multicollinearity[6]. In concluded remarks, we are able to argue that overall regression specification is robust and estimated coefficients are not spurious.

4.5.3. Table 4.9: Regression Specification Model-III

Dep Variable Log (TP)	Coefficient	Std. Error	t-Statistic	Prob.
$log(GDP_{jt})$	0.206421	0.010684	-19.32133	0.0000
$log(GDP_{it})$	0.640675	0.527157	1.215349	0.0958
$log(GDP_{PC})$	0.284274	0.012625	22.51640	0.0000
$log(POP_{it})$	0.215225	0.259295	4.918048	0.0001
$log(REER_{jt})$	-0.209447	0.100907	-2.273848	0.0331
$Import\ Ratio_{it}$	0.165485	0.107168	2.104033	0.0470
C	5.984997	0.684043	8.749442	0.0000

[6] Residual Analysis in Appendix-D

R-squared	0.318685	Mean dependent var	4.125695
Adjusted R-squared	0.316998	S.D. dependent var	0.628019
S.E. of regression	0.519020	Akaike info criterion	1.529537
Sum sq residual	326.2209	Schwarz criterion	1.546335
Log likelihood	-925.1936	Hannan-Quinn criter.	1.535861
F-statistic	188.8155	Durbin-Watson stat	1.159809
Prob(F-statistic)	0.000000		

Source: Author's own compilation

The estimated parameters of GDP and GDP per capita in the panel of these countries are significant with positive sing. If trade activities increased by one percent in the panel of these countries then gross domestic product increased by 0.20 and 0.28 percent respectively. Similarly, the sings of coefficients in case of GDP and population of destination country are also significant with positive sings which elaborate that one percent increase in panel of these countries will lead 0.28 and 0.21 increase in the respective variables respectively. However, trading activity will increase by one percent if REER deteriorate by 0. 20 percent. The variable is import to GDP ratio shows significance impact if trade activities increased by one percent in the panel of these countries then import to GDP ratio increased by 0.16 percent.

These diagnostic statistics such as F stat, R-Squared and DW, describe the intensity of model. The calculated F statistics is significant and does not accept the null hypothesis. The estimated result of R-squared is confirmed that, the predictor variable capture the high variation from endogenous variables i.e. seventy six percent. Furthermore, the results of DW in favor regression model.

In short, As can be seen from the table above, the GDP coefficient is statistically significant at 1% and has the predicted sign. This means that when the output of GDP rises by 1%, Pakistan's bilateral trade increases in all three regression model. The distance variable's coefficient is negative and statistically significant at in both regression models. Every 1% increase in distance reduces trade between Pakistan and its trading partners. In further extension, to incorporate the absolute difference in GDP per capita for a pair of nations as an explanatory variable in the model in addition to the two basic variables to assess the relative strength of the Linder hypothesis versus the Heckscher-Ohlin (HO) hypothesis. At 5%, the coefficient of the variable is positive and significant impact in both regression model. The bilateral trade grows when the gap between Pakistan's and its trading partner's per capita GDP widens, but not proportionally. In the case of Pakistan, the available evidence supports the HO hypothesis differences in factor endowments. However, the impact of trade openness is of special concern to us.

We evaluated the model by individually incorporating the variables for Pakistan and its trading partners. The variable has the predicted positive sign and is statistically significant at 5%. This means that, with the liberalization of trade and the removal of trade obstacles in these nations, Pakistan's trade with all of the mentioned partners is projected to improve significantly. Finally, Pakistan's trade might expand the import-to-GDP ratio of its partner countries improved.

4.6 ARDL to Bound Cointegration and ECM Model(s)

Instead of using the usual technique of moments, this study employed the pooled mean group estimator. The pooled mean group has the benefit of being an intermediate estimator since the calculated parameters are pooled average. Intercepts, short run parameters, and error variance are all estimated using the pooled mean group estimator across regions, while long run parameters are the same for all (Pesaran et al., 1999). The ARDL cointegration approach was presented by Pesaran and Shin (1997) and Pesaran, Shin, and Smith (2001). So, based on the Akaike information criterion, this study used the ARDL (1, 1) model and used a common ARDL (p, q) specification for all areas (AIC). With a strong balanced panel with a big T, the regression specification is trustworthy, and the obtained indicators in the panel data setting meet the requirements. The coefficient signs are compatible with the theory, and the overall estimated parameters using pooled mean group (PMG) regression specification appear to be good. The explanatory factors are significant in the long run, indicating that they are important to the model, although endogenous variables are negligible in the short run in the case of Low, Middle, and High Income Countries.

4.6.1. Table 4.10: Regression Model I

Dep Variable (TP)	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
$log(GDP_{jt})(GDP_{it})$	-0.166900	0.020566	-8.115481	0.0000
		Short Run Equation		

COINTEQ01	-0.145156	-0.019840	7.316432	0.0000
$D(GDP_{jt})(GDP_{it})$	-0.177530	0.137826	-1.288074	0.1980
C	1.229694	0.163762	7.509050	0.0000

Mean dependent var	0.000735	S.D. dependent var	0.121847
S.E. of regression	0.116038	Akaike info criterion	-4.323662
Sum squared resid	15.78088	Schwarz criterion	-3.720911
Log likelihood	3020.588	Hannan-Quinn criter.	-4.097730

4.6.2. Table 4.11: Regression Model II

Dep Variable (TP)	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
$log(GDP_{jt})$	-0.291459	0.017678	-16.48694	0.0000
$log(GDP_{PC})$	0.179939	0.006381	28.20018	0.0000
$log(POP_{it})$	0.651541	0.046405	14.59545	0.0000

$log(Dits_{it})$	12.66642	88.95102	0.142398	0.8868
		Short Run Equation		
COINTEQ01	-0.201254	0.026462	-7.605377	0.0000
$D(GDP_{jt})$	0.927404	2.196366	0.422245	0.6729
$D(GDP_{PC})$	-0.496296	2.159215	-0.229850	0.8183
$D(POP_{it})$	0.426157	0.053073	8.040698	0.0000
$D(Dits_{it})$	0.280549	0.023085	12.15305	0.0000
C	2.007324	0.250051	8.027655	0.0000

Mean dependent var	0.000735	S.D. dependent var	0.121847
S.E. of regression	0.116511	Akaike info criterion	-4.364414
Sum squared resid	15.20383	Schwarz criterion	-3.558137
Log likelihood	3099.607	Hannan-Quinn criter.	-4.062194

Source: Author's own compilation

4.6.3. Table 4.12: Regression Model-III

Dep Variable Trade Potential	Coefficient	Std. Error	t-Statistic	Prob.*

	Long Run Equation			
$log(GDP_{it})$	-0.005911	0.016460	-0.359131	0.7196
$log(GDP_{PC})$	0.396976	0.007258	54.69156	0.0000
$log(POP_{it})$	0.001541	6.446405	23.93672	0.0000
$log(REER_{jt})$	-0.640819	0.073123	-8.763577	0.0000
$Import\ Ratio_{it}$	0.020822	0.024306	0.856659	0.3918
	Short Run Equation			
COINTEQ01	-0.205811	0.022361	-9.203962	0.0000
$D(GDP_{it})$	-0.319440	0.215913	-1.479482	0.1393
$D(GDP_{PC})$	-0.008427	0.057228	-0.147245	0.8830
$D(POP_{it})$	0.426157	2.453073	0.173724	0.8621
$D(REER_{jt})$	-273.1479	191.8762	-1.423563	0.1549
$D(Import\ Ratio_{it})$	0.108531	0.015895	6.828160	0.0000
C	0.820906	0.094071	8.726502	0.0000
Mean dependent var	0.000735	S.D. dependent var		0.121847

S.E. of regression	0.119045	Akaike info criterion	-4.668171
Sum squared resid	15.87235	Schwarz criterion	-3.861893
Log likelihood	3300.997	Hannan-Quinn criter.	-4.365950

AAut

Source: Author's own compilation

In the near term, the pooled mean group findings of control factors are unimportant, however it's worth noting that these inconsequential parameters of control variables are extremely significant when analyzed individually or across countries. Table 4.10, 4.11 and 4.12 contain all of the results, and the error correction term (ECT) are negative and significant. In the long term, endogenous variables converge to their equilibrium, hence the negative sign is beneficial to these economies. In other words, in the case of these economics, there is evidence of a long-run link between bilateral trade and appropriate endogenous variables such as GDP, Population, Distance, GDP per capita, Real effective exchange rate, and import-to-GDP ratio.

6. Conclusion and Recommendations

In the case of our selected nations, one of the key goals is to address the low intra-regional trade volume and excessive reliance on industrialized economies. Tariffs and non-tariff barriers between low, middle, and high income nations might be removed, exposing some of the benefits of intra-regional trade channels. Because of a country's concern for national autonomy, which might lead to the failure of political designs for political union, it is preferable for low-member nations to focus on economic and functional cooperation, as well as integrative measures that keep political ambitions at bay. There is a need to begin regional economic integration, which benefits from economies of scale, trade creation, and the expansion of technological and scientific collaboration, as well as increased export competitiveness and diversification, and global bargaining strength.

Member nations should make urgent efforts to diversify their exports, strengthen their trading and manufacturing capabilities for non-traditional items, and take steps to improve regional and sub-regional trade and complementarities. To harvest economies of scale, regional markets, enhance regional and home markets, and deal efficiently with ASEAN, the EU, APEC, and NAFTA, backward and forward linkages in investment and production should be enhanced. Through clearing union agreements, payment unions, and export credit, these countries' financial cooperation will improve. These countries can take additional steps to reap the benefits of regional economic cooperation. For instance, encouragement of joint ventures allows economies of scale to be leveraged to establish new competitive advantages, which may then be used to meet domestic demands, expand intra-regional commerce, and increase global competitiveness. Moreover, countries moving their investments toward increased diversification, with a specific emphasis in value added products, should examine trade structural changes. Additionally, the nations should priorities trade liberalization and trade facilitation, including favorable tariffs, to enhance intra-regional trade. To boost regional commerce within member nations, trade obstacles must be removed through measures such as trade law facilitation, supplementing, and regulation. Last but not the least, extending technical and scientific collaboration between nations would aid in the development of scientific and technological infrastructure, which will boost value-added goods. Conducting intra-regional trade research to identify current and projected demands, as well as the necessary capacities.

The cultural cooperation is critical for strong intra-regional relations, which enable and encourage intra-regional trade, encourage openness in order to progressively build complementarity and interdependence through broadening collaboration to avoid limited tendencies inside groupings. To minimize disillusion in sub-regional integration, LDCs should be given particular consideration. Economic integration initiatives should be incorporated into the member nations development plans.

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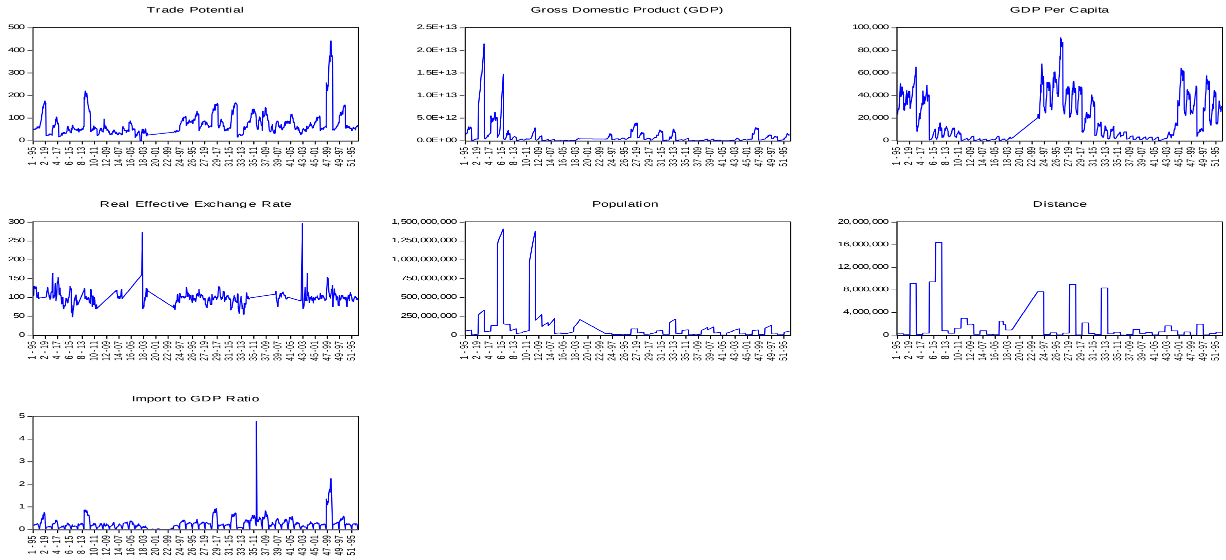
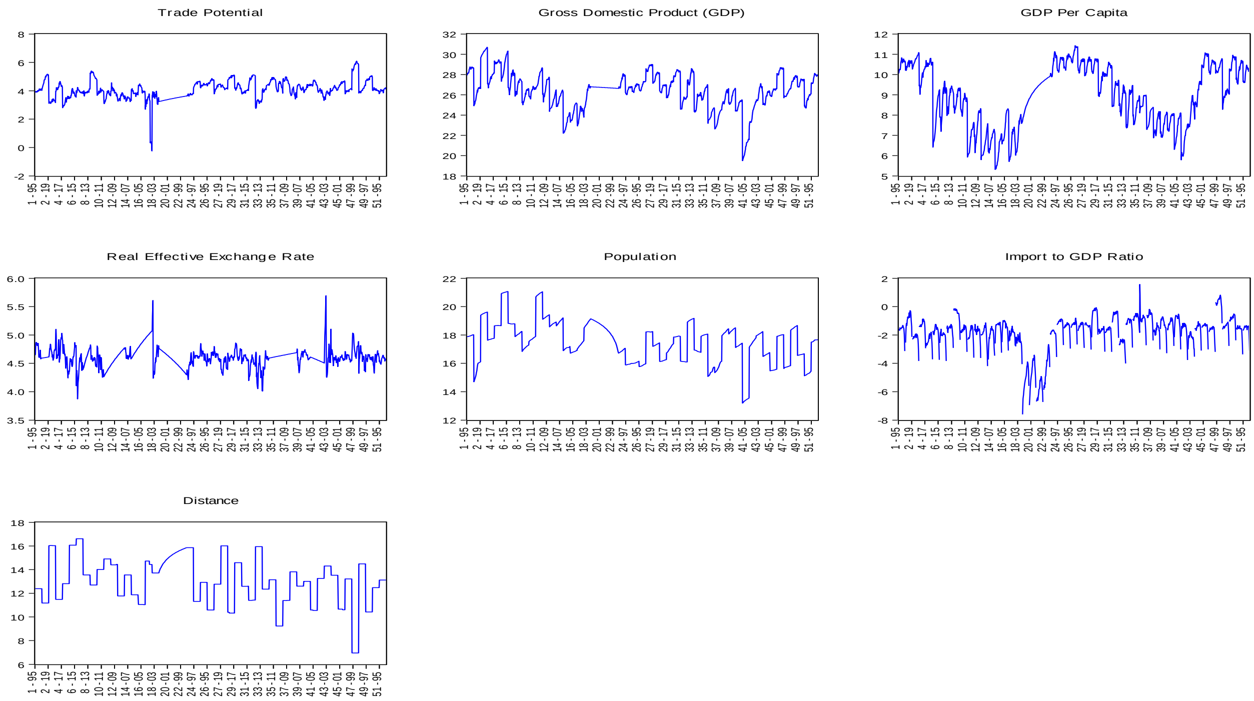
Appendixes

Appendix-A: Original Data



Log Transformation



Appendix-B

Correlogram at Level

Sample: 1995 2020
Included observations: 1326

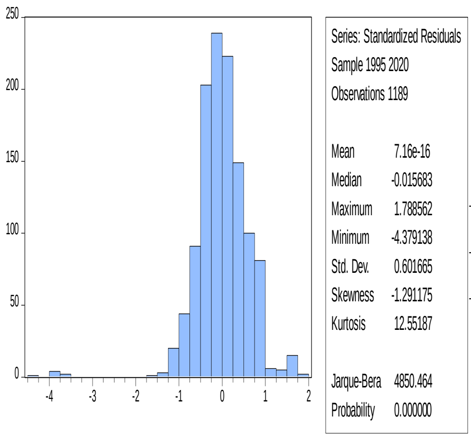
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.960	0.960	1225.9	0.000
		2	0.920	-0.025	2352.7	0.000
		3	0.880	-0.033	3382.4	0.000
		4	0.837	-0.042	4315.9	0.000
		5	0.794	-0.029	5156.7	0.000
		6	0.750	-0.044	5906.6	0.000
		7	0.703	-0.057	6566.0	0.000
		8	0.653	-0.065	7135.5	0.000
		9	0.603	-0.029	7621.6	0.000
		10	0.555	-0.009	8033.1	0.000
		11	0.507	-0.018	8377.5	0.000
		12	0.464	0.026	8666.0	0.000
		13	0.420	-0.039	8902.5	0.000
		14	0.378	-0.009	9093.8	0.000
		15	0.338	0.000	9247.0	0.000
		16	0.298	-0.023	9366.7	0.000
		17	0.261	-0.011	9458.5	0.000
		18	0.226	-0.003	9527.4	0.000
		19	0.193	-0.016	9577.5	0.000
		20	0.161	-0.013	9612.3	0.000
		21	0.130	-0.015	9635.2	0.000
		22	0.103	0.016	9649.5	0.000
		23	0.077	-0.022	9657.5	0.000
		24	0.051	-0.027	9661.0	0.000

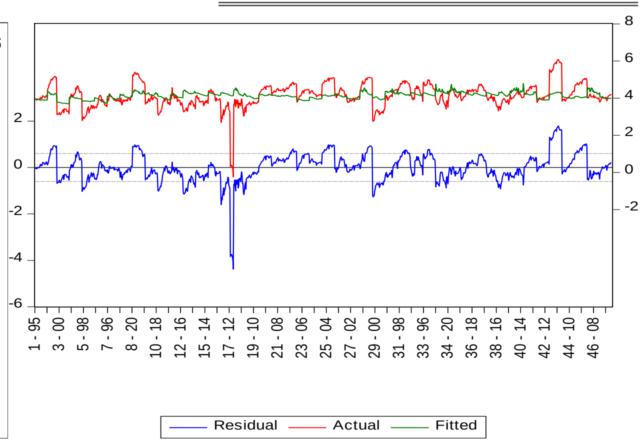
Correlogram at 1^{st} Difference

Sample: 1995 2020
Included observations: 1275

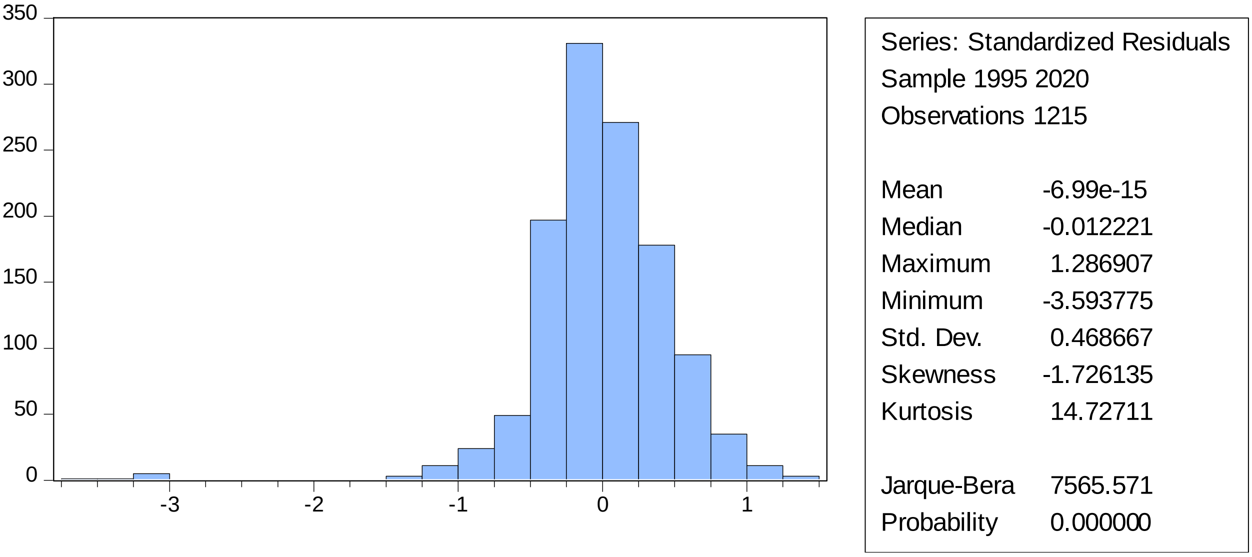
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.068	0.068	5.8368	0.016
		2	-0.004	-0.008	5.8527	0.054
		3	0.067	0.068	11.628	0.009
		4	0.041	0.032	13.778	0.008
		5	-0.042	-0.046	16.035	0.007
		6	0.087	0.090	25.764	0.000
		7	0.103	0.086	39.271	0.000
		8	-0.026	-0.034	40.151	0.000
		9	-0.179	-0.186	81.137	0.000
		10	0.040	0.046	83.182	0.000
		11	0.032	0.035	84.472	0.000
		12	-0.099	-0.083	97.002	0.000
		13	-0.023	-0.027	97.668	0.000
		14	-0.024	-0.047	98.425	0.000
		15	-0.085	-0.031	107.85	0.000
		16	-0.079	-0.038	115.99	0.000
		17	0.015	-0.002	116.27	0.000
		18	0.032	0.021	117.63	0.000
		19	-0.009	0.033	117.73	0.000
		20	-0.026	-0.016	118.63	0.000
		21	-0.002	-0.028	118.63	0.000
		22	-0.000	0.021	118.63	0.000
		23	-0.005	0.001	118.67	0.000
		24	-0.003	-0.035	118.68	0.000

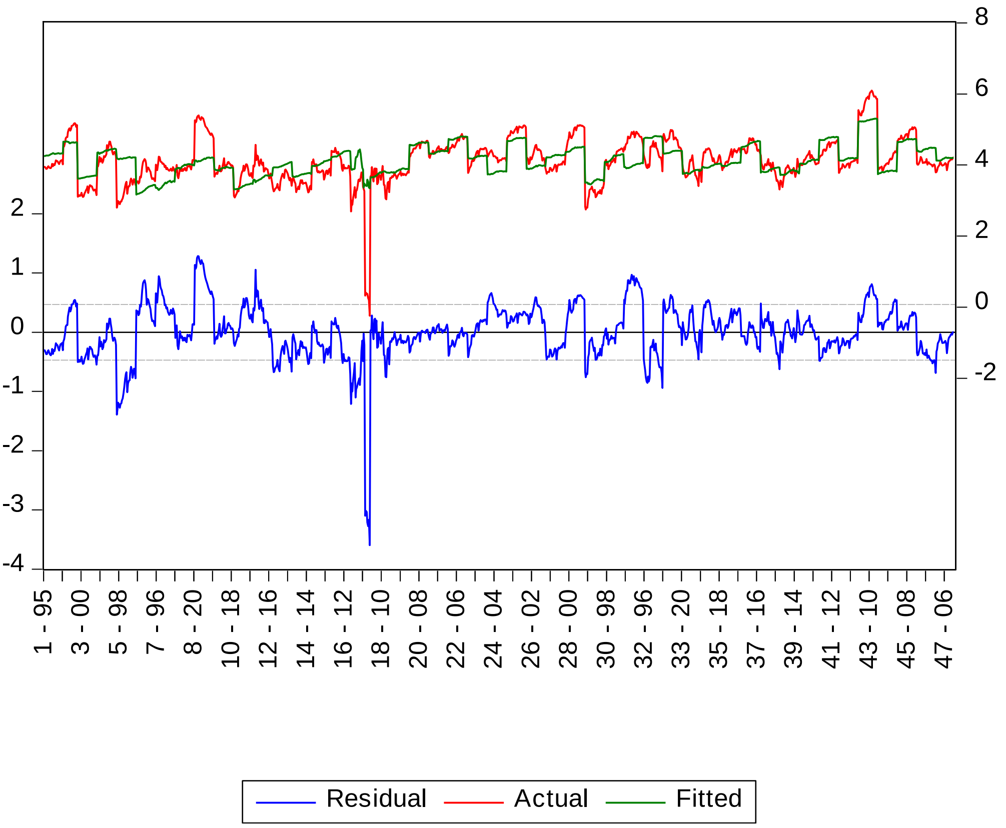
App



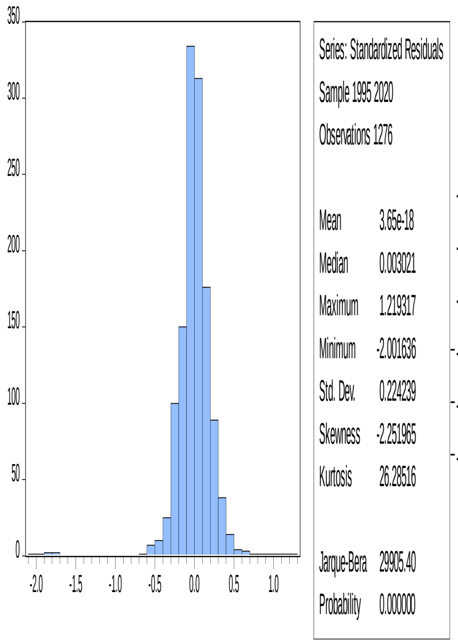


Appendix-D





Appendix-E



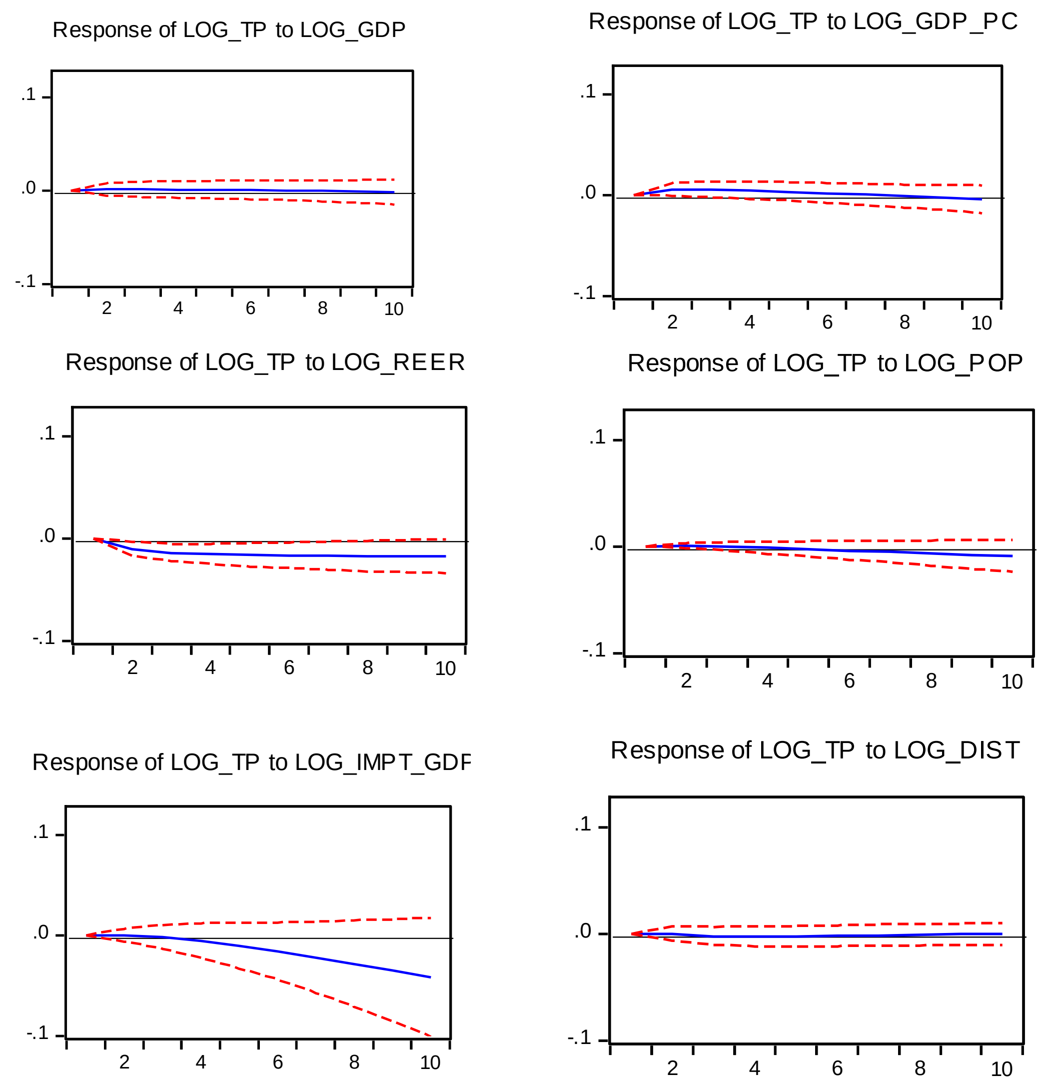
Appendix-F

Pairwise Granger Causality Tests
Sample: 1995 2020

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause Trade Potential	1224	1.24722	0.2877
Trade Potential does not Granger Cause GDP		1.96439	0.1407
GDP Per Capita does not Granger Cause Trade Potential	1224	2.13429	0.1188
Trade Potential does not Granger Cause GDP Per Capita		7.79003	0.0004
REER does not Granger Cause Trade Potential	1224	3.64296	0.0265
Trade Potential does not Granger Cause REER		0.06564	0.9365
Population does not Granger Cause Trade Potential	1224	0.44424	0.6414
Trade Potential does not Granger Cause Population		0.64722	0.5237
Import to GDP Ratio does not Granger Cause Trade Potential	1174	0.01019	0.9899
Trade Potential does not Granger Cause Import to GDP Ratio		24.6878	0.0000
Distance does not Granger Cause Trade Potential	1224	0.51866	0.5954
Trade Potential does not Granger Cause Distance		3.73361	0.0242

"*Granger Causality*"

Appendix-G
Impulse Response



Appendix-H

$$TP_{it} = \alpha_{it} + \beta_1 GDP_{it} + \beta_2 Dist_{it} + \beta_3 POP_{it} + \beta_4 REER_{it} + \varepsilon_{it}$$

The following ARDL(1,1,1,1) equation:

$$TP_{it} = \alpha_{it} + \alpha_1 TP_{it-1} + \beta_1 GDP_{it} + \beta_2 GDP_{it-1} + \beta_3 Dist_{it} + \beta_4 Dist_{it-1} + \beta_5 POP_{it} + \beta_6 POP_{it-1} + \beta_7 REER_{it} + \beta_8 REER_{it-1} + \varepsilon_{it}$$

Whereas:

$TP_{it} = \Delta TP_{it} + TP_{it-1}$

$GDP_{it} = \Delta GDP_{it} + GDP_{it-1}$

$Dist_{it} = \Delta Dist_{it} + Dist_{it-1}$

$POP_{it} = \Delta POP_{it} + POP_{it-1}$

$$REER_{it} = \Delta REER_{it} + REER_{it-1}$$

The following equation of Error Correction Mechanism (ECM)

$$\Delta TP_{it} + TP_{it-1} = \alpha_{it} + \alpha_1 TP_{it-1} + \beta_1 GDP_{it-1} + \beta_2 GDP_{(\Delta GDP_{it} + GDP_{it-1})} + \beta_3 Dist_{it-1} + \beta_4 Dist_{(\Delta Dist_{it} + Dist_{it-1})} + \beta_5 POP_{it-1} + \beta_6 POP_{(\Delta POP_{it} + POP_{it-1})} + \beta_7 REER_{it-1} + \beta_8 REER_{(\Delta REER_{it} + REER_{it-1})}$$

$$\Delta TP_{it} = \alpha_{it} - TP_{it-1} + \alpha_1 TP_{it-1} + \beta_1 GDP_{it-1} + \beta_2 GDP_{(\Delta GDP_{it} + GDP_{it-1})} + \beta_3 Dist_{it-1} + \beta_4 Dist_{(\Delta Dist_{it} + Dist_{it-1})} + \beta_5 POP_{it-1} + \beta_6 POP_{(\Delta POP_{it} + POP_{it-1})} + \beta_7 REER_{it-1} + \beta_8 REER_{(\Delta REER_{it} + REER_{it-1})}$$

$$\Delta TP_{it} = \alpha_{it} - TP_{it-1} + \alpha_1 TP_{\Delta it-1} + \beta_1 GDP_{it-1} + \beta_2 GDP_{\Delta it} + \beta_2 GDP_{it-1} + \beta_3 Dist_{it-1} + \beta_4 Dist_{\Delta it} + \beta_4 Dist_{it-1} + \beta_5 POP_{it-1} + \beta_6 POP_{\Delta it} + \beta_6 POP_{it} + \beta_7 REER_{it-1} + \beta_8 \Delta REER_{it} + \beta_8 REER_{it-1}$$

$$\Delta TP_{it} = \alpha_{it} - (1 - \alpha_1) TP_{it-1} + (\beta_1 + \beta_1) GDP_{it-1} + (\beta_3 + \beta_4) Dist_{it-1} + (\beta_5 + \beta_6) POP_{it-1} + (\beta_7 + \beta_8) REER_{it-1} + \beta_2 \Delta GDP_{it} + \beta_4 \Delta Dist_{it} + \beta_6 \Delta POP_{it} + \beta_8 \Delta REERI_{it}$$

$$\Delta TP_{it} = \alpha_{it} - (1 - \alpha_1) \left[TP_{it-1} + \frac{(\beta_1 + \beta_2)}{(1 - \alpha_1)} GDP_{it-1} + \frac{(\beta_3 + \beta_4)}{(1 - \alpha_1)} Dist_{it-1} + \frac{(\beta_5 + \beta_6)}{(1 - \alpha_1)} POP_{it-1} + \frac{(\beta_7 + \beta_8)}{(1 - \alpha_1)} REER_{it-1} \right] + \beta_2 \Delta GDP_{it} + \beta_4 \Delta Dist_{it} + \beta_6 \Delta POP_{it} + \beta_8 \Delta REER_{it}$$

Therefore:

$$\Delta TP_{it} = \alpha_{it} + \gamma_1 ECT_{it-1} + \beta_2 \Delta GDP_{it} + \beta_4 \Delta Dist_{it} + \beta_6 \Delta POP_{it} + \beta_8 \Delta REER_{it}$$

Whereas:

$$\gamma_1 = 1 - \alpha_1$$

$$ECT_{t-1} = \left[TP_{it-1} + \frac{(\beta_1 + \beta_2)}{(1 - \alpha_1)} GDP_{it-1} + \frac{(\beta_3 + \beta_4)}{(1 - \alpha_1)} Dist_{it-1} + \frac{(\beta_5 + \beta_6)}{(1 - \alpha_1)} POP_{it-1} + \frac{(\beta_7 + \beta_8)}{(1 - \alpha_1)} REER_{it-1} \right]$$

So that based on ARDL (1, 1, 1, 1) model, determine long-run coefficients:

$$\Delta TP_{it} = \alpha_{it} + \alpha_1 TP_{it-1} + \beta_1 GDP_{it} + \beta_2 GDP_{it-1} + \beta_3 Dist_{it} + \beta_4 Dist_{it-1} + \beta_5 POP_{it} + \beta_6 POP_{it-1} + \beta_7 REER_{it} + \beta_8 REER_{it-1} + \varepsilon_{it}$$

So that long-run coefficients as following:

$$TP_{it} = \theta_{it} + \varphi_1 GDP_{it} + \varphi_2 Dist_{it} + \varphi_3 POP_{it} + \varphi_4 REER_{it} + \delta_{it}$$

Whereas:

$$\varphi_1 = \frac{(\beta_1 + \beta_2)}{(1 - \alpha_1)}$$

$$\varphi_2 = \frac{(\beta_3 + \beta_4)}{(1 - \alpha_1)}$$

$$\varphi_3 = \frac{(\beta_5 + \beta_6)}{(1 - \alpha_1)}$$

$$\varphi_4 = \frac{(\beta_7 + \beta_8)}{(1 - \alpha_1)}$$

$$\delta_{it} = error\ term$$

Appendix-I

Australia
Austria
Bangladesh
Belgium
Bhutan
Brazil
Canada
Chile
China
Denmark
Egypt, Arab Rep.
France
Germany
Hong Kong SAR, China
Hungary
India
Indonesia
Iran, Islamic Rep.
Italy
Japan
Jordan
Kenya
Korea, Rep.
Lebanon
Malaysia
Mexico
Morocco
Nepal
Netherlands
New Zealand
Nigeria
Pakistan
Philippines
Romania
Russian Federation
Saudi Arabia
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Thailand
Turkey
United Arab Emirates
United Kingdom
United States
United Arab Emirates
United Kingdom
United States
Yemen, Rep.