

Estimating Equilibrium Real Exchange Rate Through NATREX Approach: A Case of Pakistan

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ABSTRACT

This paper attempts to estimate the long run equilibrium real exchange rate for Pakistan economy by employing Natural Real Exchange Rate (NATREX) given by Stein (1995) for the period of 1983Q1- 2010Q4. This is an alternative approach which incorporates the role of external debt while establishing the real equilibrium exchange rate for an economy. Johansen (1988) and Johansen and Juselius (1990) cointegration test is used to establish the long run relationship between the relevant variables; real exchange rate, terms of trade and productivity, of the NATREX equation. The obtained results exhibit that there is a long run cointegrated relationship between real exchange rate and NATREX equation variables. Moreover, fluctuations in real exchange rate from NATREX-based equilibrium exchange rate are found during the sample period.

KEYWORDS: NATREX Approach, Real Exchange rate, Pakistan.

1.INTRODUCTION

This paper adopts the NATREX approach (Stein, 1990) to determine the real equilibrium exchange rate for the economy of Pakistan over the period of 1983Q1 -2010Q4. The NATREX approach offers an alternative paradigm, among other approaches, for the determination of real exchange rate equilibrium. The equilibrium concept proposes simultaneous internal and external equilibrium and explains the behavior of fundamental variables that are the main driving forces behind the investment and saving decision in the absence of cyclical factors, speculative capital movements and international reserves movements.

The salient features of the NATREX approach are; the identification and modeling the fundamental variables; thrift, productivity, capital intensity, and net debt to foreigners which influence desired long-term capital flows and fluctuate real exchange rate equilibrium. The plunge in thrift lowers desired savings and an increase in the marginal product of capital raises desired investment that leads to new borrowing from foreigners. The usage of the borrowings determines how the country grows over time, whether wealth and consumption would tend to rise or fall in the long run. The NATREX theory proposes the following two outcomes:

- i) When borrowing funds are utilized in financing new consumption, in the long run perspective, wealth and consumption will decrease and the economy would face higher net debt and large interest payments to foreigners.
- ii) If borrowing from foreigners is used to finance new investment, long-run wealth and consumption will go up and the borrower country can be turned into a creditor one. In our case, we consider the former case where borrowing is mostly used to finance the new consumption. Pakistan is a small open economy with burgeoning external and domestic debt. In this context, NATREX approach is an appropriate one while establishing the equilibrium real exchange rate. The NATREX approach is not a single model rather; we can say broadly, a family of NATREX models that possess a number of common attributes.

A great deal of empirical studies already has adopted the NATREX approach in their context to explain the medium-long term dynamics of the real exchange rate. Primarily the NATREX approach distinguishes from other approaches in the sense of modeling and examining the behavior of equilibrium exchange rates. For instance, other approaches such as Purchasing Power Parity (PPP) etc, examine the equilibrium exchange rate in long-run sense. Whereas the NATREX approach approaches the equilibrium exchange rate in medium to long run trajectory.

2. LITERATURE REVIEW

A number of studies apply the NATREX approach in different economies, using different time periods. For instance, Stein (1995, 1997) uses the NATREX approach in U.S.A. Similarly, considering the terms of trade and

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world interest rate as given, Lim and Stein (1995) examine the NATREX approach for a relatively small economy, Australia. Lim and Stein (1995) assert that relatively small country, like Australia, has not been able to affect the terms of trade and world interest rate. Also, Stein and Sauernheimer (1996) and Federicied and Gandolfo (2002) adopt the approach in case of Germany and Italy, respectively. Similarly, Stein and Paladino (1998) apply the approach in case of France, and Gandolfo and Felettigh (1998) apply the same approach for Italy. NATREX approach has also been adopted in the cases of developing countries. Holger et al. (2001), for instance, apply NATREX approach in China, and Kardi (2003) apply the same approach for Hungary.

Stein (1995) indicates that the NATREX approach is not just one model but rather a family of models that can be applied to alternative economies according to their characteristics. For instance, the NATREX approach applied to the U.S economy is totally different as compared to that of Germany and Australia. This is because of the nature and scale of the economies and their influences over the world economy. Stein (1995) classifies the US economy as a bigger economy that can influence terms of trade and interest rates. The German economy is considered a medium size economy. Likewise, the Australian economy is classified as a small open economy with given terms of trade and world interest rate.

Holger et al. (2002) apply a modified version of the NATREX approach in the case of China. They incorporate internal migration and productivity variables in the approach and employ ARDL methodology to obtain the estimated results. The introduction of modern co-integration techniques makes it easy for researchers to establish the long run co-integration relationship among the relevant variables. In Euro Zone, Duval (2002) applies the NATREX approach by employing a time series and Johansen co-integration among the relevant variables. Assuming a single co-integration vector, applies Vector Error Correction Model (VECM), Duval (2002) obtain long run relationship through Stock and Watson (1993) methodology.

All above mentioned studies have applied the NATREX approach in a one-country framework where the “rest of the world” is treated as given. However, Mariama and Daniela (2007) extend one-country NATREX approach to two-country case and have constructed a two-country model considering USA and Euro zone as two big countries.

3. METHODOLOGY AND RESULTS

NATREX equation has three exogenous variables; terms of trade, government spending and productivity. First, we examine the long run relationship among the variables of the equation. If there is a long run relationship existing, then the estimation process can be carried out further to compute the NATREX-based real equilibrium rate. We employ Johansen (1988) cointegration approach to examine the long run relationship among the variables.^a The results presented in table 3.1 show a long run cointegrated relationship among the variables of NATREX equation.

Table 3.1: Johansen Cointegration Test Results

Null Hypothesis:	Eigen-Values	Trace Statistic	Max-Eigen Value	5 percent Critical value	1 percent Critical value
R=0	0.31679	52.8716*	0.3167	29.68	35.65
R=1	0.10203	14.4010	0.1020	15.41	20.04
R=2	0.0343	3.5289	0.0343	3.76	6.65

R is the maximum number of cointegrating vectors. * denotes the level of significance at 5%.

In order to obtain the NATREX equilibrium values, we obtain the estimated values of the exogenous variables by estimating the following equation.

$$RER = \beta_0 + \beta_1 TOT_t + \beta_2 GOV_t + \beta_3 PRD_t + \mu_t \quad (3.1)$$

Where RER is real exchange rate, TOT is terms of trade, Gov stands for government expenditure and PRD denotes productivity.

The signs of the coefficients of equation (3.1) can be explained as follows:

The sign of terms of trade variable can be negative or positive. As explained by Edwards (1988b) and Edwards and Wijnbergen (1987), dynamic changes in terms of trade generate inter-temporal income and substitution

^a The long run cointegration relationship can also be determined by using Auto Regressive Distributive Lag Model (ARDL) that is based on F-statistics. We employed the ARDL methodology and results support the findings of Johanson Cointegration test. In order to apply the Johanson (1988) cointegration approach, first we checked the level of stationarity of the relevant variables and our results, though not reported here, depict that all variables are stationary at the level of first difference.

effects. The effect of government expenditure on real exchange rate depends upon whether it is utilized for the consumption of tradable or non-tradable goods. Similarly, the sign of productivity can be negative or positive. An increase in productivity is expected to improve the current account balance and appreciate the real exchange rate, and it can be persistent even in the long run. On the other hand, if productivity declines, then the real exchange rate can be depreciated.

Table 3.2: Regression Results of Real Exchange Rate and Exogenous Variables

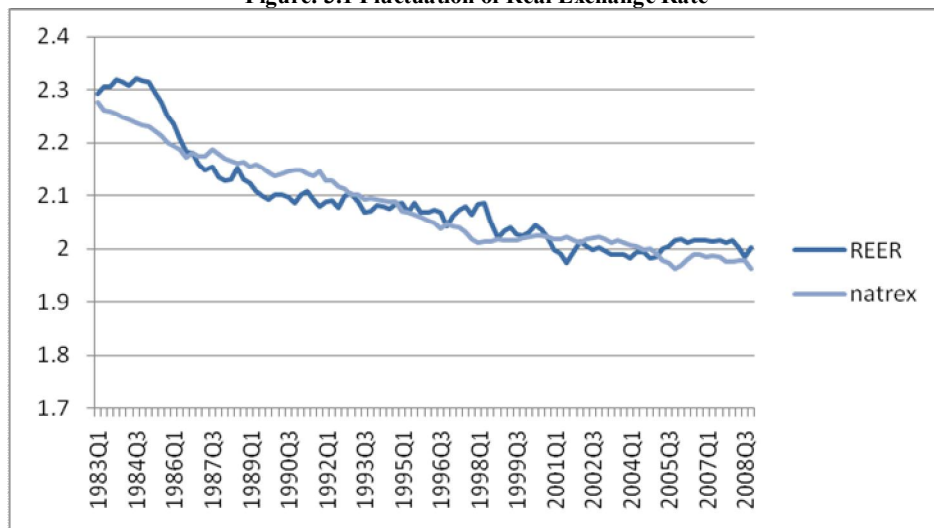
Variable	Coefficient	t-Statistic	Prob
Constant	6.0338	19.328 (0.31217)	0.000
TOT	-0.1936	3.0836* (0.06281)	0.0026
PRD	-0.0177	0.2943 (0.06035)	0.769
GOV	-0.8120	9.8895* (0.0821)	0.000
R-squared	0.851086	Mean dependent var	2.086486
Adjusted R-squared	0.846619	S.D. dependent var	0.094751
S.E. of regression	0.037108	Akaike info criterion	-3.712253
Sum squared resid	0.137702	Schwarz criterion	-3.610546
Log likelihood	197.0372	Hannan-Quinn criter.	-3.671048
F-statistic	190.5094	Durbin-Watson stat	2.167472
Prob(F-statistic)	0.000000		

We estimate equation (3.1) and obtain the NATREX equilibrium exchange rate by inserting the regression estimates of coefficients in equation (3.2).

$$LN Natrex = \beta_0 + \beta_1 TOT_t + \beta_2 GOV_t + \beta_3 PRD_t \quad (3.2)$$

After calculating NATREX-based real equilibrium exchange rate, we compute the fluctuations of exchange rate. The results are shown in Figure 3.1. According to the graph, real exchange rate of Pakistan has deviated from the equilibrium real exchange rate obtained by the NATREX approach.

Figure: 3.1 Fluctuation of Real Exchange Rate



4. Conclusion

This paper attempts to calculate the equilibrium real exchange rate by employing NATREX approach given by Stein (1990, 1995). The approach is more appropriate in case of Pakistan as it incorporates the role of external borrowing. The results of cointegration tests depict that a long run cointegration exists between the real exchange rate and exogenous variables of NATREX model. We estimate the NATREX equilibrium exchange rate and find

out the fluctuations in real exchange rate of Pakistan economy over the period of 1983 Q1 to 2010Q4. The results depict that external debt, among other macroeconomic variables; play a significant role in the fluctuations of real exchange rate.

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