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Macroeconomic Fundamentals and Exchange Rates in South Asian Economies: Evidence from Pooled and Panel Estimations

Muhammad Umar Draz, Fayyaz Ahmad, Bhumika Gupta, Waqas Amin

Structured Abstract

Purpose: This study examines the impact of macroeconomic fundamentals on exchange rates of selected South Asian economies during 1981-2013.

Design/methodology/approach: We have used two econometric approaches to the data. For the pooled sample, EGLS and the two-stage Least Square Method are applied. For the panel data, we have used the panel GMM and OLS methods.

Findings: The results suggest that macroeconomic factors have a significant impact on exchange rates. Our robust findings highlight that improvements in domestic economic and political systems are crucial for a successful exchange rate policy.

Originality/value: The existing literature on exchange rate fundamentals have either focused on exchange rates and international trade or investigated the relationship for the developed economies. Covering a period of more than three decades, and using both pooled and panel estimations, our study is unique in terms of its focus on the South Asian economies.

Key Words: South Asian economies, Exchange rates, Macroeconomic fundamentals

Article Classification: Research paper

1. Introduction

Over the last few decades, the global economic system has gradually transformed from an abridged financial design to a compound entangled set of financial structures. The international markets' environment has experienced considerable variations in the form of extreme unpredictability in exchange rates, better capital movement and a sequence of worldwide financial crises during the last couple of decades. Although the majority of modern empirical models have neglected the possible presence of a long-term association between exchange rates and financial fundamentals, both theoretically and empirically exchange rates are still the subject of many controversies in the field of economics and international finance (Beckmann et al., 2011). Surprisingly, the connection between exchange rates and macroeconomic variables still remains an imperative problem due to the little attention paid to investigating this aspect especially in [developing](#) economies. Over the last few decades, the Asian economies have transformed enormously and the eruption of the Asian Financial Crisis has stimulated different implementations of exchange rate arrangements because [developing](#) economies are more exposed to turmoil.

Exchange rate fluctuations are significantly influential on the various aspects of the economy and also on the concerned parties. The role of exchange rates is extremely significant in the international market and the variability of exchange rates, both in the case of appreciation or depreciation, is directly connected with the economic performance of a country. Exchange rate movements have become excessive subsequent to the implementation of flexible exchange rate regimes and the volatility of [developing](#) economies' currencies depends on the pegging system and the implied burden of the currency that a particular nation pegs (Chong and Tan, 2007).

However, currency crises are more frequent in developing markets because the nominal currencies of these economies might not create fixed and anticipated exchange rates and their equality level might diverge, flagging way for currency speculation passages. Even though the Asian economies usually favor a managed floating exchange rate scheme, the exchange rate instability of every currency varies even in the existence of a pegging arrangement (Warner and Kreinin, 1983; Alba and Papell, 1998). Moreover, exchange rate constancy, capital mobility with independent policies cannot be accomplished concurrently and technically there has always been a tradeoff among these three macroeconomic fundamentals. Therefore, it is worthwhile to investigate the importance of exchange rate determination factors for the sustainable performance of a country.

As a result of neighboring countries' reforms during the previous decade, several South Asian economies stayed on internal and external transformations to incorporate with the international economy during mid-90s. This in turn increased the vulnerability of financial turmoil, because financially more integrated and open economies are highly vulnerable to external and internal blows. Therefore, an amount of exchange rate elasticity and associated monetary policy sovereignty turned out to be critical for macroeconomic management. Cavoli and Rajan (2013) have explained that, under the IMF behavioral classifications of the leading South Asian currency systems, India is characterized as a managed floater, roughly regular with its official declarations, while Bangladesh and Sri Lanka are categorized as soft-peg countries. On the other hand, a key component of an exports-based strategy is balanced exchange rates. In fact, it is sometimes argued that developing economies can encourage exports by means of an undervalued currency, and China is indeed following the same policy stance. Furthermore, stable exchange rates reflect lower risks, which in turn lead to the lower

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3 cost of capital. However, one size does not fit all, and different policies may be required to
4 suit different nations (Edwards, 2011).
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7 Figure 1 shows the instability of exchange rates from 1990 to 2013 for the five South Asian
8 economies included in the sample*. The volatility rates are computed taking the first year as a
9 base. Percentage changes from the base year indicate the annual movement of currencies
10 compared with the US dollar. Over the last decade, a majority of Asian economies has shifted
11 to the managed floating exchange rate and all Asian economies have attached substantial
12 significance to exchange rate constancy in their policy structure.
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16 *Insert figure 1 here*
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20 The exchange rates of Bhutan and India are the most volatile. Bangladesh preserved a
21 substantially low exchange rate risk and its exchange rate instability was normally lesser than
22 Sri Lanka and Nepal after introducing the managed floating classification. Since
23 liberalization, rapid changes have been seen in the monetary and fiscal strategies of Asian
24 economies in reply to the volatile market atmosphere. Rapid changes were also particularly
25 visible subsequent to the Asian Financial turmoil because the exchange rates of Asian
26 economies had devalued abruptly as a result of currency conjecture spells. Most of the South
27 Asian economies have also favored managed floating systems after the currency crisis. Sri
28 Lanka started a floating regime in 2001, and later Bangladesh shifted from the fixed to
29 managed floating system in 2003. Furthermore, the currency of Nepal is tied to the Indian
30 Rupee but flexible for all other currencies, and India is also a managed floater in terms of
31 exchange rate policy.
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33
34 By and large, all of the economies of South Asia have a great amount of similarity in their
35 economic structure, ecological location and phases of growth, but each economy has taken
36 different measures to respond to the economic collapse. Therefore, the macroeconomic
37 fundamentals of exchange rates are of utmost important to the study of this region because of
38 its increasing importance in international market.
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43 **2. Literature Review**

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45 Unscrambling the key drivers of exchange rates is still one of the utmost provocative research
46 regions in economics. Standard exchange rate models suggest the comparative anticipated
47 inflation gaps and relative productivity gaps as fundamental determinants of exchange rates,
48 but these predictors are not explained adequately in the present literature (Mark, 2009).
49 Previously, the majority of the research has scrutinized the different aspects regarding
50 exchange rates. The current literature can be presented categorically according to the
51 directions that have been focused on by researchers. For example, exchange rate constancy
52 has been contended to affect growth adversely because it reduces the capacity to respond
53 against asymmetric real shocks in a flexible way and increases the possibility of projected
54 capital inflows and stickiness. However, it also has positive effects because of the declining
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* Our sample consists of Bangladesh (BGD), Bhutan (BTN), India (IND), Nepal (NPL) and Sri Lanka (LKA).

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3 transaction cost of international trade and enhanced macroeconomic stability with less
4 uncertainty for foreign capital flows.
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8 Although an extensive literature has empirically analyzed the relationship between exchange
9 rates and international trade, the theoretical justification for these studies comes from
10 exchange rate determination (Chaban, 2011). Accommodating the unconventional but
11 important factors, Ogun (2012) argued that weather condition, the parallel market exchange
12 rate and associated premium as well as corrupt practices are the important drivers of short
13 term variations in the nominal exchange rates of developing countries. Moreover, the effects
14 of these variables differ in countries having advanced legal system. Using the Autoregressive
15 Distributed Lag (ARDL) modeling, Chowdhury (2012) found that the terms of trade,
16 government expenditure, interest rate differentials and trade openness are the significant
17 determinants of exchange rates for Australia in the long run. Furthermore, productivity
18 differentials are very important determinants of exchange for the EU member states and
19 Malaysia (Candelon, et al, 2007; Wong, 2013). Investigating the real exchange rate
20 determinants for a small open economy, Kia (2013) found that, for Canada, for the long term
21 the real exchange rate is a utility of real money supply, national and overseas interest rates,
22 real GDP, real government spending, deficit per GDP, national and external unpaid debt and
23 product prices.
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31 AbuDalu and Ahmed (2014) cited that the domestic money supply, domestic and foreign
32 interest rates, domestic money supply, term of trades, foreign interest rate (R^*) for Thailand
33 and net foreign assets are the main determinants for exchange rates of the ASEAN5
34 countries. More importantly, the significance of each factor varies among all countries in the
35 short run. Using the annual data from 1973 to 2011 Griffoli et al. (2015) investigated the
36 determinants of Swiss Franc. The main findings indicated that trade openness and the
37 government spending are the key determinants in the long run. The role of GDP per capita
38 and net foreign assets differ and relative productivity differentials have no significant impact
39 on exchange rates.
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43 Among the recent studies, Chen and Liu (2017) investigated real exchange rate variation for
44 China through structural Vector Autoregression (VAR) model; the authors incorporated
45 five macroeconomic variables, i.e. technology, monetary policy, government spending,
46 foreign demand, and risk premium shocks; the results of their study demonstrated that
47 external demand variability is the extremely vital driving power for Chinese
48 real exchange rate and monetary policy and risk premium shocks cause nominal variations in
49 exchange rate. In another study, Aloui et al. (2018) used a dataset from Saudi Arabia over the
50 period of 1969 to 2014 and found that Saudi economy is facing risk factors due to the
51 instability of oil market and pegging of the Saudi Riyal to the USD. These factors have a
52 significant negative impact on the Saudi economic growth, inflation and sovereign financial
53 policies. Assessing the long run path and the fundamental determinants for Turkish currency,
54 Tunaer (2018) found that the fiscal expenditures, real GDP per capita relative to trading
55 partners, international openness and oil prices are the main determinants of Turkish exchange
56 rates. However, there is no connection between net foreign assets and exchange rates and the
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3 rise in GDP per capita puts appreciation pressure on equilibrium exchange rates.
4 Investigating the main determinates of exchange rates for developing and emerging
5 economies, Barbosa et al. (2018) concluded that productivity differentials might contribute to
6 appreciate the real exchange rate and the financials factors are more relevant to exchange rate
7 determination than variables attached to fundamentals. Additionally, the effect of interest rate
8 differential and international liquidity on exchange rate is ambiguous.
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13 Using the case of high income and upper middle income economies Vogiazas et al. (2019)
14 confirmed that financial development and natural resources rents have no significant effect on
15 the real effective exchange rates of the upper-middle income countries but this link is
16 substantial for the high-income countries. Likewise, trade openness is the key factor that
17 influences the exchange rates and the impact of total factor productivity varies for both
18 countries. Examining the Asia-Pacific region recent data Phuc and Duc (2019) explored the
19 determinants of exchange rates pass through (ERPT). The results revealed that
20 macroeconomic determinants such as inflation volatility, interest rates, and trade openness
21 cause the changes in ERPT, but this impact varies substantially across the surveyed countries
22 and the three price indices.
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26 Assuming that the Asian economies have experienced numerous changes in their exchange
27 rate provisions since liberalization, this paper adds to the literature by focusing on the
28 macroeconomic fundamentals affecting the exchange rates of this region. Most of the
29 literature has focused on the relationship between international trade and exchange rates, but
30 very few studies have investigated the macroeconomic fundamentals of exchange rates. In
31 addition, the majority of the previous work focused on the advanced economies, and then
32 only on an individual country level. The novelty of our work is that we have established a
33 panel and a pooled data set of both small and large economies from South Asia. A
34 comprehensive approach is applied for investigation on a data set of more than three decades.
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38 39 **3. Theory, Variables and Exchange Rate Fundamentals**

40
41 The two broad categories of exchange rate fundamentals are the external and internal
42 fundamentals. The external variables include international trade, prices, interest rates and
43 government debts. On the other hand, internal factors represent different taxes, capital
44 controls and government expenditures, used as a policy weapon for controlling the exchange
45 rate (Edwards, 1989). A general form of both domestic and international factors can be
46 shown in following equation:
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$$49 \quad ER_t = \alpha + \beta X1_t + \delta X2_t + \dots \phi Xn_t + v_t \dots \dots \dots (1)$$

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51 ER denotes the exchange rate and all other factors are the independent variables. The next
52 section introduces the most important internal and external factors to affect the exchange rate,
53 including interest rates, inflation, GDP, and international trade-related variables.
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56 **3.1 Economic Growth**

57 The economic growth of Asian economies is an open secret because, over last decade, many
58 of the Asian economies have emerged as economic powers in relation to the rest of the world.
59 Exchange rate fluctuations are very important in terms of their impact on GDP growth. The
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relationship between GDP and exchange rates has indeed been robust and more influential on developing nations. A sudden appreciation in currency has a significant influence on output growth, and for many developing economies exchange rate fluctuations have an adverse impact on economic activity (Kandil and Dincer, 2008; Wong, 2013).

3.2 Interest Rate

The impact of monetary policy on exchange rates is significant. Interest rates and international transfer movements also affect the equilibrium of exchange rates. Chowdhury (2012) argues that pushing up the price of non-tradable with more expenditure also appreciates the exchange rate. On the other hand, a relaxation of capital controls increases capital inflows, which in turn raises current expenditures, demands and prices as well as appreciates the exchange rate. However, within flexible monetary policy, a high interest rate reduces the demand of money and the price of goods as well, leading to the depreciation of currency. Therefore, policy-oriented interest rates can also yield ambiguous results depending on the political, economic stability and the demand for goods and services of a country.

3.3 Inflation

The inflation rate of a country can have a substantial impact on the currency. While a low inflation rate may not guarantee a favorable exchange rate, a high rate of inflation is more likely to have a significantly negative impact on the currency of a particular country. Inflation and interest rates are closely related to each other and policy makers attempt to balance the effects of both factors. The interrelationship between these factors has been complex and often there has been a tradeoff between the two. Higher interest rates attract investment but also tend to increase the inflation, which has a negative influence on the exchange rate. In contrast, lower interest rates are healthy for growth and consumer spending but generally not significantly attractive for foreign capital. In addition, the currencies only have a perceived value in modern times.

3.4 Government Expenditures

Government expenditure is the fundamental variable of exchange rates and its role has been extensively discussed in the literature. The relative price of non-tradable increases with an increase in government expenditure, and this in turn increases demand and appreciates the exchange rate (Froot and Rogoff, 1991). Furthermore, fiscal expansions can affect the expectations of investors and this will result in a higher demand for risk premiums on interest rates. Likewise, budget deficits are often associated with lower national savings in the long run, which depreciate the exchange rate. Therefore, the impact of government spending is also indistinct.

3.5 Government Debt

The lack of capital funds to encounter the demand of capital expenditures is a common characteristic of [developing economies](#). The motive of external borrowing is to get underway the infrastructure essential for the financial growth and the development of a country. Nevertheless, maximum borrowings come with interest involved, which upshots in debt servicing (Saheed et al., 2015). This, in turn, involves a demand for external currency and consequently affects the exchange rate of the country. Additionally, both the risk of default and the credit rating may also affect the value of a currency.

3.6 Trade Liberalization

Generally, trade restrictions appreciate the exchange rate and liberalization of the trade regime tends to depreciate the currency. But Edwards (1989) has argued that the position of

exchange rates depends on the impact of trade restrictions, in the form of tariffs, on the current account. The currency value appreciates with improvements in current account, or the opposite. Therefore, the overall effect of openness is also ambiguous.

3.7 Balance of Trade

The strict supervision of the exchange rate policy has been a portion of export-led expansion policy in many Asian economies. However, this has led to huge worldwide macroeconomic differences vis-à-vis many of the progressive economies because of the surplus accumulations in trade over recent years (Rafiq, 2013). The current account is the balance of trade reflecting payments. A deficit shows that a country requires more funds for foreign settlements than its income from exports, and generally the excess demand of a foreign currency depreciates the relative exchange rate. Therefore trade balances can be influential on exchange rates.

We have used the following abbreviations to represent the aforementioned variables of our study: exchange rates (EXR), gross domestic product (GDP), interest rates (IR), inflation (INF), government expenditure (GEXP), government debt (GDEBT), openness (OP) and balance of trade (BOT).

4. Research Design and Methodology

4.1 Sample, observation period and data

To recognize the effects of macroeconomic variables on exchange rates, we specify a cross-country balanced data panel model for five economies of South Asia. We included five South Asian economies which have already joined the South Asian Association for Regional Cooperation (SAARC). Pakistan and Afghanistan are excluded because of insufficient data. Most of the Asian economies redirected their exchange rate policies to maintain their balance of their trade and the relative value of their currencies. Our data estimation approach is subdivided into a pooled analysis and a panel analysis. Based on our empirical modeling, both the pooled and the panel regression approaches are also checked for robustness with the help of alternative methods. Furthermore, a battery of tests has also been applied for checking the unit root between variables, and variables are also tested for multicollinearity prior to the regression analysis.

The data sources are IMF International Financial Statistics, IMF World Economic Outlook and the World Bank economic indicators. We used annual data, as for some countries data does not exist at higher frequencies. The sample period for five Asian economies starts from 1981, because the majority of the Asian nations started liberalization in the last few decades. Therefore, to identify the impact of macroeconomic fundamentals, recent data is taken for empirical analysis. The observation period is up to 2013. The annual bilateral nominal exchange rate versus the dollar has been used for this study. We calculated the proxy for the balance of trade by extracting exports from the imports. The degree of openness is measured by adding imports, exports and dividing by GDP. There are a great amount of additional macroeconomic variables that affect exchange rates and hence may be measured as control variables; these include such factors as political stability, terms of trade and recession. Counting these variables into the measurement increases the suitability of the model, but also reduces the degree of freedom. For parsimony reasons and data availability, we restrict to the variables described earlier.

4.2 Model Specification and Estimation Procedure

We used a cross-country panel data model that clarifies the relationship between exchange rates and macroeconomic fundamentals. Beckmann et al. (2011) specify that all monetary models of exchange rates based on the constant money demand function:

$$\frac{M}{P} = L(Y^r, i) \dots\dots\dots (2)$$

M represents the money supply, P is the price level and L is the money demand depending on real income (Y) and interest rates (i). Based on the money market function, the exchange rate can be stated as the change between internal and external money supply minus money demand, which is broadly identified as the Frenkel and Bilson (FB) model. Under the assumption that the interest elasticity is equal, the whole function can be written as follows:

$$S = \alpha + \beta_1 m - \beta_1^f m^f - \beta_2^y + y^f + \beta_3 (i - i^f) \dots\dots\dots (3)$$

The term β is the elasticity and α is a constant term. The variables m and y represent the money supply and real income. Since it is notorious that the exchange rate frequently diverges from the PPP, therefore with the combination of the expectations concerning the expected rates of inflation and interest resulted in the Rapid Instructional Design (RID) model by (Frankel, 1979):

$$S = \alpha + \beta_1 m - \beta_1^f m^f - \beta_2^y + y^f - \beta_3 (i - i^f) + \beta_4 (\pi_t - \pi_t^f) \dots\dots\dots (4)$$

The parameter π represents the anticipated rate of inflation. The equation responds adversely on interest rates, but still positively on inflation rate anticipations. Moreover, traditional models assumed the exchange rate to be constant in the long run; hence if the overall price index and PPP is merely effective for traded goods, the model will take the following form:

$$S = \alpha + \beta_1 m - \beta_1^f m^f - \beta_2^y + y^f - \beta_3 (i - i^f) + \beta_4 (\pi_t - \pi_t^f) + \beta_5 \frac{P_t^T}{P_t^{NT}} - \beta_5^f \frac{P_t^{fT}}{P_t^{fNT}} \dots\dots (5)$$

The parameter T signifies tradable and NT means non-tradable. In addition, government debt, an inadequate holding of global reserve, and foreign obligation raises the risk premium and depreciates the exchange rate. The balance of trade has been used as proxy as an indicator of risk premium (Hooper and Morton, 1982). Hence, equation 4 can be extended with the addition of cumulative trade balance in following form:

$$S = \alpha + \beta_1 m - \beta_1^f m^f - \beta_2^y + y^f - \beta_3 (i - i^f) + \beta_4 (\pi_t - \pi_t^f) - \beta_5 TB_t + \beta_5^f TB_t^f \dots\dots\dots (6)$$

Since our estimations are one per year, it appears appropriate to also take the values of trade balance on an annual basis. Taking into consideration the above discussion and factors estimated in previous models, we have estimated a panel data model with the additional variables likely to affect exchange rates. The data sets of our estimation have covered a period of more than three decades, which, we believe, is sufficient to observe the long-run effects. We have applied a series of panel unit root tests to check the unit root problem in the data. The unit root includes both the tests with common unit root processes and the tests with

an individual process. The generalized form of the Levin, Lin and Chu method under a common unit root process can be described in the form of following equation:

$$\Delta X_{it} = \alpha X_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta X_{it-j} + Y_{it}' \delta + \varepsilon_{it} \quad \dots\dots (7)$$

ΔX_{it} represents the endogenous variables in the model and Y_{it}' is for exogenous variables. We assumed a common $\alpha = p-1$ as well as ε_{it} are to be mutually independent. We can extract $\Delta \bar{X}_{it}$ with the following equation:

$$\Delta \bar{X}_{it} = \Delta X_{it} - \sum_{j=1}^{p_i} \beta_{ij} \Delta X_{it-j} - Y_{it}' \delta \quad \dots\dots\dots (8)$$

Likewise, \bar{X}_{it-1} using the second set of coefficients:

$$\bar{X}_{it-1} = \bar{X}_{it-1} - \sum_{j=1}^{p_i} \beta_{ij} \Delta X_{it-j} - Y_{it}' \delta \quad \dots\dots\dots (9)$$

On the other hand, The Im, Pesaran, and Shin, and the Fisher-ADF and PP tests are categorized as individual unit root process tests. A separate ADF regression for each cross section for The Im, Pesaran, and Shin tests can be explained in following form:

$$\Delta X_{it} = \alpha X_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta X_{it-j} + Y_{it}' \delta + \varepsilon_{it} \quad \dots\dots\dots (10)$$

Secondly, if we define π_i as the p -value from any individual unit root test for cross-section i , then under the null of unit root for all N cross-sections, the results under the Fisher-ADF and PP tests can be elaborated in the equation form as follows:

$$-2 \sum_{i=1}^N \log(\pi_i) \rightarrow \chi_{2N}^2 \quad \dots\dots\dots (11)$$

Finally, summarizing the above discussion, we can rewrite our economic estimators in the following function:

$$EXR = f(GDP, INF, GEXP, GDEBT, IR, OP, BOT) \quad \dots\dots\dots (12)$$

As a starting point, consider that a general and more advanced form of regression that is suitable for a multivariate model and is known as Multiple Regression can be extracted from the above function:

$$Y = a + b_1 X_1 + b_2 X_2 \dots\dots\dots + b_n X_n \quad \dots\dots\dots (13)$$

Y represents an endogenous variable whose value is determined by the rest of the exogenous variables. Thus, after adjusting our variables in that model, our ultimate estimation equation will be:

$$EXR_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 INF_{it} + \beta_3 IR_{it} + \beta_4 GEXP_{it} + \beta_5 GDEBT_{it} + \beta_6 OP_{it} + \beta_7 BOT_{it} \quad (14)$$

5. Results and Discussion

Testing our data for unit root is essential as a first phase. The concept of long run co-integration makes sense if variables appear to be cointegrated of order I (1). Neither can a fixed variable force a non-stationary variable to modify, nor is a stationary connection between I (1), and I (2) possible (Beckmann et al., 2011). A stationary sequence has a continuous mean, variance and auto-covariance for all specified lag, therefore the concept of stationary is important for accurate estimations as well.

Insert table 1 here

We have applied a series of tests on the panel data to test the unit root. This includes the Phillips-Perron (PP), The Im, Pesaran and Shin, the Fisher-ADF and the Levin, Lin and Chu methods. In the first order, we tested for stationary properties in the levels. The variances are taken and verified again if a unit root exists, for example if the parallel variables are stationary of order I (1). The results of the tests are offered in table 1. According to our results, most of our variables can be measured as actually stationary at first difference. Nonetheless, in a few cases, the indication is mixed. For example, our results for GDP, inflation and government expenditures suggested that these variables are stationary. On the other hand, the rests of the variables are integrated of first order. What is more, the PP-Fisher and the ADF-Fisher tests reject the null for the OP at level. But, since the additional tests specify I (1) properties of the individual series we presume them all as I (1).

Insert table 2 here

Table 2 displays the Pearson correlation coefficient matrix for the dependent and independent variables. The results represent that the correspondence constants between the independent variables are rationally low. Low coefficients of connection between descriptive variables suggests the nonexistence of harmful multicollinearity. This enhanced our confidence that the results are not distorted by spurious correlations between variables. As a cross check of this, another collinearity tests were carried out to confirm the accuracy of estimations. In our case the values of diagnostic tests fall within provided limits. Therefore, the result confirms the absence of multicollinearity and the coefficients to be assessed are projected to be realistically stable as well.

Insert table 3 here

Table 3 represents the results of the pooled sample for our data. The sample period starts from 1981 to 2013 for all approaches. For the pooled sample, there is strong indication from both pooled EGLS and the TSLS with cross-section weights that the macroeconomic fundamentals are very important for determining exchange rates. The particular coefficients turn out to be extremely significant, with the expected signs representing that traditional macroeconomic fundamentals are very influential on the exchange rates of Asian economies. The higher growth rates are associated with the appreciation of exchange rates. [More openness of the trade and higher interest rates contributes positively towards exchange rates.](#) [The inflation rates have an adverse influence on exchange rates.](#) [On the other hand, government expenditures are also significant and negative.](#) For both pooled methods, public

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3 debts and trade deficits are adversely related to the exchange rate with a high level of
4 significance.
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7 The Pearson correlation matrix shows that the concern about endogeneity for both
8 endogenous and exogenous variables is significantly low, but the independent variables may
9 influence each other leading to distortions in the estimations. To control for a potential
10 endogeneity partiality, with respect to the independent variables, we employ a dynamic
11 Generalized Method of Moments (GMM) for the panel data. The fixed effect GMM is well
12 specified with a 2SLS instrument weighting matrix and White cross-section standard errors
13 and covariance. The first column of table 3 represents the results of GMM. The GMM
14 specifications indicate that all variables significantly affect the level of exchange rates of our
15 sample. The expected signs and the level of significance adequately describe the strong
16 relationship between the economic indicators of the panel data. *The level of significance for
17 BOT is higher in the pooled estimation than in the GMM.* The value of Durbin Watson is also
18 adequate, which ensures that the model is free from the damaging effects of serial correlation.
19

20
21 We now use the OLS method to estimate the long-run relation between exchange rates, GDP,
22 openness and other variables, as formulated in equation (14). First, a joint panel of sample
23 countries was estimated for initial specification properties and then we applied the panel
24 regression model as a crosscheck for our GMM results. Subsequently, we decided to split the
25 total group of variables into three sub-models, based on their significance level. The results
26 are presented in table 4. Starting from our basic model 1 with all variables, the coefficients
27 and the corresponding t-statistic values confirm that the GDP, OP, IR, GDEBT and BOT are
28 statistically significant at the given level and that *the level of significance for INF and GEXP
29 is lower than the assigned level. Then, we gradually remove the variables with lower
30 significance level.* After the removal of every variable the remaining estimators have been
31 tested for basic properties of the model specification including the correlation analysis.
32
33

34
35 The results remain consistent with the expected signs in every model. The subsequent values
36 of R^2 and the DW test are also significant. The majority of variables are significant at a 5%
37 level except the inflation and government expenditures. In model 2, we removed the
38 government expenditures. The results show that all other variables are significant at 5% other
39 than BOT and inflation. In model 3, our estimations produced similar results without taking
40 into consideration inflation. *Finally, in our last model we excluded both variables with a
41 lower significance level.* The coefficients of all remaining variables are significant and the DW
42 value is also significant. Furthermore, our estimated model is free from serial correlation as
43 well. The results of GMM and OLS under the panel approach produce similar evidence,
44 which specifies the robustness of our estimations and supports the view that the traditional
45 macroeconomic fundamentals have a significant influence on the exchange rates of the five
46 economies of South Asia.
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51 *All of the economies included in our sample have carried trade deficits. International trade is
52 one of the fundamentals stimulating economic development because the developing
53 economies integrate with the world through trade.*
54

55
56 *Insert table 4 here*
57

58 In contrast, the increase in trade deficits has deteriorating effects on foreign debt and also on
59 the value of domestic currency (Abbas, 2014). A trade deficit arises when a country is
60 importing more than it is exporting, which means that a country needs to buy a foreign

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3 currency for trade settlements. Although a short-run trade deficit is somehow manageable, a
4 prolonged one is often considered as an indication of a greater problem. This is the case
5 because abandoning supply reduces the demand of domestic currency and depreciates its
6 value against a foreign currency. Therefore, the trade balance of the Asian economies
7 included in the analysis adversely affects the exchange rate.
8
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10 Recently, domestic products of Asian economies have gained access to the international
11 market and brought production and consumption gains to the trading nations. Therefore,
12 international organizations such as the World Trade Organization, the International Monetary
13 Fund and the World Bank are persistently directing countries, especially developing
14 economies, to rapidly speed up the process of trade liberalization to achieve attractive
15 economic growth (Tahir and Khan, 2014). Therefore, these efforts of developing nations
16 encourage the economic activities at the macro level and boost the exports of the country,
17 which in turns leads to an appreciation of the domestic currency. This shows that both trade
18 liberalization and economic growth have a positive impact on the exchange rate.
19
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21 In developing economies, the fiscal policy of the government is especially important because
22 small economies are vulnerable to external shocks. Government expenditure is one of the
23 leading tools of macroeconomic equilibrium policy and an upsurge in domestic absorption
24 pushes up national prices interpreting the domestic economy comparatively more costly than
25 the rest of the world; it also leads to an appreciation of the exchange rate. Against
26 conventional wisdom, Ravn et al. (2012) have argued that “provisional on an unexpected
27 increase in government expenditure, the economy in which this improvement initiates
28 becomes fairly inexpensive than its trading partners”. This, in turn, deteriorates the trade
29 balance and depreciates the real exchange rate. In our case the results support the traditional
30 view of appreciating the exchange rate.
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34 Similarly, over the last few decades, developing economies have increased their degree of
35 indebtedness. Most of the South Asian economies are ranked among small economies that
36 relied on external funding for the development of various aspects of their economy. By and
37 large, all economies of South Asia have been borrowing billions of dollars for so-called
38 infrastructural developments, but the ultimate result of these borrowings is not much
39 productive for the majority of the population. Therefore, unproductive loans increase the
40 degree of indebtedness, which leads to the depreciation of the domestic currency and a large
41 number of economic restrictions from international institutions (Otusanya, 2011).
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45 Likewise, an undervalued currency helps to produce relatively low-cost products. This, in
46 turn, results in higher profits, production, employment, and output. However, higher output
47 also raises inflation. The common practice among policy makers is to escalate interest rates in
48 order to decrease inflation. The incentives of extra earnings encourage foreign investors to
49 invest and the capital inflows raise the demand of domestic currency as well as help policy
50 makers to control the domestic circulation of money. Therefore, the higher inflation
51 depreciates the value of local currency because it adversely affects the macroeconomic
52 indicators of development. On the other hand, as interest rates drop, consumer spending
53 increases. Thus, there has always been a tradeoff between rates of interest and inflation and
54 authorities generally attempt to create a policy that balances interest and inflation rate.
55 Similar to the traditional view, our results indicated a negative impact of interest rates on
56 exchange rates. This indicates that higher interest rates results in the currency appreciation.
57 Finally, to check the accuracy of our OLS estimations, a battery of specification tests has
58 been performed. This includes; the Breusch Pagan LM, Pesaran scaled LM and the Pesaran
59
60

CD test for the correlation and cross-section dependence. The results are presented in table 5. The estimated test values and the assigned probabilities of all tests indicate that we cannot reject the null hypothesis of no correlation among residuals. Therefore, the estimated coefficients are accurate and our results are reliable.

Insert table 5 here

Additionally, we also applied the Hausman test of fixed and random effects for all OLS models. The numerical values of our estimation are presented in table 5. The null hypothesis of the Hausman test states that the random effects model is suitable. The chi-square values and the corresponding probabilities suggest rejecting the null hypothesis. Therefore, we used fixed effects in all OLS models. Thus, our results are considered reliable and accurate in terms of specifications.

6. Conclusion and Policy Implications

We have tested the empirical relationship between exchange rates and macroeconomic fundamentals. The panel of five South Asian economies tested included both the small and the leading economies of Asia. In this study, we developed a monetary model of exchange rate that assumed exchange rates as a function of economic growth, interest rates, inflation, government monetary measures and the impact of internationalization. The model was tested on selected Asian economies' data for the period of 1981 to 2013. The econometrics techniques were applied to the pooled and the panel data.

Our empirical estimations confirmed the relationship between exchange rate and macroeconomic fundamentals in the five South Asian economies. The pooled sample estimations of EGLS and the two-stage least square method showed that the coefficients of all variables are significant. The results of the panel GMM and the OLS also specified the link between exchange rates and applied estimators, i.e. macroeconomic fundamentals. The expected signs are correct for all variables except the interest rate. The results of this study have important policy implications for developing economies. Improvements are required in terms of market information, domestic market efficiency and investors' protection for balancing exchange rates with international trade.

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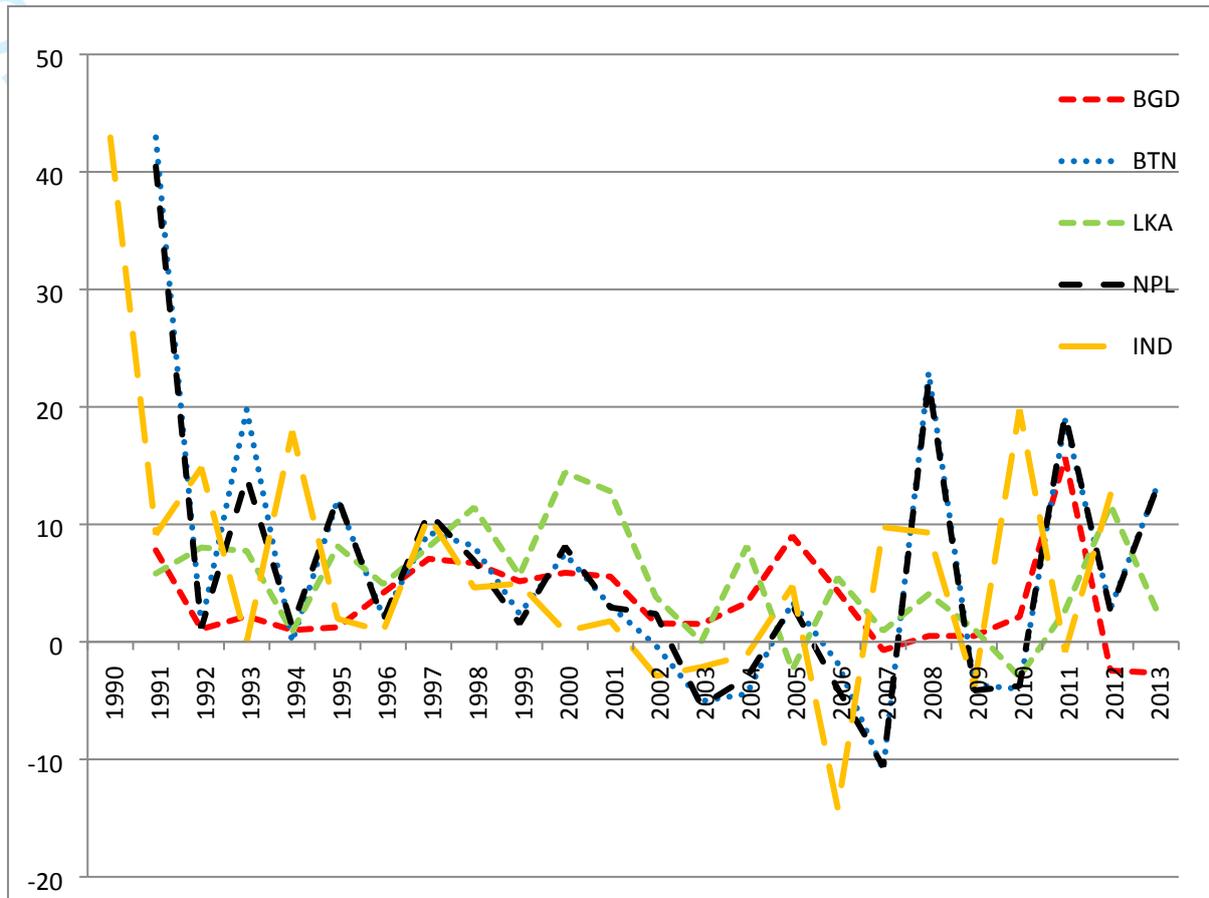


Figure 1: Exchange rate volatility

Tables

Table 1: Unit root tests

Variables	Levin, Lin and Chu	Im, Pesaran, and Shin	Fisher-ADF	Fisher-PP
<i>BOT</i>	6.89	7.98	0.08	4.10
<i>Ist</i>	-0.05*	-3.41*	26.07*	66.77*
<i>EXR</i>	2.20	4.44	0.50	0.63
<i>Ist</i>	-11.49*	-11.62*	111.93*	127.55*
<i>GDEBT</i>	4.26	7.37	6.41	4.35
<i>Ist</i>	-2.51*	-3.30*	43.89*	50.84*
<i>GDP</i>	-8.73	-9.20	85.72	90.25
<i>GEXP</i>	-2.30	-2.54	25.49	23.77
<i>INF</i>	-6.60	-5.95	54.43	62.44
<i>IR</i>	-1.24	-1.40	17.69	14.24
<i>Ist</i>	-11.71*	-10.11*	92.61*	68.38*
<i>OP</i>	2.21	0.61	34.06	35.44
<i>Ist</i>	-11.04*	-10.33*	116.35*	119.52*

Source: Authors' analysis

Notes:

1. Given values are test statistics.
2. * indicates stationary at first difference.

Table 2: Pearson correlation

Variables	EXR	BOT	GDEBT	GDP	GEXP	INF	IR	OP
EXR	1							
BOT	-0.06	1						
GDEBT	-0.01	-0.39	1					
GDP	-0.08	-0.10	0.11	1				
GEXP	-0.05	0.03	-0.03	0.28	1			
INF	-0.07	0.07	-0.11	-0.27	-0.09	1		
IR	-0.21	0.29	-0.30	-0.19	-0.37	0.36	1	
OP	0.03	-0.49	0.19	-0.03	-0.02	-0.08	-0.28	1

Source: Authors' analysis

Table 3: Summary of Pooled and Panel Approach

Variables	Panel Approach		Pooled Approach			
	GMM coefficient	t-statistic	EGLS coefficient	t-statistic	TSLS coefficient	t-statistic
<i>C</i>	43.17*	(7.73)	11.57*	(9.32)	30.54*	(8.69)
<i>BOT</i>	3.26	(2.35)	6.79*	(3.96)	6.34*	(4.14)
<i>GDEBT</i>	1.31*	(4.46)	1.11*	(3.06)	1.24*	(4.36)
<i>GDP</i>	-0.35*	(-3.83)	-1.20*	(-4.32)	-1.03*	(-4.15)
<i>GEXP</i>	-0.57*	(-2.68)	-1.47*	(-9.50)	-3.97*	(-2.43)
<i>INF</i>	0.88*	(2.07)	1.39*	(6.10)	1.32*	(3.56)
<i>IR</i>	-1.11*	(-2.29)	-1.14*	(-5.18)	-1.29*	(-5.67)
<i>OP</i>	-1.17*	(-2.80)	-4.73*	(-8.47)	-4.36*	(-8.54)
<i>R</i> ²	0.77		0.88		0.95	
<i>DW</i>	1.87		1.91		1.96	

Source: Authors' analysis

Notes:

1. * indicates significance at 5%.
2. DW is the value of Durbin Watson statistic.

Table 4: Panel OLS estimation models

Variables	Model 1	Model 2	Model 3	Model 4
<i>C</i>	43.17* (6.95)	-43.07 (-6.94)	42.92* (6.90)	42.92* (6.92)
<i>GDP</i>	-4.35* (-2.79)	-5.29* (-2.66)	-6.31* (-2.68)	-6.91* (-3.70)
<i>IR</i>	-1.10* (-2.54)	-1.11* (-2.57)	-1.14* (-2.55)	-1.18* (-2.56)
<i>GDEBT</i>	1.31* (2.39)	1.40* (2.65)	1.50* (2.06)	1.42* (5.08)
<i>OP</i>	-1.17* (-2.78)	-1.41* (-4.21)	-1.95* (-5.17)	-1.90* (-2.46)
<i>BOT</i>	3.26* (2.21)	4.88* (2.93)	5.90* (2.45)	6.60* (2.24)
<i>INF</i>	0.88 (0.41)	0.90 (0.45)		
<i>GEXP</i>	-0.57 (-0.14)		-0.60 (-0.25)	
<i>R</i> ²	0.79	0.87	0.96	0.96
<i>DW</i>	1.78	1.98	1.81	1.98

Source: Authors' analysis

Notes:

1. * indicates significance at 5%.
2. The values in parenthesis are the corresponding t-statistic.
3. DW is the value of Durbin Watson statistic.

Table 5: Diagnostic tests

Tests		Model 1	Model 2	Model 3	Model 4
Hausman Test	Chi-square values	50.35*	49.89*	58.22*	64.88*
	Probabilities	(0.00)	(0.00)	(0.00)	(0.00)
Correlation Tests	Breusch-Pagan LM	0.77	0.45	0.25	0.67
	Probabilities	(0.35)	(0.54)	(0.79)	(0.38)
	Pesaran scaled LM	0.76	0.39	0.81	0.35
	Probabilities	(0.47)	(0.66)	(0.24)	(0.76)
	Pesaran CD	0.47	0.27	0.45	0.41
	Probabilities	(0.69)	(0.78)	(0.64)	(0.64)

Source: Authors' analysis

Notes:

1. The corresponding probabilities are given in the parenthesis.
2. * represents the Chi-square values of the Hausman test.