

## Economic Integration of Pakistan: An Empirical Test of Purchasing Power Parity

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**ABSTRACT:** This paper empirically analyses the substantiation of (PPP) purchasing power parity theory in Pakistan. For finding the association in exchange rate's precariousness and inflation rate's disparity between Pakistan and its thirteen major trading partners, study used OLS method, and for long run relationship applied co-integration, error correction model and panel co-integration technique over the time span of 1972Q1-2012Q3. OLS results are shown very small values of  $R^2$ . But co-integration, Unit root test results and Panel tests' results revealed the existence of long run equilibrium relationship between Pakistan and sample countries. The error correction terms also exposed and confirmed the speed of adjustment from disequilibrium to long run equilibrium condition at significant level. Panel unit root test and panel co-integration test by Pedroni also revealed that expected inflation rate differential have a positive and significant effect on exchange rate change between Pakistan and its trading partners during the sample period. The results also provided the strong evidence that economic integration between foreign exchange markets and commodity markets among the sample countries is very high. For getting the proper fruits of globalization it is required to enhance the canvas of exports quantity and numbers of export items.

**Keywords:** Inflation disparity, purchasing power parity, economic integration.

**JEL Classification:** C32; F31; F36.

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### I. INTRODUCTION

Economies become too closer after the globalization process and adoption of clean floating exchange rate system. International institutions are strictly following a free trade concept with zero trade barriers between countries. World Trade Organization (WTO) is performing principal role in this regard. This paper is an attempt to gauge the level of integration of Pakistan's commodity market with respect to thirteen trading countries' commodity markets. This concept is based on the literature known as Purchasing power parity theory. The awareness about arbitrage opportunities in goods market is useful for empirical evidence of this theory, many researchers and policy makers' emphases work on them.

The reminder sections of this paper are as follows: section 2 explains the theory of PPP and its model, section 3 presents literature review, section 4 relates to data and methodology, section 5 displays estimated results and section 6 explains conclusion.

#### Theoretical Perspective of Purchasing Power Parity:

This study presents an important part of International finance. In 1916, a Swedish economist Gustav Cassell introduced the concept of the Purchasing Power Parity. This theory states that arbitrage forces equalize goods prices internationally when prices are measured in term of one currency. This theory is an application of law of one price and explains in two forms; one is strict form known as absolute purchasing power parity while the other is a weaker form termed as relative purchasing power parity.

The absolute version of purchasing power parity states as:

$$e = \frac{P_d}{P_f} \quad (2.1)$$

Where  $e$  is the exchange rate  $P_d$  and  $P_f$  are domestic and foreign prices respectively. Absolute version of PPP describes that specific basket of goods of two countries have same value when they judged in one currency. Commonly non holding of absolute version of PPP due to the existence of transportation costs, imperfect information, tariff and non-tariff barriers on trade, productivity differentials and commodities difference. However weak form of PPP anticipated to hold in the presence of these distortions.

Second version of PPP known as relative PPP states that difference in inflation rates between two countries is responsible to change the value of currency of both the countries. A rise in general prices of an economy depreciates the value of that economy's currency in term of other economy.

$$\pi_{t-1} - \pi_t = \pi_d - \pi_f \quad (2.2)$$

Where  $e_{t+1} - e_t$  is anticipated variation in exchange rate,  $\pi_t$  is rate of inflation in home economy and  $\pi_f$  is rate of inflation in external economy, all variables are in log form, the PPP equation in an empirically recognisable form is

$$\Delta e_{t+1} = \alpha + \beta(\pi_d - \pi_f)_t + \varepsilon_t \quad (2.3)$$

Left hand term design at esanticipated variation in exchange rate as dependent variable, right hand side defines,  $\alpha$  as constant,  $\beta$  as coefficient of dependent variable and  $(\pi_d - \pi_f)$ , difference in inflation between two economies as independent variable, last term  $\varepsilon_t$  shows the error in forecast.

Present study throughout concerned with the relative version of Purchasing Power Parity theory. After the adoption of flexible exchange rate system in the world economies empirical evaluation of PPP theory got more attention by researchers. As volume of global trade is rising it is important for each country to find out its degree of integration which is very important.

## II. LITERATURE REVIEW

Existing literature Nelson, 1990; Wu, 1996; Parikh and Williams, 1998; Zyoud, 2015 expressed that empirical existence of PPP is very weak in the short run as output prices move very slowly as compare to change in currencies' value. On the other hand, long run existence is supported by many economists (Bhatti, 1996; Lothain and Taylor, 1996 and Shively, 2001) according to them relative prices between two countries move proportionately to the nominal exchange rate volatility and their real exchange rate (RER) return to its long run equilibrium position. Shively emphasized that although PPP do not influence real exchange rate but play a dominant role in the determination of nominal exchange rate. Kanyembo and Sheefeni (2013) empirically tested PPP between Zambia and South Africa their result also supportive and showed the existence of PPP in the long run.

Qayyum and others (2004) concluded that liberalization policy in trade and exchange rate, made possible the working of law of one price / absolute version of PPP. They provided supportive evidence of PPP in the long run but not for short run. Janjua and Ahmed (2006) and Mohammad and others (2009) evaluated the technique of sustainable real effective exchange rate in Pakistan. Janjua and Ahmed tested PPP for four South Asian countries and verified its existence among these countries. During the study period they exposed that there is weak form of PPP as real exchange rates were remaining highly unstable in Pakistan. Both studies results have same conclusion about the holdings of PPP.

Many studies have been done to empirically investigate the existence of PPP theory, between developed economies, between developed and developing economies, emerging and developed economies, emerging and developing economies. With reference to Pakistan many empirical work has been done but they concentrated to US, UK and South Asian countries. This study is different from the previous research because its sample countries are those which contribute almost fifty percent of Pakistan's total trade and also the main provider of worker remittances.

Related literatures provide strong evidence in the support of the PPP theory. This theory keeps significant inference. If any economy does not effect by any external shock it means it has steady real exchange rate with floating nominal exchange rate and provide strong evidence of the holding of Purchasing Power Parity. Forecasting error in expectation about future inflation is responsible for nonconformity of PPP theory.

## III. RESEARCH METHODOLOGY

The consistency of Purchasing Power Parity (PPP) theory explains the determinants of exchange rates based on the arrangements of exchange rate in a long span also evaluated by researchers. Knowledge about arbitrage movements and real market equilibrium are very important for the researchers and policy makers.

Present research used econometric technique as research methodology to empirically analyse the existence of Purchasing Power Parity (PPP). This paper is an empirical investigation of such relationship between Pakistan and its thirteen trading partners. These trading partners are Canada, China, France, Germany, Hong Kong, Japan, Korea, Kuwait, Malaysia, Saudi Arabia, the United Arab Emirates, the United Kingdom and the United States of America. Present research employed quarterly data with time span from 1972Q1 to 2012Q3. All these macroeconomic variables data are collected from the International Financial Statistics (IFS-CD ROM.) which are published by the International Monetary Fund (IMF). Both series are taken into log form.

OLS regression methodology is used to analyse the relationship between dependent variable (exchange rate change) and independent variable (inflation rate differentials). The strength of this relationship is determined by the value of  $R^2$ . Values of t show the individual relationship. For empirical existence of the theory coefficients' signs and values are helpful to accept or reject the hypothesis.

As many macroeconomics time series are non-stationary at level and become suitably presentable after first difference. This happened when means and variances of variables change over time and they become as unit root variables. ADF unit root test is applied for each exchange rate change series and inflation differential series

for each country-pair, their first differences are used to determine the stationarity of each individual country-pair. Series become stationary after taking difference, although long-run relationship hypothesized when values of variables hold at level. Johansen's (1991, 1995) co-integration test is mostly used in research to find out long-run relationship. Johansen's test based on two tests, the maximum eigenvalue test and the trace test. The  $\lambda$ -max test assembled as

$$\lambda_{\max[H_1((r-1)|H_1(r))]} = -T \log(\mathbf{1} - \hat{\lambda}_r) \quad (4.1)$$

For  $r = 0, 1, 2, \dots, p - 2, p - 1$ . Null hypothesis is that  $r$  co-integrating vectors are existed against the alternative hypothesis of  $r + 1$  vectors. The trace test is constructed as

$$\lambda_{\text{trace}(H_1(r)|H_0)} = -T \sum_{i=r+1}^p \log(\mathbf{1} - \hat{\lambda}_i) \quad (4.2)$$

Null hypothesis is that  $\lambda_i = 0$ , and first  $r$   $\lambda$ -max values are not zero. Trace test is better than Maximum Eigen value test as it adjusted for degree of freedom. ECMs are a theoretically-driven approach useful for estimating both short-term and long-term effects of one-time series on another. The term error-correction relates to the fact that last-periods deviation from a long-run equilibrium, the error, influences its short-run dynamics. Thus ECMs directly estimate the speed at which a dependent variable returns to equilibrium after a change in other variables. It is also more vigorous to skewness and excess kurtosis. Decision should be made on trace test. For more accuracy Panel unit root test and Panel co-integration test are applied which compute several tests. Paderoni panel co-integration techniques are applied which construct seven statistic tests, four based on within group and three between groups.

#### IV. ESTIMATED RESULTS

The empirical evidence of Purchasing Power Parity existed by linking the inflation rates differential between two countries to the change in the exchange rates and according to the models.

$$\Delta E_t = \varphi_1 + \varphi_2(\pi_d - \pi_f)_t + \varepsilon_t$$

Where  $\Delta E$  = change in exchange rate

$\pi_d - \pi_f$  = inflation differential

And  $\varepsilon_t$  = error term.

Econometrically, co-integration defines the correlation between non-stationary variables by testing for the existence of a unit root in the residuals  $\varepsilon_t$  of equation.

Purchasing Power Parity theory states that there is one to one relationship between changes in the value of currency in exchange of other foreign currency and expected inflation differential between two countries. Ordinary Least Square methodology results of this bivariate model are presented in Table 1. Constant's value of each country-pair is zero with positive sign and statistically significant, except Pak-China pair where it is negative and also insignificant.

**Table I** Results of purchasing power parity model

$\Delta e$ Countries Pair	C	$(\pi_d^e - \pi_f^e)$	$R^2$	DW
Pak-Canada	0.02 (0.01) [3.8]	-0.13 (0.23) [-0.6]	0.002	0.7
Pak-China	-0.0005 (0.01) [-0.9]	1.4 (0.3) [5.5]	0.29	2.01
Pak-France	0.02 (0.01) [2.6]	0.3 (0.3) [1.03]	0.01	0.92
Pak-Germany	0.02 (0.01) [3.23]	0.1 (0.26) [0.4]	0.001	0.72
Pak-HK	0.012 (0.003) [4.03]	0.24 (0.16) [1.5]	0.02	1.2
Pak-Japan	0.003 (0.0013) [2.18]	0.12 (0.05) [2.5]	0.04	1.6
Pak-Korea	0.0004	0.0112	0.02	1.5

	(0.0002) [2.13]	(0.01) [1.77]		
Pak-Kuwait	0.015 (0.002) [6.5]	-0.01 (0.1) [-0.1]	0.0001	1.4
Pak-Malaysia	0.013 (0.01) [2.3]	0.36 (0.25) [1.44]	0.13	0.7
Pak-Saudi Arabia	0.017 (0.005) [3.72]	0.16 (0.15) [1.02]	0.01	0.56
Pak-UAE	0.012 (0.005) [2.99]	0.4 (0.2) [2.7]	0.044	0.6
Pak-UK	0.02 (0.01) [2.8]	0.021 (0.23) [0.1]	0.0000 5	1.01
Pak-USA	0.02 (0.005) [3.7]	0.05 (0.22) [0.224]	0.0003	0.6

Note: - values are given in parenthesis are standard error and in [ ] are t-statistics.

The coefficients' values, of exchange rate change variable with respect to the expected inflation differential, are not according to the theory. Only in the Pak-China pair coefficient value is 1.4 and it is statistically significant as theory states. In all other countries' coefficient values are positive except in Pak-Canada and Pak-Kuwait pairs where this coefficient values are negative. In Pak-Japan, Pak-Hong Kong, Pak-Korea Pak-Malaysia and Pak-UAE pairs although the coefficients' values are very low but their statistical level of significance is 10 % or better as compare to other remaining countries' pairs. These pairs are Pak-France, Pak-Germany, Pak-Saudi Arabia, Pak-UK and Pak-US, they do not show the existence of purchasing power parity theory. Because, instead of one for one relationship between exchange rate and price differential, results present very weak relationship between these two variables.

These results reveal that the empirical existence of Purchasing Power Parity is very weak. Pakistani exports consist on primary products and foods items which are non-competitive in the world's goods market. Their demands are inelastic in nature that is why although prices in Pakistan are very low as compare to its trading countries but there is continuous reduction in the value of Pakistani currency in exchange of foreign currencies. This is the main reason of non-existence of Purchasing Power Parity theory.

**Table II** Unit Root Test Results

Country-Pair	T	Deterministic Term	Lag	Test Statistics $\pi_d - \pi_f$	Test Statistics $\Delta e$
Pak-Canada	154	Constant/1st Diff	6	-8.20	-12.60
Pak-China	73	Constant/1st Diff	4	-3.13	-11.39
Pak-France	154	Constant/1st Diff	6	-8.44	-11.42
Pak-Germany	154	Constant/1st Diff	7	-2.99	-11.71
Pak-H K	119	Constant/1st Diff	6	-8.38	-12.93
Pak-Japan	154	Constant/1st Diff	6	-11.00	-4.74
Pak-Korea	158	Constant/1st Diff	3	-3.66	-10.67
Pak-Kuwait	156	Constant/1st Diff	0	-12.16	-13.77
Pak-Malaysia	158	Constant/1st Diff	3	-4.02	-11.99
Pak-S A	158	Constant/1st Diff	3	-3.52	-13.98
Pak-UAE	153	Constant/1st Diff	6	-8.94	-14.03
Pak-UK	154	Constant/1st Diff	6	-7.46	-12.48
Pak-USA	158	Constant/1st Diff	3	-3.37	-13.67

Critical Test Values at 1%, 5% and 10% levels, -3.45, -2.88 and -2.57 respectively.

Unit root tests results are very important for the co-integration tests procedure. Table 2 presented the results of ADF test of exchange rates change and expected inflation rate differentials between Pakistan and other twelve countries. Augmented Dickey Fuller (1979) unit root test is performed. The ADF test statistics which tests the

unit root null of stationary, if these values are greater than ADF critical values, do not reject null hypothesis that is existence of unit root. If ADF critical values are greater than test statistics it rejects the null hypothesis of no existence of unit root. For applying ADF test time series transform from non-stationary to stationary.

For data with deterministic trend, Trend-Stationary Process (TSP) is used first but results could not reject the null hypothesis for all countries pair and variables. After that, Difference Stationary Process (DSP) is used. At first difference all calculated test statistics are smaller than the critical values for the ADF tests, for all countries' pair thus null hypothesis is rejected here and alternate hypothesis accepted. Expected inflation rate differential and change in exchange rate series become stationary at level I (1) with constant. So results reject the null hypothesis at 5% significant level and accept the alternate.

To check the long-run relationship between these two variables (expected inflation rate differentials and change in exchange rate), Johanson's co-integration technique is used. Co-integration test results are presented for all country-pair in table 3. This co integration test is based on Purchasing Power Parity (PPP) model, assuming an intercept without trend. Null hypothesis for this test is that there is no co-integrating ( $r = 0$ ) vectors between these two variables which are considered for this study.

**Table 3** Results of co-integration test:  $\Delta e_t, (\pi_t - \pi_t^e)$  Trend assumption: linear deterministic trend

Country Pair	No. of Co-integrating Vectors	Trace Statistics	No. of Co-integrating Vectors	Max. Eigen Statistics
Pak-Canada	None *	53.82	None *	51.76
	At most 1	2.06	At most 1	2.06
Pak-China	None *	26.33	None *	25.84
	At most 1	0.49	At most 1	0.5
Pak-France	None *	53.4	None *	51.03
	At most 1	2.34	At most 1	2.34
Pak-Germany	None *	45.51	None *	45.33
	At most 1	1.77	At most 1	1.77
Pak-Hong Kong	None *	40.94	None *	38.82
	At most 1	2.12	At most 1	2.12
Pak-Japan	None *	33.32	None *	28.13
	At most 1 **	5.19	At most 1 **	5.2
Pak-Korea	None *	44.91	None *	44.08
	At most 1	0.83	At most 1	0.83
Pak-Kuwait	None *	34.15	None *	33.96
	At most 1	0.22	At most 1	0.22
Pak-Malaysia	None *	52.43	None *	51.15
	At most 1	1.27	At most 1	1.27
Pak-Saudi Arabia	None *	35.78	None	35.57
	At most 1	0.20	At most 1	0.20
Pak-UAE	None *	42.2	None *	40.16
	At most 1	2.08	At most 1	2.08
Pak-UK	None *	58.2	None *	56.24
	At most 1	1.95	At most 1	1.95
Pak-USA	None *	39.56	None *	37.24
	At most 1	2.33	At most 1	2.33

Note: Trace Statistics Critical Values at 5%, 15.49471, 3.841466 and Max-Eigen Statistics

Critical Values at 05% 14.26460, 3.841466 are existing to test the null hypotheses of "no co-integrating vectors ( $H_0: r=0$ )", and "at most one co-integrating vector ( $H_0: r=1$ )". Critical values at 5% significance level are consistently the same for all. A\* denotes rejection of the null hypothesis of  $r=0$  at the 0.05 significant level. A\*\* denotes rejection  $r=1$  at 0.05 significant level.

Table 3 reports the summary of the results and show that there is strong rejection of null hypothesis of no co-integration ( $r = 0$ ) for all the country pairs and acceptance of the alternative hypothesis that there is one co-integration vector during full sample period. Depending on two possible tests, Trace and Max-Eigen statistics, these tests statistics values are greater than their critical values. After considering trace  $\lambda$  test, the null of no-co-integration ( $r = 0$ ) against the alternative of one or more co-integrating vectors ( $r > 0$ ) is rejected at 5% level. The null hypothesis at most one co-integrating vectors ( $r = 1$ ) is not rejected for all countries' pairs except Pak-Japan pair where these null hypotheses were rejected even at 5 % level against the alternative ( $r > 1$ ). The max  $\lambda$

test helps to clarify the exact value of  $r$ . The null of no co-integrating vectors ( $r = 0$ ) against the specific alternative ( $r = 1$ ) is rejected at 5% level for all country-pair. The null of one co-integrating vector ( $r=1$ ) is not rejected for all countries pair except Pak-Japan. The both test statistics imply the presence of at least oneco-integratingequation at 5 % significance level, for both variables in each country-pair.

Trace-test is better than maximum eigenvalue test as trace test adjusted for degree of freedom. So according to the Trace-test statistics the presence of oneco-integrating equations implies that both variables are related in long run between Pakistan and its thirteen major trading partners. Purchasing Power Parity Condition (PPPC) indicates that expected domestic expected inflation rate and foreign expected inflation rate have an important role in the determination of the equilibrium exchange rate.

After applying co-integration test error correction technique is used to find out error-correction terms (ECT)as regressors which reveal long run dynamics and system convergent towards long run equilibrium. The lagged values' coefficients of dependent and independent variables are short run parameters measure the immediate impact of inflation differentials on the value of currencies.

The error-correction results in Table 4 specified the negatively signed error-correction terms and t- statistics which confirm significance level at 5 % for each country-pair. These error correction terms expose the speed of adjustment from disequilibrium to long run equilibrium condition.

**Table 4** Results of ECM

Variables	C	$\Delta e(-1)$	$\Delta e(-2)$	$\Delta \pi(-1)$	$\Delta \pi(-2)$	ECT	R2
Pak-Canada	0.00 (0.00) [0.42]	0.20 (0.05) [ 3.03]	0.04 (0.05) [ 0.82]	1.16 (0.4) [3.05]	-0.4 (0.4) [ -1.01]	-0.84 (0.09) [-9.02]	0.44
Pak-China	-0.00 (0.00) [0.08]	0.071 (0.165) [ 0.43]	0.07 (0.13) [ 0.63]	-0.24 (0.46) [ 0.52]	0.98 (0.45) [2.20]	-0.976 (0.21) [-4.63]	0.48
Pak-France	0.00 (0.00) [0.03]	0.105 (0.07) [ 1.44]	-0.064 (0.06) [-1.07]	0.514 (0.71) [ 0.72]	-0.18 (0.71) [-0.26]	-0.825 (0.10) [-7.93]	0.40
Pak-Germany	-0.00 (0.01) [-0.0]	0.07 (0.08) [0.98]	-0.106 (0.06) [-1.73]	0.65 (0.65) [0.99]	-0.25 (0.65) [-0.38]	-0.85 (0.11) [-7.86]	0.43
Pak-HK	-0.00 (0.00) [0.30]	0.21 (0.09) [ 2.23]	0.03 (0.08) [-0.36]	-0.098 (0.24) [-0.4]	-0.12 (0.24) [-0.49]	-0.76 (0.11) [-6.94]	0.37
Pak-Japan	-0.00 (0.00) [0.19]	-0.17 (0.09) [-1.8]	-0.37 (0.07) [-4.93]	0.21 (0.10) [ 2.03]	0.27 (0.10) [2.69]	-0.50 (0.11) [-4.5]	0.48
Pak-Korea	0.00 (0.00) [0.22]	0.16 (0.09) [ 1.6]	-0.06 (0.08) [-0.76]	0.03 (0.00) [ 3.06]	0.02 (0.01) [1.72]	-0.98 (0.13) [-7.33]	0.46
Pak-Kuwait	0.00 (0.00) [0.01]	0.09 (0.09) [ 0.96]	-0.09 (0.08) [-1.12]	-0.23 (0.07) [-3.19]	-0.15 (0.06) [-2.42]	-0.67 (0.10) [-6.21]	0.35
Pak-Malaysia	0.00 (0.00) [0.15]	0.08 (0.06) [ 1.35]	0.01 (0.06) [ 0.24]	0.55 (0.26) [2.06]	-0.08 (0.26) [-0.32]	-0.63 (0.08) [-7.37]	0.33
Pak-Saudi Arabia	0.00 (0.00) [0.13]	0.12 (0.05) [2.34]	-0.05 (0.05) [-1.08]	0.02 (0.07) [0.29]	-0.035 (0.07) [-0.47]	-0.59 (0.08) [-7.46]	0.31
Pak-UAE	0.00 (0.00) [0.07]	0.12 (0.05) [ 2.20]	-0.058 (0.04) [-1.19]	0.04 (0.08) [ 0.49]	0.06 (0.08) [ 0.74]	-0.59 (0.08) [-7.35]	0.30
Pak-UK	0.00 (0.00) [0.21]	0.20 (0.07) [ 2.58]	0.00 (0.06) [ 0.05]	0.64 (0.32) [1.99]	0.41 (0.31) [1.31]	-1.02 (0.11) [-9.14]	0.45
Pak-USA	0.00 (0.00) [0.34]	0.21 (0.05) [3.99]	0.00 (0.05) [0.08]	0.44 (0.24) [1.78]	0.23 (0.25) [0.94]	-0.62 (0.08) [-7.68]	0.32

According to the result speed of adjustment of exchange rate change towards eliminating disequilibrium within a quarter varies among countries. The absolute values of the error correction terms are 85, 97, 82, 85, 76, 50, 98, 67, 63,59,59,102, 62,between Pakistan and Canada, China, France, Germany and Hong Kong, Japan, Korea, Kuwait, Malaysia,Saudi Arabia, United Kingdom and United States of America respectively. Allestimated coefficients in percentage revealed adjustment in one quarter due to disequilibrium and designated that any change in inflation rate differentials between these pairs of countries created disequilibrium will be corrected by the adjustment in the value of exchange rates in one quarter. Results clearly show that for all countries pair speed of adjustment is very high and there is quick convergence towards equilibrium. These results also express that there are close ties between Pakistan and its thirteen main trading partners.

In recent research Panel Data got more attention, as they give more efficient results, suitable to detect and measure effects and study the dynamics of change and they are time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power.

Current literatures recommend panel unit root tests as compare to tests based on individual time series as panel has higher power. Four different types of tests commonly known as panel unit root. Levin, Lin and Chu (2002), on the one hand, have null “unit root, assume common unit root process,on the other hand, Im, Pesaran and Shin (2003), Fisher-type tests using ADF and PP tests (Maddala and Wu (1999) and Choi (2001), have null “unit root, assume individual unit root process”.

**Table5** Panel Unit Root Test

Variable (Levels, C)	LLC	IPS	ADF	PP
$\Delta e$	-3.38* (0.00)	-43.75* (0.00)	1073* (0.00)	1168* (0.00)
$(\pi_d - \pi_f)_t$	4.4 (1.00)	-8.1* (0.00)	157* (0.00)	867* (0.00)

Thus, the evidence recommends that the both variables are progress as non-stationary processes and estimated results of OLS are biased and unreliable. Therefore, it is required to apply panel co-integration techniques for the determination of a long-run equilibrium relationship existence between the non-stationary variables in level form.

**Table 6** Panel Co-Integration Result

	Panel Statistics	Group Statistics
Variance-Ratio	38.73* (0.00)	
Rho-Statistics	-56.53* (0.00)	-51.97* (0.00)
PP-Statistics	-35.81* (0.00)	-41.32* (0.00)
ADF-Statistics	-36.52* (0.00)	-43.41* (0.00)

N=13, T= 2132

Table 6 represented the Pedronico-integration result. Seven out of seven statistics verified the existence of co-integration in the panel and long run relationship among countries as group. In the case of panel statistics, the first-order autoregressive term is assumed to be the same across all the cross sections, while in the case of group panel statistics the parameter is allowed to vary over the cross sections. As autoregressive term is same across sections in panel statistics and parameter is varying over the cross sections. The null is rejected in the panel case, and the expected inflation rate differentials are co-integrated for all the countries. On the other hand, the null is rejected in the group panel, and co-integration between the changeability of exchange rate and expected inflation rate differential exists for at least one of the country-pair.

## V. CONCLUSION

This study is an empirical work to find out the existence of purchasing power parity theory in Pakistan with its thirteen trading partner countries. Estimated OLS results demonstrate a weak form of existence of the theory. One reason of deviation from PPP theory is the forecasting error about expected inflation in different economies. Results indicated that inflation differential does not only the determinant of exchange rate change. Unit root, co-integration and panel co-integration tests revealed that almost all countries-pair are integrated and exposed the existence of long run equilibrium relationship between Pakistan and sample countries. Panel unit root test and Pedronico-integration test results also expressed that expected inflation rate differential have a positive and significant effect on exchange rate change between Pakistan and its trading partners during the sample period. The results also provided the strong evidence that economic integration between foreign exchange markets and commodity markets among the sample countries is very high.

On the other hand, Pakistan's exports and imports demands are less sensitive to the change in prices, as expected inflation and deflation rates in Pakistan do not influence trade balance proportionately.

For getting the proper fruits of globalization it is required to enhance the canvas of exports quantity and numbers of export items. Reliance on traditional export items should be shrink. Policy makers should encourage investors to invest in (ISI) import substitute industries and provide subsidy to infant industry at certain level. It is also recommended that there is plenty of rooms in the functioning of commodity markets. More emphasis on investments in market infrastructure: trekking new destinations for exports and imports, provision of rail and road transport at domestic level, discontinue supply of power, gas, and water, distributing reliable market information. Now it is the responsibility of policy makers and implementers to work for the improvement and easy access of infra-structure for all in general and specific for private investors.

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