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Real exchange rate and trade balance of Pakistan: an empirical analysis

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Abstract

This study evaluates the relationship between real exchange rate and trade balance prevailed in Pakistan during the 1985-2010 period. Engel Granger residual based and Johansen Juselius tests have been used to inquire into the long term connection between exchange rate and trade balance. Error correction model is then employed to study the short term connection. It has been discovered that there exists a connection between real exchange rate and trade balance in long as well as short run. The evidences set forth lead to a decisive conclusion that Marshall Lerner Condition and J curve effect both hold in case of Pakistan.

JEL Classification: F13, F14, F18, F31
Keywords: Real Exchange rates, trade balance, currency depreciation, Pakistan.

I. INTRODUCTION

Exchange rate policy is considered as one of the powerful tools as it directly affects trade and indirectly business, investment and other sectors of economy, and policy decisions (Liew, Lim & Hussain, 2000). Exchange rate policy is sometimes used to target balance of trade and to push it in some specific direction. Elasticity model of balance of trade has shown the existence of a theoretical relationship between exchange rate and trade balance (Kruger, 1983). However there is still ambiguity whether depreciation or appreciation in exchange rate affects balance of trade or not and up to what extent (Quio, 2005). Empirical evidences are somewhat mixed; these are unable to provide valuable inputs to policy makers in order to use the exchange rate as an effective tool to direct balance of trade (Koray and McMillin, 1998). A large number of developing countries follow an active strategy of devaluing their currencies to cope with a severe problem of balance of payment deficit (Aftab & Khan, 2008). Depreciation or devaluation of currency impacts trade balance in two ways. First, by making domestic goods cheaper as compared to foreign goods, this shifts spending from foreign to domestic goods and ultimately improves trade balance. Secondly, devaluation reduces real value of cash balances and changes relative price of traded and non traded goods, thus improving trade balance (Ling, Mun & Mei, 2007).

Economic literature states that depreciation and devaluation of currency will improve trade balance if sum up value of imports and exports demand elasticities is greater than one. This condition is known as “Marshal Lerner Condition” and has become an underlying assumption for those who support devaluation as a means to stabilize foreign exchange market and to improve trade balance (Rincon, 1998).

Even if Marshall Lerner Condition is satisfied, there are some cases where trade balances are not improved and are continued to deteriorate (Bahmani-Oskooee & Cheema, 2009). These exceptions lead to a concept, a relatively short run phenomenon that exists when a depreciation or devaluation takes place. This phenomenon is known as “J curve”. According to this concept, depreciation of currency will worsen trade balance first and then improve it later on (Magee, 1973). Marshal Lerner Condition and J curve are two concepts that explain the relationship between exchange rates for a nation’s currency and its balance of trade.

This is a conventional wisdom that if currency of a country, let’s say Pak Rupee, depreciates relative to other currencies, then this should lead to an improvement in Pakistan’s balance of trade. One reason is that, imported goods will become expensive, so consumers will buy less imported goods. On other hand, other countries will buy more goods from Pakistan due to lower real price. Hence fewer imports and more exports will lead to improvement in country’s balance of trade. This wisdom is acceptable in long run only, as the current account deteriorates sharply right after real depreciation of currency.

Literature or theory supports the argument that there is an improvement in balance of trade if Marshal Lerner Condition holds but this argument still lacks empirical support because its impact may vary depending upon the economies. J curve or a short run observed phenomenon on the other hand has also some theoretical justification but still is not supported by a lot of empirical evidences (Petrovic & Gligoric, 2010). On the basis of observed facts, there is an active need to look for empirical evidences in order to support or reject the two important phenomena, that is, Marshal Lerner Condition and J curve. Exchange rate and trade balance relationship is especially important from the view point of Pakistan because in case of Pakistan, trade balance determines major part of balance of payments. This gives an opportunity to check the relationship between exchange rate and trade balance so that valuable inputs could be provided to policy makers regarding the effectiveness of exchange rate policy to balance the

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country's foreign trade. This study empirically investigates the existence of Marshall Lerner Condition and J curve case of Pakistan. In other words, this study tries to look for empirical evidences for connection between exchange rate and trade balance and to know whether such connection is strong enough to be able to base a policy on it.

II. LITERATURE REVIEW

A large number of studies have tried to investigate the relationship between the trade balance and exchange rate. Junz and Rhomberg (1973) started work in this area and investigated the impact of exchange rate changes on trade balance. They were followed by Magee (1973). All three researchers were first to discover that there exist some lags, that is, whenever change would come in exchange rates, producers and consumers both will take time to fully adjust to new prices and this change would give rise to J curve. This concept follows a simple path that just after currency depreciation or devaluation trade balance will first deteriorate and then adjust fully to the new exchange rate. Artus and McGuirk (1981) tried to estimate demand elasticities of exports and imports of the developing countries and found out that there are no clear evidences for the existence of Marshall Lerner Condition. Kruger (1983) presented his elasticity model to theoretically address the relationship between exchange rate and trade balance. Rose and Yellen (1989) then tried to investigate the existence of J curve and Marshall Lerner Condition both for developing and developed countries and set forth their evidence for rejection of J curve hypothesis. These studies were based on ideas that were presented by Bickerdike (1920), Robinson (1947) and Metzler (1948). They put forward the elasticity approach to balance of payments. This approach addresses the improvement of trade balance when exchange rates depreciate. Marshall (1923) and Lerner (1944) further studied and explained the concept that their exist a positive effect of depreciation or devaluation on trade balance if the absolute value of demand elasticities for exports and imports exceeds one. The Bickerdike, Robinson and Metzler's approach along with Marshall Lerner Condition have now become the supporting assumption for those who look at exchange rate as an effective policy tool to direct the trade balance of a country in some particular direction.

A large number of economists are in favor of the view that a nominal devaluation improves trade balance. Rose (1991) found out that Marshall Lerner condition does not hold for five major countries who are the members of Organization for Economic Co-operation and Development (OECD) i.e. United States, United Kingdom, Japan, Canada and Germany. Backas, Kehoe and Kydland (1994) reported that movement of trade balance could observe different paths due to positive or negative correlation of trade balance with the cause of this fluctuation that is real exchange rate. Shirvani and Wilbrattee (1997) investigated the relationship between real exchange rate and trade balance of United States with group of seven industrialized nations (G7) countries i.e. United Kingdom, Japan, Germany, Canada, France and Italy. Rincon (1998) studied that behavior of trade balance of Columbia both in long as well as in short run. The results are not enough either to support or reject the existence of Marshall Lerner Condition. Another study regarding testing the short-and-long run exchange rate effects on trade balance in Colombia by Rincon (1999) examined that whether exchange rate impact balance of trade in the short run only or it also has a significant impact in the long run.

Three researchers Lim, Liew and Hussain (2000) tried to find the answer to a very simple question that if exchange rate fluctuates or simply change does the trade balance always change in response to this change or fluctuation. The evidence is collected from five members of the Association of Southeast Asian Nations (ASEAN countries) i.e. Indonesia, Malaysia, Philippines, Singapore and Thailand and showed that impact of exchange rate on trade balance is exaggerated and also that it is real exchange rate not nominal exchange rate that affects trade balance. During the twentieth century the discussion of relationship between trade balnce and exchange rate also got a lot of interest from different researchers as Bahmani-Oskooee (2001) looked into the matter and found out that real exchange rate does not change on its own it is actually the nominal exchange rate that is changed first and this change causes a shift or fluctuation in real exchange rate. Akbostanci and Fan (2002) investigated the existence of J curve for Turkey. A very important question i.e. whenever exchange rate policy is used by monetary authority what are the outcomes that follow it was addressed by Islam (2003). He argued that in order to restrain and to reduce current account gap there must be a strong connection between real exchange rate and trade balance so that a policy could be based on it. Mustafa and Nishat (2004) worked on exchange rate volatility and export growth in Pakistan and found that the two phenomenons are related in the long run perspective only. Yarmukhamedov (2007) evaluated the relationship of exchange rate fluctuations with exports and imports in Sweden and reported the absence of no significant evidence for the existence of relationship.

An empirical study conducted to explain the Real Exchange Rate and Trade Balance Relationship in Malaysia by Yuen and Mun (2007) examined the Marshall Lerner Condition and J curve effects in Malaysia using co integration techniques, Eagle Granger tests, Vector Error Correction Model and impulse response analysis. Their empirical results provided significant evidence for the existence of the Marshall Lerner Condition where as no J curve effect was observed in the Malaysian case. The short-run and long-run effects of real depreciation of Pakistani Rupee on bilateral trade balance between Paki-

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stan and each of her twelve trading partners is investigated by Aftab and Khan (2008) in their working paper. While talking of the developing countries Aziz (2008) tried to find out the long term and short term relationship between real exchange rate and trade balance. With the application of Engel Granger and Johansen technique followed by ECM the study set forths a general argument that real effective exchange rate has a significant positive relationship with trade balance in the long as well as short run for Bangladesh. Zaiby (2008) talks about devaluation and its possible impact on the economy along with the proper management of side effects of devaluation of currency, so that the benefits of using this strategy can be best achieved in case of Pakistan.

A large number of researchers have looked into the impacts of currency depreciation on balance of trade of a country. The discussion that is available is a mixture of both theoretical and empirical knowledge set forth from time to time. Bahmani-Oskooee and Cheema (2009) investigated the existence of short and long run effects of currency depreciation on trade balance of Pakistan. Using the cointegration approach the relationship between Pakistan and her thirteen trading partners have been analyzed and it is stated that the analysis is unable to provide any concrete conclusion and the relationship is somewhat confusing and need some more sophisticated model to look deep into the relationship that exist between the exchange rate and trade balance in long as well as short run. A study conducted to understand the Exchange Rate and Trade Balance: J curve effect by Pavale and petrovic and Mirjana Gligoric (2010) found that the exchange rate depreciation and trade balance are deeply related in case of Serbia. Both the Johansen's and ARDL approaches have been employed and the results validate the fact that like other countries the improvement in trade balance in long run give rise to a short run phenomenon known as the J curve.

III. THEORETICAL FRAMEWORK

The economic theory suggests that exchange rate will affect trade balance, however the extent and nature of this effect is not clear. The reason is that this relationship is also affected by the state of economy in which it persists. Exchange rate sometimes is seen as an instrument or tool that could be used to derive trade balance in some particular direction (Mark, 2006). Depreciation in currency will increase the volume of exported goods by making them cheap for foreign buyers. Due to this reason, the foreign buyers pay less in terms of their currencies or they import more exported goods from the country. On the other hand, this depreciation or fall in price will also affect imports. The imports will become expensive for local residents and they will switch to domestic substitutes, thus reducing the volume of imports. Whenever the relationship is discussed, it is assumed that trade balance will adjust fully to any change in the exchange rate but it is not the case. Trade balance actually takes time to adjust fully to new changed environment and during that time, economists argue that, there exists a short time phenomenon of adjustment. This short run phenomenon is quiet interesting as it states that trade balance will first deteriorate before it adjusts itself in response to changes in the real exchange rate. Koray and McMillian (1998) argued that, there exists a short run phenomenon known as J curve that is followed when a change in exchange rate comes. They argue that whenever there is a change in exchange rate the trade balance will improve in the long run but worsen in the short run first as trade is not something that could be adjusted immediately. It will take time and hence one can look into a simple short run phenomenon known as the J Curve.

Following Shirvani and Wilbrattee (1997), Baharumshah, (2001), Gomez and Alvarez-Ude (2006) and Ling (2008), we present the trade balance equations in the following paragraphs. The balance of trade or the net exports (NX) is simply the difference between exports and imports, so trade balance or net exports (NX) can be written as:

$$NX = X - M \qquad (1)$$

where "X" stands for "Exports" and "M" stands for "Imports".

The volumes of imports and exports depend on the real exchange rate, which is mathematically determined, as follows.

$$ER = EN \times (p/p^*) \qquad (2)$$

where ER is the real exchange rate, EN is the nominal exchange rate, "p" is the domestic-country price level and "p*" is the foreign-country price level. The real exchange rate is thus related with the ratio of the price levels of the two countries, directly related with domestic country price level and inversely related with foreign country price level. A higher real exchange rate (depreciation in other words) would mean higher domestic price level and expensive imports; so imports would decline. On other hand, higher prices would be received by domestic exporters for their exports items, and consequently, they will export more relatively to the earlier situations when real exchange rates were comparatively lower.

In addition, exports (X) and imports (M) are affected by foreign (Y*) and domestic (Y) incomes, respectively. Increase in foreign income Y* positively increase the demand for domestic goods and services; hence exports will increase. When the domestic income Y increases, domestic people will buy more goods; hence demand for foreign goods (imports) in domestic market will increase.

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As explained, the exports X and imports M are affected not only by changes in real exchange rates but these are also affected by national or per capita incomes of the two countries. Incorporating these effects in equation 1 would mean:

$$NX = X(Y^*, ER) - M(Y, ER) \quad (3a)$$
$$NX = f(Y, Y^*, ER) \quad (3b)$$

IV. RESEARCH METHODOLOGY

The general form trade balance (TB) model, postulated in equation (3b), can be estimated as a log-linear econometric model, in the following form.

$$\ln TB = \beta_0 + \beta_1 \ln ER + \beta_2 \ln Y + \beta_3 \ln Y^* + \mu_t \quad (4)$$

where "μ" is assumed to be white noise process. Here, natural logarithm (ln) is taken for each data series. The natural log is taken for two major reasons. First, the data are of economic time series and these series normally exhibit a strong trend, that is, a consistent upward or downward movement in values. When this is caused by some underlying growth process, a plot of the series will reveal an exponential curve. In such cases, the exponential component dominates other features of the series. Taking natural logarithm of such a series effectively linearizes the exponential trend. Second, logs are used to linearize a model, which is non linear in the parameters. Here, the logs are taken of all the variables involved rendering them linear in parameters and hence the model can easily be estimated using ordinary least squares (OLS) regression. "TB" stands for trade balance. The "ER" represents real exchange rate as already discussed, "Y*" expresses gross domestic product of foreign country and "Y" represents the domestic country income (gross domestic product of Pakistan).

The data for period 1985 to 2010 have been used. All previous studies that tried to predict the connection between exchange rate and trade balance for Pakistan used data for period prior to 1982. Since Pakistan started to follow the floating exchange rate system in 1982 and it took about two to three years for the exchange rate to adjust fully to floating exchange rate, the timeframe of 1985 onwards seemed appropriate for this study.

Since data pertaining to time series were to be used, all four variables were first tested for order of integration. For this purpose, data were graphically plotted, and were also tested for unit roots, using the three well known tests, namely Augmented Dickey Fuller (ADF), Phillip Perron (PP) and Kwiatkowski Phillips Schmidt Shin (KPSS) tests. Three methods, including Engel Granger residual based test, Error Correction Model and Johansen Juselius test were used for cointegration.

For Engel Granger residual based test, the disequilibrium errors were calculated, using relationship:

$$\mu_t = \ln TB - \beta_0 - \beta_1 \ln ER - \beta_2 \ln Y - \beta_3 \ln Y^* \quad (5)$$

The μ_t thus calculated were then tested, and the order of integration of these residuals was found. For the four variables to be co integrated, the residuals should turn out to be stationary. Johansen Juselius approach was then applied to further verify the long term connection between the variables. Error Correction Model (ECM) was used to check the long and short term relationship between Pakistan trade balance (TB) and its three determinant-variables (ER, Y and Y*). Pair wise Granger casuality test was also conducted.

V. RESULTS AND DISCUSSION

Appendix table I provides the results of ADF, PP and KPSS tests for unit roots; the first panel of the appendix provides results for unit roots test at level and the second panel at the first difference. The null hypothesis for ADF and PP tests are that the series have unit roots (non-stationary) where as the null hypothesis for KPSS test is that the series is stationary. Tests results, in light of the critical values, provided at the end of table, show that all the four variables have unit root at level and become stationary after the first differences. On the basis of the results, it is concluded that lnTB, lnER, lnY and lnY* are integrated of order one, that is I(1).

After finding that all economic time series are stationary the study proceeds to Engel Granger residual based approach. The long term equilibrium relation is estimated as follows:

$$\ln TB = -45.73917 - 0.021207 \ln ER - 2.420353 \ln Y + 3.448435 \ln Y^* + \mu_t \quad (6)$$

The residuals are then obtained of this estimated equation. Here μt is the series of estimated residuals of the long term relationship. If the residuals are found to be stationary, then the variables are cointegrated. Appendix II reports the results of ADF test for residuals based on Engel Granger two step procedure. Figure 1 reinforces the results in form of graphical representation of the residuals.

It is found that the residual series is stationary at level and integrated of order zero, that is, I(0); so the null hypothesis that the variables are not cointegrated is rejected and it is concluded that there is cointegration among the variables, that is that lnTB, lnER, lnY and lnY* are cointegrated, suggesting that long run equilibrium relationship exists between the variables.

Since the model is multivariate, hence Johansen Juselius approach is also used to better understand and explain the long

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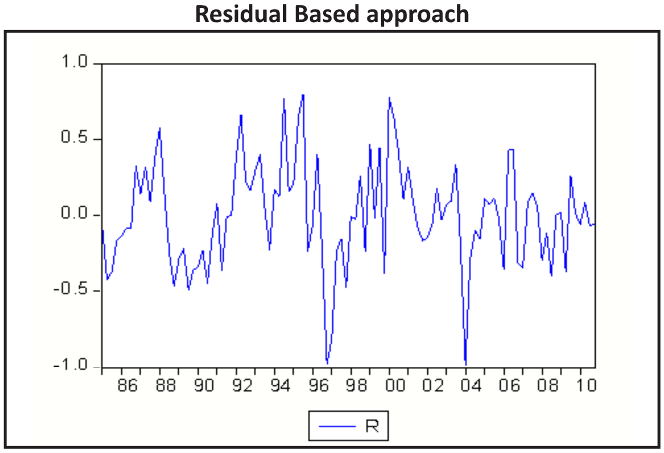
run relationship between the variables (Appendix III). The lag length is selected on the basis of AIC and SBC criterion. It is selected by running VAR model with different lag lengths and the lag that gives minimum values of these AIC and SBC is selected. The lag length is found equal to one in this model; appendix III reports the results of two types of test statistics involved in Johansen Cointegration approach. One is trace statistics and other is Max Eigen statistics. Both test statistics are checked. In case of trace test statistics, the null hypothesis is number of cointegrating equations. The first is none, meaning that there is no cointegrating equation or there is no cointegration among the four variables. The p value for null hypothesis is three percent which is less than five percent. The guide line is when the p value is less than five percent, null hypothesis is rejected but when the p value is more than five percent, null hypothesis cannot be rejected, rather it is accepted. The first null hypothesis of no cointegration can be rejected. The second null hypothesis is that there is at most one cointegrating equation. The p value is 0.3863 so null hypothesis cannot be rejected meaning that there is at most one cointegrating equation which means that there is cointegration among the four variables or these four variables have long run association ship or in the long run, they move together. The second test is max Eigen statistics. Here again, the null hypothesis is that there is no cointegrating among the variables. The p value is 0.0299 which is less than five percent, so null hypothesis can be rejected. Second null hypothesis is that there is at most one cointegrating equation. It can be tested again by looking at the p value and the p value is 0.2991 which is more than five percent, so we cannot reject null rather, and accept null meaning that there is at the most one cointegrating equation among the variables, suggesting that variables have long run association ship or all the four variables move together in the llong run. Both the trace and Max Eigen tests indicate one cointegrating equation at five percent level meaning that there iis cointegration among the four variables.

Figure I
Unit root test results of residuals based on Engel Granger Residual Based approach



After knowing that the four variables are cointegrated, the error correction model (ECM) is run; the results ECM are provided, as follows:

$$\Delta lnTB = -0.041254 + 0.765636\Delta lnER + 0.950020\Delta lnY + 0.565892\Delta lnY^* - 0.581672\mu_{t-1} \quad (7)$$

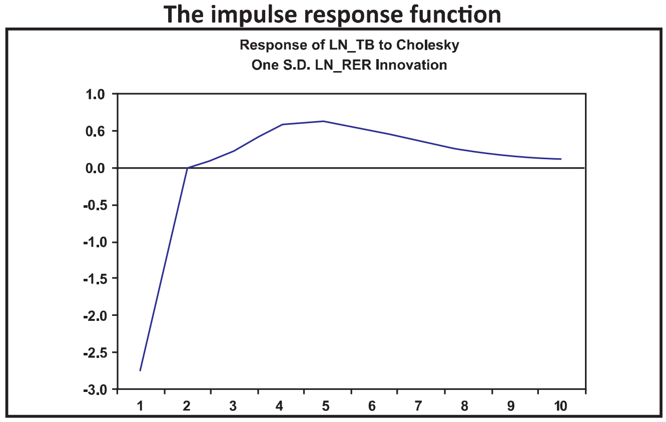
Model (7) indicates that the coefficients carrying with explanatory variables ER, Y and Y* (0.7656, 0.9500 and 0.5658) do not show long run relationship, they are short run coefficients. The coefficient of error correction term is -0.581672 that indicates that the error correction term actually corrects the disequilibrium of the system. The speed at which the error term is correcting disequilibrium is 58.16% per quarter, as the data is quarterly. The sign is negative and is also significant $p < 0.05$. It is further checked that whether this error correction model has a serial correlation or not. The Breusch Godfrey Serial Correlation LM test is used; appendix IV provides the results of Breusch-Godfrey Serial Correlation LM Test. The p-value is more than 5%, meaning that the null hypothesis of no autocorrelation is accepted and alternate hypothesis of existing of autocorreltion is rejected. Residuals are further checked for Jarque Bera normality test (Appendix V); the p value of Jarque Bera is more than 5%, meaning that null hypothesis for normality of residuals cannot be rejected

The results of Granger Pair wise causality test, reported in appendix VI, show that real exchange rate, domestic income and foreign income cause trade balance of Pakistan. All the three variables show a unidirectional granger causality at five percent significance levels.

In the end, the impulse response function is employed to have a look at short term response of trade balance to change sign of real exchange rate; purpose is to check whether the classical J curve effect could be observed or not in case of Pakistan.

Figure II reflects that the trade balance deteriorates immedi-

Figure II
The impulse response function



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ately right after the depreciation in exchange rate and then improves over the period of time; hence it can easily be said that J curve is observed in case of Pakistan.

VI. CONCLUSION

Our both the Engel Granger and Johansen Juselius approaches provide ample support to the assumption under study and affirm that there exists a long term as well as short term connection between the real exchange rate and trade balance in case of Pakistan. The Granger Causality Test also shows the casual relationship between real exchange rate and trade balance of Pakistan. It is found that real depreciation in exchange rate has a significant relationship with trade balance. A valuable input could be provided to policy makers of Pakistan that the trade balance could be shifted to a progressive path by using an active strategy of controlled depreciation of currency by keeping in hand the aggregate price levels. The monetary authority could look deep into the matter and find a stabilization policy so that the exchange rate fluctuation could be used to shift balance of trade to surplus mode and put the trade driven economy of Pakistan on the track of prosperity.

APPENDIX I
UNIT ROOTS-TESTS (AT LEVEL)

	ADF statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(0)	
LnTB	-2.185509 (0.2129)	-1.5583 (0.8023)
LnER	0.749764 (0.9927)	-1.067469 (0.9286)
LnY	0.686745 (0.9913)	-2.148247 (0.5125)
lnY*	-1.594738 (0.4815)	-1.251983 (0.8935)
	PP statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(0)	
LnTB	-2.238437 (0.1942)	-2.238437 (0.1942)
LnER	1.295903 (0.9985)	1.295903 (0.9985)
LnY	0.834457 (0.9942)	0.834457 (0.9942)
lnY*	-1.264066 (0.6439)	-1.264066 (0.6439)
	KPSS statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(0)	
LnTB	1.582378	1.582378
LnER	2.087410	2.087410
LnY	2.171306	2.171306
lnY*	2.161048	2.161048

AT FIRST DIFFERENCE

	ADF statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(1)	
ΔlnTB	-4.3644** (0.0006)	-4.5416** (0.0022)
ΔlnER	-3.5605** (0.0083)	-3.6856* (0.0280)
ΔlnY	-4.2616** (0.0009)	-4.2416** (0.0057)
ΔlnY*	-4.1540** (0.0013)	-4.3501** (0.0041)
	PP statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(1)	
ΔlnTB	-16.008** (0.0000)	-16.406** (0.0000)
ΔlnER	-9.6163** (0.0000)	-9.7298** (0.0000)
ΔlnY	-5.2877** (0.0000)	-5.2838** (0.0002)
ΔlnY*	-8.6280** (0.0000)	-8.6967** (0.0000)
	KPSS statistics	
Variables	Intercept & no trend	Intercept & trend
	Tests for I(1)	
ΔlnTB	0.142325	0.038116
ΔlnER	0.269445	0.144317
ΔlnY	0.111804	0.055279
ΔlnY*	0.240479	0.086627

Note: * & ** show 5% and 1% level of significance, respectively. The critical values for ADF are -3.43 (without trend), -3.96 (with trend) at 1%, -2.86 (without trend), -3.41 (with trend) at 5% and -2.57 (without trend), -3.13 (with trend) at 10% level of significance. These values are from Mackinnon (1991) one sided p-values. The critical values for KPSS are 0.739 (without trend), 0.216 (with trend) at 1%, 0.463 (without trend), 0.146 (with trend) at 5% and 0.347 (without trend), 0.119 (with trend) at 10% level of significance.

APPENDIX II
ADF TEST FOR RESIDUALS BASED ON ENGEL GRANGER TWO STEP PROCEDURE

Variable	ADF test statistic	Prob.
μ_t	-3.895285	0.0002

APPENDIX III
JOHANSEN JUSELIUS TEST OF COINTEGRATION

Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.2495	49.8373	47.8561	0.0322
At most 1	0.1355	20.5492	29.7970	0.3863
At most 2	0.0540	5.69291	15.4947	0.7315
At most 3	0.0002	0.02397	3.84146	0.8769
Cointegration Rank Test (Maximum Eigen value)				
Hypothesized No. of CE(s)	Eigen value	Max Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.24959	29.2881	27.5843	0.0299
At most 1	0.13554	14.8563	21.1316	0.2991
At most 2	0.05406	5.66894	14.2646	0.6560
At most 3	0.00023	0.02397	3.84146	0.8769

APPENDIX IV
BREUSCH GODFREY SERIAL CORRELATION LM TEST

F-statistic	1.093912	Prob. F(2,96)	0.339041
Obs*R-squared	2.295049	Prob. Chi-quare(2)	0.317422

APPENDIX V
JERQU-BERA RESIDUAL NORMALITY TEST

Test statistic	0.961887	Prob.	0.618200
Test statistic	0.961887	Prob.	0.618200

APPENDIX VI
GRANGER PAIR WISE CAUSALITY TEST

	ΔlnTB	ΔlnER	ΔlnY	ΔlnY*
ΔlnTB	-	5.97786**	5.26394**	8.90063**
ΔlnER	1.18936	-	2.76540*	0.57652
ΔlnY	0.02160	0.76740	-	0.68121
ΔlnY*	0.10164	5.06608**	1.19612	-

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