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TIME SERIES ANALYSIS OF REAL EFFECTIVE EXCHANGE RATES ON TRADE BALANCE IN PAKISTAN

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ABSTRACT

Many developing countries including Pakistan face the problem of trade deficit. These countries use various measures to improve the trade balance. One of the components is devaluation of domestic currency. The purpose of this paper is to find whether the devaluation using REER is effective in improving the trade balance in Pakistan or not. The bound testing approach of ARDL is used to estimate the long run relationship among the variables, after endorsing stationarity through ADF test. The time series annual data from 1981 to 2008 are used to estimate the results. There is a long run relationship among the variables as Wald F-statistic is higher than the upper bound critical value at 1 percent level of Pesaran.

Keywords: *REER, Devaluation, Trade Balance, ARDL, Pakistan*

1. Introduction

As the imports of Pakistan are higher than its exports, so the country is facing a continuous trade deficit. The government of Pakistan used various measures to increase the trade balance. One of the most important measures to improve the trade balance is the devaluation of domestic currency. Pakistan has experienced its first devaluation in 1955, second in 1972, third in 1982 and fourth in 1997. After 2006, the country is facing continuous devaluation in the rupee against dollar (Zaiby, 2009). The government and policy makers of Pakistan tried different exchange rate policies in Pakistan. In early 1980s, the real effective exchange rates (REER) were appreciated substantially due to the appreciation of US dollar against major currencies and higher domestic inflation compared to major trading partners. To strengthen the balance of trade and balance of payments (BOP) and keeping in view this frequent appreciation of dollar against other major currencies, Pakistan adopted the managed floating exchange rate system in 1982. The exchange rate observed much larger devaluation in nominal terms as there was a higher level of inflation in Pakistan in the beginning of 1990s compared to other major trading partners. In July 2000, the State Bank of Pakistan moved away from managed exchange rate to floating exchange rate regime. There was a sharp nominal depreciation of 18.5 percent during fiscal year 2001, which showed the market overvaluation during fiscal year 1999 and fiscal year 2000 (Hyder and Mehboob, 2005).

There are several schools of thought that built the foundation for devaluation of domestic currency. The most common are elasticity approach, monetary approach and absorption approach. According to Alse and Oskooee (1995), it is common to find arguments for and against the devaluation, but the issue is to find the effects of devaluation in the terms of trade, as the devaluation lowers the exports prices and raises the prices of imports. Usually the currency devaluation is considered as a tool to stabilize foreign sector of an economy (Upadhyaya, 1999). Some economists believe that the necessary and sufficient condition for an improvement in the trade balance is a combination of a sufficiently large price elasticity of demand and a sufficiently small price elasticity of supply (Brahmasrene and Jiranyakul, 2002). There are a number of empirical evidences for devaluation. Thanh and Kalirajin (2006) suggest that the devaluation can be implemented to encourage the exports and to improve the trade balance. Furthermore, it reduces the real exchange rate appreciation in short run. Narayan (2006), find that in short and long run, a real devaluation of currency improve the trade balance. Oskooee

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(1998) argues that the devaluation has improved the trade balance in the less developed country. Halicioglu (2008) find a long run relationship between real effective exchange rates and trade balance using bound testing cointigration approach, by keeping the trade balance as dependent variable. Upadhyaya (1999) argues about the long run effects of devaluation in six Asian countries including Pakistan and suggests that devaluation has a narrowing or slimming down effect in Pakistan in the long run.

There are several empirical evidences found for developing countries but no separate evidence was found for Pakistan. In previous studies, attempts have been made to investigate the j-curve phenomena. Due to the advent of new econometric techniques it is expected to find better results for future policy making. Therefore, the objectives of this study are to find the impact of devaluation on trade balance in Pakistan in the long run using ARDL approach.

After the introduction, the rest of the article is organized as follows. Section II describes the model and methodology. Similarly, Section III discusses the empirical results of the study and finally the Section IV concludes the paper.

2. Data and Methodology

The annual data over the period from 1980 to 2008 was used to estimate the ARDL equation. The whole data set was extracted from the annual reports of the State Bank of Pakistan. The data for real effective exchange rates from 1981 to 2005 was extracted from the study of Hyder and Mehboob (2005). In this study, the model used is suggested by Aftab and Khan (2008) and Onafowora (2003). However, the difference between their study and present study is that they used the real exchange rates as a proxy of devaluation, but we use the real effective exchange rates as the proxy. The real effective exchange rate (REER) is a key macro economic relative price, which plays an important role in the broad allocation of resources in production and spending behavior in the economy. The real effective exchange rate (REER), as a measure of competitiveness, also determines and influences the performance of export sector. The real effective exchange rates can be calculated by the following formula.

Where $REER_{jt} = \sum_{i=1}^{k} (NEER)_{jit} (P_{it}^{*} / P_{jt})$

J = country I = trading partner t = period

P_{it}^{*} = total trade weighted wholesale price index

P_{jt} = CPI of domestic country.

The impact of real effective exchange rate on trade balance can be analyzed through Auto Regressive Distributed Lag (ARDL) model. The ARDL model is used for studying the long run and short run relationship among the variables.

The model can be written in log linear form as:

$$\ln(X/M)_t = \alpha + \beta_1 \ln(REER)_t + \beta_2 \ln(GDP)_t + \beta_3 \ln(FI)_t + \varepsilon_t \qquad (1)$$

where $\ln(X/M)_t$ is the logarithm of the real exports to imports ratio; $\ln(REER)_t$ is the logarithm of the real effective exchange rate (Rs per US dollar); $\ln(GDP)_t$ is the logarithm of gross domestic product, $\ln(FI)_t$ is the logarithm of the foreign income, α is a constant and ε_t is a error term.

The volume of exports or imports to a foreign or domestic country ought to increase as the real income and purchasing power of the trading partner or domestic country rises. So, in this study it is expected that β_2 is less

than zero and β_3 is greater than zero. If rise in the real income is due to increases in the production of import substitute goods, imports may decline as the income increase in which case β_2 is greater than zero and β_3 is less than zero. According to Onafowora (2003), the impact of exchange rate changes is unpredictable, i.e. β_1 could either be positive or negative. If there is a real depreciation or devaluation of domestic currency i.e. RER increases, then the increased competitiveness in prices for domestic country should result in exporting more and importing less "volume effect". However, the higher RER also increases the value of each unit of import "import value effect", which would tend to diminish the trade balance. In the short run there prevails an import value effect, whereas the volume effect dominates in the longer run.

Before estimating the data, the stationarity of data was analyzed through Augmented Dickey–Fuller (ADF) test. The test uses the existence of a unit root as the null hypothesis. The ADF statistic, used in the test, is a negative smaller number. The smaller it is, the stronger the acceptances of the hypothesis that there is a unit root at some level of confidence. Unit root test equation is presented below as follows:

$$\Delta X_t = \alpha_0 + \alpha_1 t + \alpha_2 X_{t-1} + \sum_{i=1}^{m} \alpha_{3i} \Delta X_{t-i} + \varepsilon_t \qquad (2)$$

An ARDL representation of equation 1 is as under:

$$\Delta \ln(\frac{X_{it}}{M_{it}}) = \beta_0 + \sum \beta_{1j} \Delta \ln REER_{t-j} + \sum \beta_{2j} \Delta \ln GDP_{t-j} + \sum \beta_{3j} \Delta \ln WR_{t-j} + \sum \beta_{4j} \Delta \ln(\frac{X_{it-j}}{M_{it-j}}) + \gamma_1 \ln(\frac{X_{it-1}}{M_{it-1}}) + \gamma_2 \ln REER_{it-1} + \gamma_3 \ln GDP_{it-1} + \gamma_4 \ln WR_{it-1} + \varepsilon_{it} \qquad (3)$$

Here Δ is the first difference operator. The *F* test is used to find out whether a long-run relationship exists between the variables through testing the significance of the lagged levels of the variables. When a long-run relationship exists between the variables, the *F* test identifies the variable to be normalized. The null hypothesis of lack of cointegration amongst the variables is as follows

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

against the alternative hypothesis

$$H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$$

The study uses quite new and a modest estimation technique, which is the bounds testing approach to cointegration, within ARDL framework. The structural lags are established by using minimum Akaike's Information Criteria (AIC).

3. Empirical Evidences

Based on the ADF test statistic, it was initiated that GDP is the only variable which is stationary at level, that is, they are I(0) variables, while the remaining variables i.e. X/M, REER and WR are demonstrated after first differencing stationary i.e., I(1). Obviously, the mixture of both I(0) and I(1) variables would not be possible

under the Johansen procedure. This gives a good justification for using the bounds test approach, or ARDL model, proposed by Pesaran et al. (2001). The results obtained are reported in Table 1 below.

Table 1

ADF - Unit Root Estimation

Level			1st Difference	
Variables	Constant	Constant and Trend	Constant	Constant and Trend
X/M	-1.218	-0.374	-4.573*	-5.322*
GDP	-8.674*	-8.855*	-2.801**	-0.464
REER	-2.071	-0.936	-5.092*	-6.698*
WR	-0.656	-1.139	-4.016*	-4.058**

Key: X/M =Export to Import ratio, GDP = Gross Domestic Product, REER = Real Effective Exchange Rates and WR = Worker's Remittances Note: The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis is based on MacKinnon critical values. The lag length are selected based on SIC criteria, this ranges from lag zero to lag fIve. *, ** and *** indicate the rejection of the null *hypothesis of non- stationary at 1%, 5% and 10% significant level, respectively.*

The estimation of Equation (3) is reported in Table 2.

Table 2

Estimated Model Based on Equation (3)

Variable	Coefficient	t-statistics	Probability
Log (X/M) $_{t-1}$	0.501***	1.964	0.067
Log (GDP) $_{t-1}$	-0.066***	1.787	0.092
Log (REER) $_{t-1}$	-0.191	-0.676	0.508
Log (WR) $_{t-1}$	-0.280*	-5.380	0.000
β_0	3.873**	2.071	0.050
Dlog (X/M) $_{t-1}$	-0.257	-1.092	0.289
Dlog(GDP) $_{t-1}$	-0.630*	-3.397	0.003
Dlog(REER) $_{t-1}$	-0.425	-1.458	0.164
DLog(WR) $_{t-1}$	0.350*	3.773	0.001
MA (2)	-0.994*	-8.916	0.000

1. Model criteria / Goodness of Fit:

R-square = 0.937; Adjusted R-square = 0.902; Durbin Watson = 1.898; Wald F-statistic = 44.539*

11. Diagnostic Checking:

ARCH (1) = 5.335 [0.029]; Breusch-Godfrey Serial Correlation LM Test = 0.798 (0.469); RESET = 23.819 [0.000]; WHITE Test = 2.456 [0.086]; Jarque-Bera [JB (1)] = 0.350 (0.839);

From these results, it is obvious that there is a long run relationship amongst the variables as F-statistic of the model i.e. 7.15 is higher than the upper bound critical values 5.06 at the 1 percent level of Pesaran. This implies that the null hypothesis of no cointegration among the variables cannot be accepted. Bounds test for cointegration analysis are mentioned in Table 3.

Table 3

Bounds Test for Cointegration Analysis Based on Equation (1)

Critical value	Lower Bound Value	Upper Bound Value
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52

Note: Computed F-statistic: 5.61 (Significant at 0.01 marginal values).

- *Critical Values are cited from Pesaran et al. (2001)*

The anticipated coefficients of the long-run relationship between X/M, GDP, REER and WR are expected to be significant, that is:

Log (X/M) = 3.873 - 0.066Log (GDP) - 0.191Log (REER) - 0.28Log (WR) (3)

Equation (3) indicates that GDP, REER and WR are negatively correlated to X/M ratio, with the estimated elasticity of 0.066, 0.191 and 0.280 percent respectively. This shows that a 1% increase in X/M ratio will result in about 0.066, 0.191 and 0.280 percent decrease in GDP, REER and WR respectively. Result shows that over the sample period studied, worker remittances have a major impact to decrease the share of exports over imports ratio in the context of Pakistan.

4. Conclusion

In this study an attempt is made to find the impact of devaluation on trade balance and balance of payments. We use the real effective exchange rates (REER) as proxy for devaluation. In this study the analysis is made on annual data ranging from 1981 to 2008. Furthermore, the tests of stationarity of variables were performed by unit root test (ADF). Similarly, ARDL model is used to study the long run relationship among the variables. The GDP is the only variable which is stationary at level while REER, WR and XM ratio are stationary at first difference. XM ratio is taken as the dependent variable for this study. All variables are significant except worker remittances. The main reason could be low exports of Pakistan; therefore, worker remittances may not increases trade balance in Pakistan. The results of the ARDL show that there is a cointegrated relationship between the REER and the trade balance. The coefficient of REER is -0.191, which shows that devaluation is not much effective in improving the exports to imports ratio, which is proxy for trade balance or balance of

payments. On the contrary, the short run dynamics shows that there is a Granger Causality between REER and X/M. Based on the findings of the study, it is suggested that policy makers must improve the trade balance by considering the alternative measures for devaluation as the successive devaluations have not made a significant change in the trade balance.

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