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Is the Botswana Pula misaligned?

Haile Kebret Taye

BOTSWANA INSTITUTE FOR DEVELOPMENT POLICY ANALYSIS

BIDPA

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ABSTRACT

The objective of this paper is to assess whether the Botswana Pula has been misaligned or has been consistent with economic fundamentals. To do that an equilibrium exchange rate is estimated with data from the 1st quarter of 1990 to the 4th quarter of 2010 using an Auto Regressive Distributed Lag (ARDL) model. A comparison of the results with the actual values of the effective exchange rate showed that the Pula exhibited a stable movement and has been consistent with economic fundamentals during the estimation period. But forecasts for the last quarters of 2011 to 2012 seem to suggest that the exchange rate has started to slightly deviate from its economic fundamentals relative to its recent history. Such a deviation (mainly a depreciation in this case) might be representing one of the following cases: (1) a temporary market adjustment and, hence in that case, should not be viewed as more than a temporary fluctuation; (ii) an indication of a shift from economic fundamentals such that the trend will encourage exports and discourage imports; this will be good news in principle but for a heavily import dependent economy for its intermediate inputs in production and consumption, this probably will entail a huge import bill (partly because of what is called the J-curve effect and import dependence of the economy) without significantly boosting exports owing to inelastic demand. If indeed this is the case, it calls for an appropriate and timey adjustment before it leads to serious economic distortions.

1. INTRODUCTION

The exchange rate is simply the price of a given currency in terms of another currency. A national currency is therefore simply the ratio of relative prices. Or, to put it differently, it is the price of tradables as a ratio of non- tradables. As such, it affects both the supply and the demand for both goods and services domestically produced and internationally traded. Therefore, its overvaluation (above its competitive value) hurts exports and encourages imports while its undervaluation (below what is its competitive value) does exactly the opposite. As Maxwell (2003, p. 2) noted "the overriding objective of exchange rate policy should be to avoid persistence in exchange rate misalignment, which is a common feature in most developing countries. However, in order to manage misalignments it is necessary to successfully identify what constitutes the equilibrium real exchange rate (ERER), and this continues to pose a fundamental difficulty in the modern literature on the real exchange rate".

In broad terms, the exchange rate regime is either fixed or floating. A fixed exchange rate is administratively determined and its value only varies from time to time when monetary authorities decide to either revalue or devalue its rate against external currencies. While this was dominant from WWII to the early 1970s under the Bretton Woods system (1944-73), since then very few countries (mainly least developed) have a fixed exchange rate system.

The floating exchange rate regime, on the other hand, is essentially determined by market forces. Even the movements of managed float (in which monetary authorities keep changing its value from time to time to minimize deviation from its true currency price) is influenced by movements of market forces. The floating exchange rate regime (either in its close to pure form or pegged) is the most widely used system at the moment. And clearly, the deviation between the actual exchange rate and what is termed an equilibrium exchange rate is, in most cases, minimal., i.e. deviation is marginal because it is market determined.

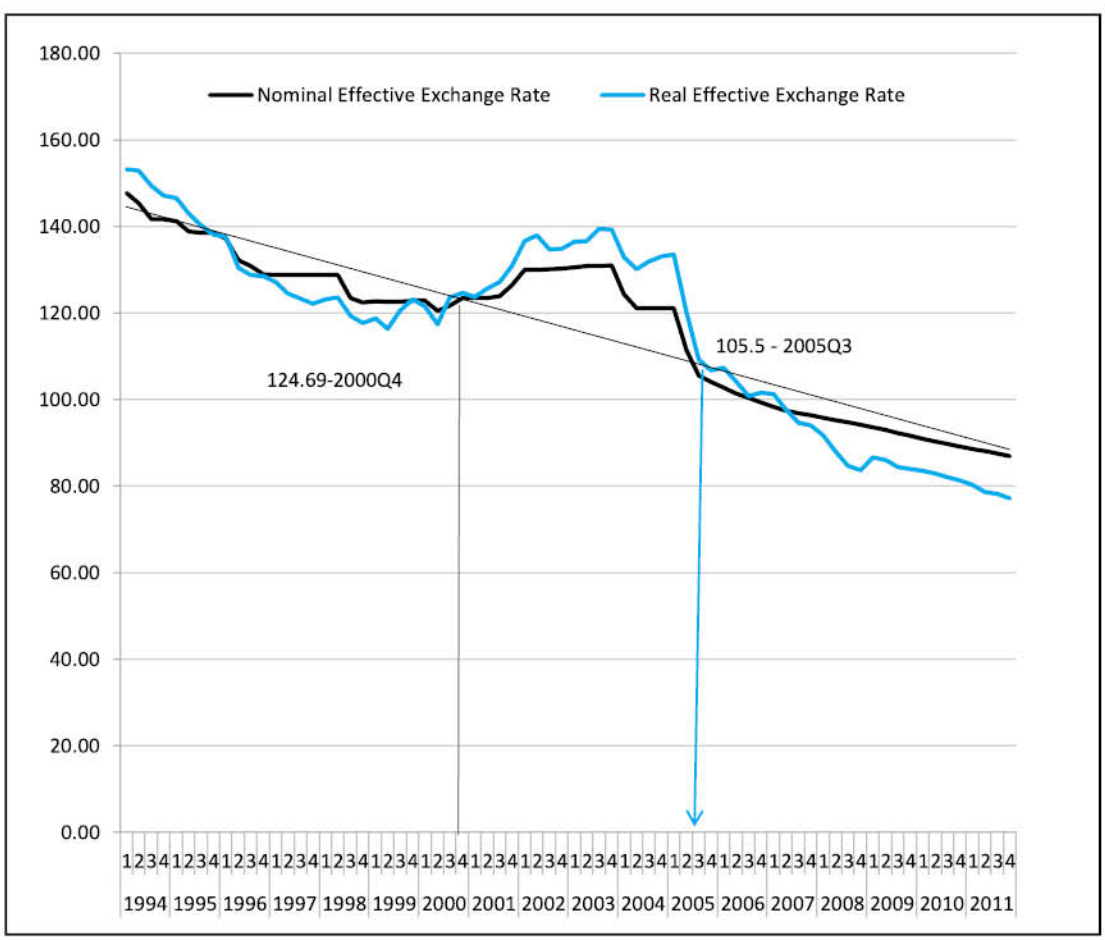
The exchange rate regime in Botswana is categorised as what is called a crawling peg. This means it is pegged to its important trading partners. It is, therefore, tied to the South African Rand and the SDR which is constituted to reflect movements in the Pound Sterling, the US dollar, the Euro, and Japanese Yen. Hence the effective exchange rate index is calculated based on the weighted average of these currencies.[1] The appreciation or depreciation of the local currency (the Pula) will then vary in tandem with the changes in these currencies.

[1]In its 2013 budget speech, the Ministry of Finance and Development Planning noted that the pula is weighted using 55% and 45% between the South African rand and the other group of currencies

The movements of the weighted average of the currencies against the Pula as summarised by the nominal and real effective exchange rates are depicted in Figure 1 covering the period from the 1st quarter of 2004 to the 4th quarter of 2011. The movement of individual currencies varied from one quarter to another over the years, but the weighted average of the effective exchange rates against the Pula showed a downward trend as shown by the trend line. The nominal exchange rate declined or depreciated by about 13.8 percentage points between 2005 and 2011 while the real effective exchange rate declined by 23 percentage points during the same period. To put it in simple terms, every unit of Pula, on average, was buying less and less of a unit of foreign currency.

While the movements in individual currencies against the Pula varied, all the currencies increased between 2002 and 2005 (indicating an appreciation of the Pula) but have since then, on the whole, depreciated or declined. For instance to cite two examples, between November 2010 and the same month in 2012, the nominal value of the Pula against the US dollar and the South African Rand declined by 15.3 and 4.9 percent, respectively, according to figures in BOB annual Report of 2011and November 20, 2012 exchange rate data.

Figure 1: Nominal and Real Effective Exchange Rates (1994Q1-2011Q4)



The important question is, then, what are the factors that determine its movements over time? More specifically, what are the macroeconomic fundamentals that economic agents (including monetary authorities) may influence or monitor that could lead to an exchange rate alignment (or avoid deviation between actual and equilibrium) exchange rates? Even though such deviations are minimal in a floating exchange rate system relative to a fixed exchange rate regime, misalignment could crop up as the exchange rate movements lag behind the dynamic movement of economic fundamentals that influence it. This brings us to the core question of what economic fundamentals influence the behaviour of the exchange rate? The purpose of this paper is to explore this question by examining whether the Botswana Pula is misaligned or it is close to its equilibrium value as determined by macroeconomic fundamentals.

The remainder of the paper is organized as follows: Following this brief introduction, the second section defines the concept and measurement of the real exchange rate; it also examines the most commonly used determinants of the equilibrium exchange rate as outlined in the literature. Section three describes the specified model and presents the bounds test in the context of an Autoregressive Distributed Lag (ARDL) model. Section four presents estimation results and evaluates the tracking performance of the model; and finally, section five presents brief conclusions and highlights the policy implications of the results.

2. LITERATURE REVIEW:

2.1. Concept and Measurement

Before explaining an equilibrium exchange rate it is instructive to define a real exchange rate. The real exchange rate is usually measured as the nominal exchange rate weighted by the ratio of the price of non-tradable to that of tradable goods. That is, it is the nominal exchange rate scaled by domestic and world price ratios.

That is RER =E (P_N/P_T)
Where RER = the Real Exchange Rate;
E is the official nominal exchange rate measured as the amount of foreign currency (USD, RAND....) per unit of domestic currency (Pula); P_N is the domestic price of non-tradable goods and P_T is the price of tradables both expressed in the same currency.

In cases where the price of tradables (P_T) is not available many researchers (Balassa, 1990; Edwards, 1990; 1989 and Ghura, 1993, for instance), used the world or the US wholesale price index as a proxy. And the domestic price index is measured by domestic CPI. But in the case of Botswana both prices are available.

Sometimes the way the real exchange rate is measured varies depending on whether it is expressed in terms of foreign currency per unit of domestic currency or the other way round. But this has no substantial difference except the interpretation of upward or downward movements. In this study, we follow the Bank of Botswana's formulation of expressing the value of foreign currencies per unit of the local currency. Hence, the nominal exchange rate is defined as the weighted average of trading partners' currencies per unit of the domestic currency (Pula). Therefore, an increase in the real exchange rate implies an appreciation of the Pula while a decrease indicates a depreciation. An increase in the ratio of price of non-tradables to the price of tradables will also, other things being equal, lead to an appreciation of the real exchange rate while a decrease in the price of non-tradables relative to tradables will lead to a depreciation of the real exchange rate.

A commonly used alternative definition of the exchange rate is the trade weighted or real effective exchange rate (REER); this is the same as a bilateral exchange rate except that the nominal exchange rate is based on a weighted average of trade partners' currencies instead of being expressed in terms of a single currency. The advantage of the effective exchange rate measure is that it reflects the value of the exchange of the countries which are most important trading partners from which the country in question imports its goods and to which it exports its goods and services. This is usually a more comprehensive measure as it reflects the relevant trade transactions of the country.

The above defined real exchange rates (RER or REER) measure the consistency of the exchange rate with macroeconomic fundamentals of the country as measured by the extent of distortions or lack thereof. An exchange rate also measures the competitiveness of the economy with trading partners because it is the price by which foreign and domestically produced goods are scaled (or weighed). Hence, other things being equal, we will expect a depreciation of the domestic currency (Pula in this case) to encourage what is domestically produced (or exports) and discourage what is imported from abroad. Appreciation of the currency will have exactly the opposite effects (discourage exports and encourage imports).

An exchange rate that is not misaligned (not under- or overvalued) will therefore help competitiveness and a healthy current account balance of payment positions in addition to an appropriate resource allocation in the domestic market. The main purpose of all the various studies that were conducted has, therefore, been to assess the extent to which the actual real exchange rate is consistent with the equilibrium exchange rate that would ensure such a resource allocation.

2.2. Determinants of the Equilibrium Exchange Rate

There is a huge body of literature on measurement and estimation of real exchange rate as surveyed by MacDonald (1995) and Rogoff (1996). In what follows only a brief review of the relevant literature will be touched on. In particular, it will briefly highlight the main two approaches, namely the Purchasing Power Parity (PPP) and the Behavioural Real Equilibrium Exchange Rate (BRER).

Some studies, take the year in which the purchasing power parity (PPP) is believed to approximate the equilibrium value of the exchange rate and trace / compare any changes taking place with that year as a point of reference. Of course, this ignores the dynamic movement of the economic fundamentals that might have taken place in the economy that would seriously impact on the behaviour of the exchange rate. Consequently, many prefer to estimate the equilibrium exchange rate based on some macroeconomic fundamentals. According to Edwards (1990), Cottani et al (1990) and Ghura (1993), to name a few, the following are the most common variables used to estimate the real exchange rate.

The terms of trade (TOT) measured as the price of exports relative to the price of imports, is expected to increase the availability of foreign currency as the price of exports relative to that of imports increases. This would then have both income and substitution effects and depending on which one dominates it would lead to either an appreciation or a depreciation of the real exchange rate, hence a priori the sign is ambiguous. Similarly, the degree of openness of the economy (ROPEN) is measured by the ratio of total exports and imports to total income (GDP). This indicates the extent to which the economy is open to external trade. The more open the economy is to external trade the more exposed it will be to external shocks and hence the more likely that the real exchange rate will depreciate. Some studies prefer the inverse of this and measure closeness.

Another important variable that is believed to affect the behaviour of the real exchange rate is the amount of capital flow (RCAPFLOY) to the country. This is measured as the difference between net changes in the trade balance and foreign reserves, scaled by GDP. An increase in net flows helps the country to accumulate more foreign currency and hence would lead to a depreciation of the domestic real exchange rate. Similarly, the growth in domestic credit (as measured by growth in total domestic credit) relative to the growth in GDP (RXCRE) is supposed to indicate the excess in money supply relative to the growth of the economy. Hence, this excess credit is expected to lead to an inflationary pressure and hence to a depreciation of the real exchange rate.

Government consumption is also usually included to capture its pressure on the exchange rate since the government imports goods from abroad directly and influences economic activity indirectly. Hence, an increase in government consumption is expected to lead to a depreciation of the domestic currency (Pula). Interest rate differential (RIRD) between Botswana and the Republic of South Africa (Botswana's important trading partner) is also included to account for any portfolio adjustment due to actual or anticipated changes in interest rates between the countries. And finally, the devaluation of the nominal official exchange is measured by a dummy variables (D1) for periods when devaluation took place (in 2005 for instance) to capture exchange rate regime shifts.

Many authors, including Cottani et. al. (1990), Edwards (1989), Elbadawi (1994), Ghura and Greenes (1993), MacDondald(1995), MacDondald and Ricci (2003), *Maxwell et. al. (2003), and* Razin, (1997), used the above and related variables to estimate the behavioural determinants of real exchange rate equilibrium. And the estimation techniques they used ranged from simple Ordinary Least Square (OLS) to more recent techniques like co-integration. Following such estimation they went on to compare the actual or observed and the model based exchange rate forecasts to determine the existence and extent of misalignment. The main conclusions of most of the studies as reviewed by MacDonald and Ricci (2003, p.3) is that the "Literature indicates that purchasing power parity (PPP) is not an appropriate model for the determination of equilibrium exchange rate... This has resulted in a shift away from PPP based measures of the equilibrium exchange rate to ones which focus on the link between the real exchange rate and various so called real determinants. ...(and) Most of this work uses co-integration techniques to identify persistent patterns of co-movements among variables".

In line with the literature this study also uses similar specification and the same modelling approach in identifying the determinants of real equilibrium exchange rate in Botswana. The specified model and the estimation techniques are presented in the next two sections.

3. MODEL SPECIFICATION, DATA AND ARDL BOUNDS TEST

3.1. Model Specification

In accordance to the above cited literature and described variables, the long run relationship is specified in equation (1).

$$Log(REER_t) = \alpha_0 + \beta_1 Log(NEEER_{t-1}) + \beta_2 Log(REXCRE_{t-1}) + \beta_3 Log(ROPEN_{t-1}) + \beta_4 Log(RCAPFLOY_{t-1}) + \beta_5 Log(RTOT_{t-1}) + \beta_6 \log(RGFCONS_{t-1}) + \beta_7 RIRD_{t-1} + \beta_8 D1 + \varepsilon_t \ldots\ldots(1)$$

Table 1: Variable Definition, Expected Signs and Order of Integration of Variables

Variables Name	Definition	Expected Signs	order of Integration
REER	Real effective exchange Rate		I(1)
NEER)	Nominal effective exchange rate	+	I(1)
EXCRE	Real Excess credit measured as growth of money supply less growth of GDP	-	I(1)
ROPEN	Real Degree of openness as measured by exports + imprts relative to GDP	-	I(1)
RCAPFLOY	Real Capital flow measured by Net changes in trade balance	+	I(1)
RTOT	Terms of trade	?	I(1)
RGFCONS	Real Government final consumption	-	I(1)
RIRD	Interest Rate Differential between South Africa and Botswana	-	I(1)
D1	Dummy for regime changes before and after 2005	.....	.....
α , t	α is a constant and t is time subscript	---	-----

Note: R in front of any variable stands for real values of the variable.

3.2. Data and Unit Root Test

The data used to estimate equations (1) and (2) is a quarterly time series ranging from the first quarter of 1994 to the fourth quarter of 2010. The data for the different variables is collected from Bank of Botswana Statistical Reports (Botswana Financial Statistics), Central Statistics Office, Ministry of Finance and Development Planning, Reserve Bank of South Africa, and World Development Indicators (for few variables).

Most of the variables are used in logs in the long-run relationships while their first differences are used in the short-run equation. Before actually subjecting the data to estimate the model, all the data were diagnosed for their statistical properties. For instance the data was tested for normality and stationarity as reported above. Even though the model to be used accommodates variables of different orders of integration, it is important to check that all do not exceed I(1).

3.3. ARDL Bounds Test and Co-integration

Applying the ARDL bounds test involves the following steps. First, it requires establishing the unit roots of the variable of interest. Second, it involves establishing co-integration (or long-term relationships) among the variables using the bounds test. And, third, once the long-run relationship is established, long-run and short-run models are estimated to infer the impacts of the exogenous variables on the endogenous variables.

Accordingly, the first test undertaken used a Dickey Fuller test to establish the unit root properties of the variables. The results are reported in Table 1 and show that all the variables are non-stationary in levels but become stationary after differencing once, suggesting that they are I(1). Hence, as long as the variables are either I(0) or I(1), we can proceed to establish the existence (or lack thereof) of any long-run relationship by applying unrestricted co-integration test.

In order to establish the existence of a long-run relationship, an ARDL bounds test using the unrestricted Vector Error Correction (UVEC) version of a VAR model was estimated, combining equations (1) and (2). The model was initially specified with four lags because it is quarterly data. When estimated, the conventional selection criteria had contradictory results as could be seen in Appendix 1. While lag 1 was selected by Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ), lag 2 was selected by the Akaike information criterion. Finally, lag 2 was chosen because it was consistent with the sequential modified Likelihood Ratio (LR) and the Final Prediction Error (FPE) test statistics.

The results of the bounds test (see Table 2) show that the computed F- value is greater than the critical values as initially tabulated by Pesaran et. al. (2001) and later modified by Narayan (2005). The reported critical values are based on an exact sample size as suggested by Narayan (2005) to take into account when the sample size is shorter than the size initially used by Pesaran et. al. (2001). Hence, the bounds test results suggest that the hypothesis of no co-integration between the variables should be rejected since the computed F-statistics is greater than the upper bound critical values.

Table 2: Bounds Test for Co-integration Analysis

Statistics	F-Value	Comment
Computed F-statistics:	4.058552	(lag: K=2)
Critical F-statistics at 5% (based on Narayan, 2005)	lower: 2.156 - upper: 3.33	For 7 regressors
Critical F-statistics at 5% (based on Pesaran et.al., 2001)	lower: 2.32 - upper: 3.50	For 7 regressors

Note: In both cases Critical Values are for unrestricted intercept and no trend, Narayan (2005, p. 1988) for 65 observations and Pesaran et. al. (2001, p. 300), Table CI (iii), Case 111.

Table 2 suggests that both critical values are consistent in showing that the hypothesis of no co-integration should be rejected in favour of its alternative as there is a long-run relationship between the variables. The specified model suggests that the variables have a meaningful relationships, as demonstrated by the unit root, co-integration, and bounds tests. The model could therefore be used to examine the long-run relationships and short-run dynamics using an error correction representation.

In sum, the following steps have been taken so far before the final estimation of the model. First, as reported in Table 1, a unit root test is carried out using an augmented Dickey Fuller test to ensure that the variables are stationary. Second, a co-integration test is performed using a Johansen approach to ensure that there indeed is a long-run relationship among the variables; Third, the ARDL bounds test is conducted to determine if it passes the F-test criteria to ensure that the order of integration is either I(0) or I(1) in the long-run relationship among the variables; these results are compared with critical values tabulated by Pesaran et. al. (2001) and based on the modified version tabulated by Narayan (2005). These tests set the stage to estimate the long-run and short-run determinants of the real exchange rate.

4. ESTIMATION RESULTS AND VALIDATION

4.1. Estimation

In principle the exchange rate equation could be estimated in many ways. But, as noted above, we have used what is referred to as an Autoregressive Distributed Lag (ARDL) model. The main advantage of this modelling approach is as Persaran and Shin (1997, P. 1) noted "Monte Carlo experiments provide strong evidence in favour of a rehabilitation of the traditional ARDL approach to time series econometric modelling. The ARDL approach has the additional advantage of yielding consistent estimates of the long-run coefficients that are asymptotically normal irrespective of whether the underlying regressors are I(1) or I(0)". Further, it handles structural breaks in data series and it performs well in small samples (Narayan, 2005).

4.2. Estimation Results

The results of the long-run version of the model are reported in appendix 2. Without going into details, the results of the estimation of the long-run model could be summarised as follows: (a) All the variables of interest have the theoretically expected signs; and (b) most of the variables have plausible parameter estimates relative to what is reported in the literature. But the focus of the analysis is on the short-run dynamics of the model since most of the explanatory variables used are related to the financial sector, whose impact is mostly likely to be in the short- to medium-term.

In terms of the overall attributes of the model more formal tests are reported in Appendix 3 but even simple inspection suggests that the various indicators like the information criteria, Durbin Watson, likelihood Ratios etc look acceptable. And the short-run error correction version of the ARDL model is specified as follows:

$$\Delta Log(REER_t) = \alpha_0 + \beta_1 \Delta Log(NEEER_{t-i}) + \beta_2 \Delta Log(REXCRE_{t-2}) + \beta_3 \Delta Log(ROPEN_{t-2}) + \beta_4 \Delta Log(RCAPFLOY_{t-2}) + \beta_5 \Delta Log(RTOT_t) + \beta_6 \Delta \log(RGFCONS_{t-i}) + \beta_7 \Delta \log(RIR_{t-2}) + \beta_8 D1 + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The variables used in estimating the short-run model are the same as in the long-run equation except the variables are in their first differences. The results of equation 2 are presented in Table 3. Most of the variables (except the degree of openness relative to GDP, ROPEN) are significant and have the theoretically expected sign (except the capital flow, RCAPFLOY). The coefficients in the short-run model suggest that the variables that have the greatest influence on Botswana's exchange rate are: terms of trade (TOT), the lagged value of the dependent variable (NEER), and government consumption (RGFCONS); and the variable that has the least impact is the interest rate differential between South Africa and Botswana (RIRD).

Table 3: Short-Run Model of Real Effective Equilibrium Exchange Rate

Dependent Variable: D(LREER)
Included observations: 65 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ(LNEER(-1))	0.339877	0.105003	3.236838	0.0020
Δ(LREXCRE(-1))	-1.05E-05	6.28E-06	-1.669603	0.1006
Δ(LROPEN)	-0.015498	0.012518	-1.238057	0.2209
Δ(LRCAPFLOY)	-0.052944	0.025956	-2.039753	0.0461
Δ(LRTOT)	-1.167688	0.114069	-10.23669	0.0000
Δ(LRGFCONS(-1))	-0.023908	0.014800	-1.615485	0.1118
D1	-0.005277	0.003163	-1.668597	0.1008
Δ(RIRD(-2))	-0.001762	0.000945	-1.864659	0.0675
ECM(-1)	-0.358188	0.151297	-2.367450	0.0214

R-squared	0.784014	Mean dependent var	-0.009350
Adjusted R-squared	0.753159	S.D. dependent var	0.026727
S.E. of regression	0.013279	Akaike info criterion	-5.677427
Sum squared resid	0.009874	Schwarz criterion	-5.376358
Log likelihood	193.5164	Hannan-Quinn criter.	-5.558636
Durbin-Watson stat	2.142539		

Note: all variables are as defined before and 'Δ" in the short run denotes first difference of the variable and ECM is the lagged value of the Error correction term.

The sign and the magnitude of the error correction term (ECM) is worth highlighting. It is statistically significant, has the right sign, and the magnitude of the coefficient suggests that about 36% of any deviation is corrected within the period or full adjustment takes about three quarters.

Before the model is used to examine the policy implications of the results, appropriate diagnostic tests were carried out so that the results are not affected by detectable biases. For instance (as noted in Appendix 3), formal tests for serial correlation using LM test, Ramsey Reset test for correct model specification, ARCH and White tests for Heteroskedasticity were conducted. In all the cases, no detectable problem was found as the significance of the tests show.

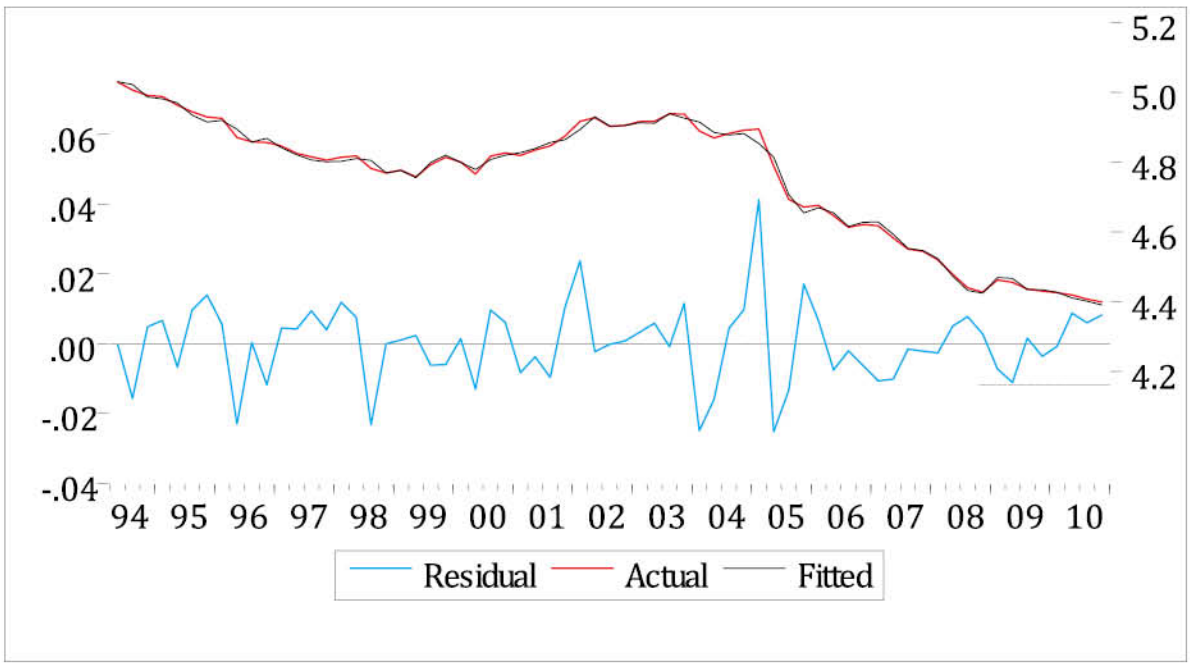
4.3. Validation and Forecasts

In addition to the above attributes of the data, various tests were also conducted to ensure the validity of the model. These included both within and outside sample tracking performance of the model. On the whole, as could be seen from the results reported for the long-run and short-run within sample forecasts (Fig. 2 and Appendix 5, respectively) fit of the model is acceptable. And further dynamic simulation forecast (as measured by ± 2 standard deviations) is reported as a sample in Appendix 4.

As an additional test for the forecasting ability of the model, in addition to the within sample forecasts, outside sample forecasts for which actual data is available (2011Q:1 to 2012Q:2) were also undertaken (reported in Appendix 6). The forecasts show a slight depreciation of the pula relative to the effective exchange rate. This is mainly because, while on average the Pula slightly appreciated against the South African rand in 2011, it depreciated against all the major currencies, hence an overall depreciation against the weighted average of the major currencies.

Further, in addition to the overall downward trend (depreciation of the Pula), its volatility as measured by the deviation of the actual REER relative to the fundamental REER is also noticeable as could be seen in Appendix 7, even though it remained within a ±1.5 band.

Fig. 2: Within Sample Tracking Performance: the Long Run Model



5. CONCLUSIONS AND POLICY IMPLICATIONS

The main conclusions that could be drawn from the above preliminary exercise are that:

(i) There seems to be no misalignment of the real exchange rate (the Pula) in Botswana in recent years; and

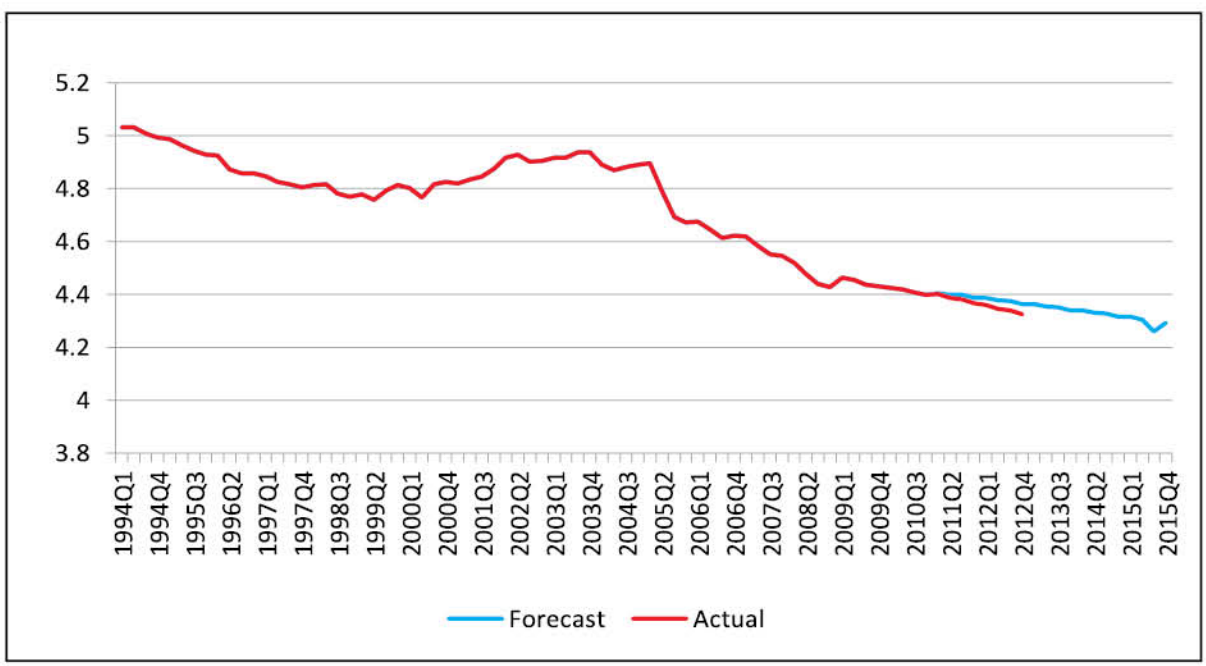
(ii) What is also worth noting is that, as the estimates suggest, any misalignment when it existed, seems to adjust to an equilibrium level in a short period of time (within a year);

Therefore, the crawling peg which the monetary authorities follow to conduct the exchange rate policy in Botswana seems to have worked well until the last few quarters.

The policy implications of the above conclusion is that the policies that have been in place seem to be on the right track in conducting the exchange rate policy and should be pursued in tandem with the developments in the fundamentals. This is because, unlike many countries which either suffer from what is called the "Dutch Disease" that affects countries with huge natural resource endowment, such distortions do not seem to reflect the movements of the Botswana Exchange rate (the Pula).

But of course, the above observation has disregarded the movement of the exchange rate in recent quarters. As indicated in Fig. 3, the actual exchange rate seems to have exhibited a downward movement (depreciation) in recent quarters. If indeed such a deviation persists and is not a temporary fluctuation, there is every reason to be concerned about such a deviation. The time is too short to make a judgement regarding the impact of such a deviation and has to be carefully monitored to ensure it does not develop into both distortions in resource allocation and/or instability. In fact this is probably one of the best features of a crawling peg exchange regime (to adjust as the need arises before any deviation entails any market distortion).

Fig. 3: Actual and Forecast Real Exchange Rate



Finally, the policy implications of the last point must be emphasised again. It should be clear that for an import dependent economy and with price inelastic exports and imports, currency devaluation does not necessarily improve a trade balance or boost exports as is the case in a diversified economy. The depreciation of the Pula has to, therefore, be carefully monitored because it is likely that due to low elasticity of exports and imports ("elasticity pessimism"), depreciation may not significantly increase exports and decrease imports both of which will lead to a deteriorating trade balance due to lack of significant increase in export revenue and increase in import bill.

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In fact, one could argue that the costs of currency depreciation probably outweigh the benefits that depreciation might bring, at least in the short to medium term. As alluded to above, the reasons are:

Botswana is not involved in many global or regional markets in selling its products, except for its two major export items (beef and diamonds).

The impact of changes in the exchange rate on the demand for diamonds is probably insignificant (since it has few substitutes); and though rigorous research is required its impact on beef exports is also not likely to be that big. On the other hand, its impact on the import bill, and its contribution to inflation is likely to be important. Hence, on the whole, one could argue that the economic cost of a depreciating Pula is likely to outweigh its benefits, in a non-diversified economy.

REFERENCES

Arghyrou, M. (2003). *Debt Sustainability, Structural Breaks and Non-linear adjustment: A testing Application to Greek fiscal policy.* Department of Economics and Finance, Brunel University.

Balassa, B. (1964). The Purchasing Power Doctrine: A Reappraisal. *Journal of Political Economy,* 72, 584-596.

Cottani, J. et. al. (1990). Real Exchange Rate Behaviour and Economic Performance in LDCs. *Economic Development and Cultural Change,* 39, 61-76.

Edwards, S. (1989). *Real Exchange Rates Devaluation and Adjustment.* Cambridge: The MIT Press.

Edwards, S. (1990). Real Exchange Rate in Developing Countries: Concept and Measurement. In T. J. Greenes, (ed.), *International Financial Markets and Agricultural Trade.* Westview Press, Boulder co.

Elbadawi A. Ibrahim (1994). Estimating Long-Run Equilibrium Real Exchange Rates. In John Williamson (Ed.), *Estimating Equilibrium Exchange Rates,* Washington, D.C: Institute for Internaltional Economics.

Ghura, M. T. Greenes. (1993). The Real Exchange Rate and Macroeconomic Performance in Sub-Saharan Africa. *Journal of Development Economics,* 42, 155-174.

MacDondald, R. (1995). Long-Run Exchange Rate Modeling: A Survey of the Recent Evidence. *IMF Staff Papers,* 42, 437-489.

_____ (1999). Exchange Rate Behavior: Are fundamentals Important. *The Economic Journal,* 109, pp. 673-91.

MacDondald, R. and L. Ricci. (2003). Estimation of the Equilibrium Real Effective Exchange Rate for South Africa. *IMF Working Paper* WP/03/44. Washington: International Monetary Fund.

Maxwell, O. et. al. (2003). *Real Exchange Rate Response to Aid Inflows: A Dynamic Analysis for Ghana.* Nottingham: School of Economics, University of Nottingham.

Narayan, P. Kumar (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics,* 37, 1979-1990.

Pesaran, H. and Shin (1997). *An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis.* Cambridge: Trinity College, Departmentof Economics .

Razin, O. (1997). *Real Exchange Rate Misalignment and Growth.* Doctoral Dissertation, George Town University.

Rogoff, K. (1996). The Purchasing Parity Puzzle. *Journal of Economic Literature,* 34, pp. 647-68.

Stock, J. and Watson, M. (1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated System. *Econometrica*, 5, pp. 1035-1056.

APPENDICES

APPENDIX 1: VAR LAG ORDER SELECTION

Lag	LogLikli.	LR	FPE	AIC	SC	HQ
0	141.3527	NA	2.14e-12	-4.167272	-3.897412	-4.060961
1	636.6818	851.3468	3.04e-18	-17.64631	**-15.21756***	**-16.68950***
2	721.0760	**123.9540***	**1.76e-18***	**-18.28362***	-13.69600	-16.47633
3	778.6281	70.14167	2.75e-18	-18.08213	-11.33562	-15.42434
4	837.6377	57.16556	5.44e-18	-17.92618	-9.020787	-14.41790

* indicates lag order selected by the criterion

LR: sequential modified LR test statistics (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX 2: LONG-RUN REAL EFFECTIVE EXCHANGE RATE

Dependent Variable: LREER
Sample (adjusted): 1994Q2 2010Q4
Included observations: 67 after adjustments

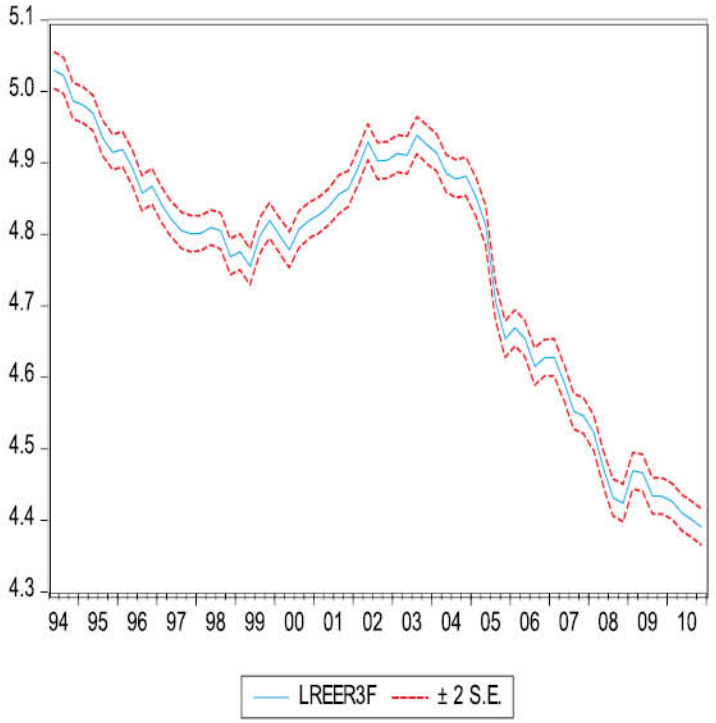
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.049341	0.531627	13.25993	0.0000
LNEER (-1)	0.751218	0.051134	14.69110	0.0000
LREXCRE(-1)	-0.020492	0.012483	-1.641658	0.1061
LROPEN(-5)	-0.020013	0.011410	-1.753887	0.0847
LRCAPFLOY(-4)	0.047973	0.011815	4.060394	0.0001
LRTOT	-1.239178	0.069264	-17.89064	0.0000
LRGFCONS(-1)	-0.032575	0.016419	-1.984014	0.0520
D1	-0.031811	0.009261	-3.434829	0.0011
RIRD(-2)	-0.001066	0.000636	-1.675956	0.0991

R-squared	0.996222	Mean dependent var	4.755738
AdjustedR-squared	0.995701	S.D. dependent var	0.182422
S.E. of regression	0.011961	Akaike info criterion	-5.889962
Sum squared resid	0.008297	Schwarz criterion	-5.593809
Log likelihood	206.3137	Hannan-Quinn criter.	-5.772774
F-statistic	1911.812	Durbin-Watson stat	1.991408
Prob(F-statistic)	0.000000		

APPENDIX 3: FORMAL DIAGNOSTIC TESTS

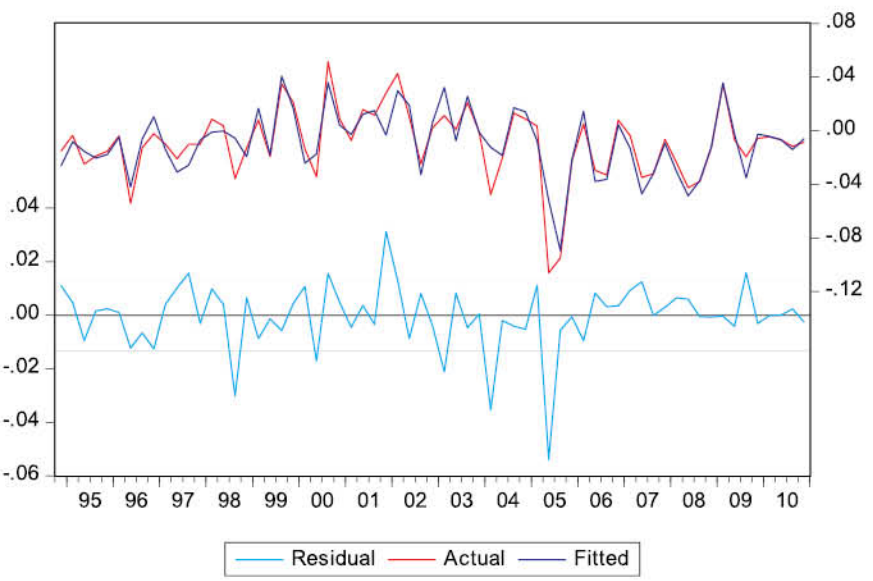
Diagnostic Test	A: Test Statistics	B: Critical Value	Decision Rule	Conclusion
LM Serial Correlation H0: No Serial Correlation	0.942027	4.309439	Reject H0 if A>B	Cannot reject the null hypothesis
Ramsey Reset Test H0: Model is correctly specified	1.593939	7.517701	Reject H0 if A>B	Cannot reject the null hypothesis
ARCH Heteroskedasticity H0: Homoskedasticity	0.28923	1.234743	Reject H0 if A>B	Cannot reject the null hypothesis
White Heteroskedasticity H0: Homoskedasticity	7.341244	61.46492	Reject H0 if A>B	Cannot reject the null hypothesis

APPENDIX 4: MODEL BASED DYNAMIC FORECASTS (± 2 STANDARD DEVIATIONS)

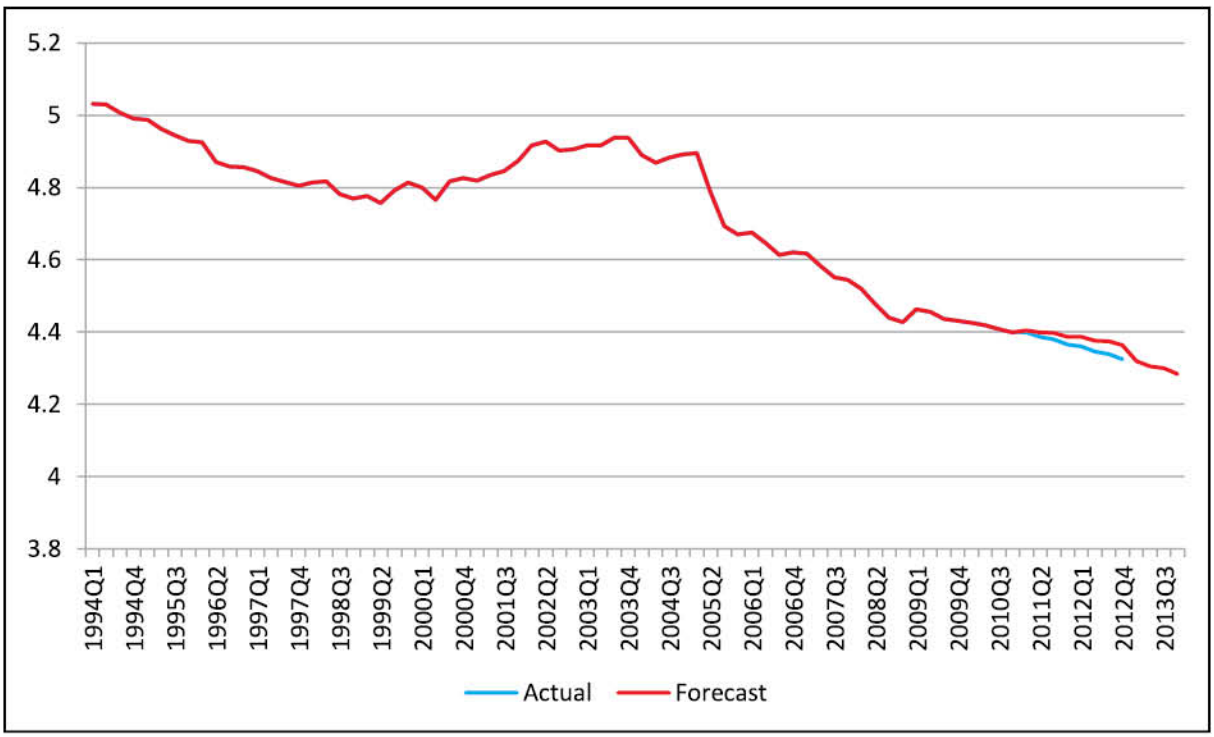


Forecast: LREERF	
Actual: LREER3	
Forecast sample: 1990Q1 2011Q4	
Adjusted sample: 1994Q2 2010Q4	
Included observations: 67	
Root Mean Squared Error	0.011128
Mean Absolute Error	0.008278
Mean Abs. Percent Error	0.173142
Theil Inequality Coefficient	0.001169
Bias Proportion	0.000000
Variance Proportion	0.000946
Covariance Proportion	0.999054

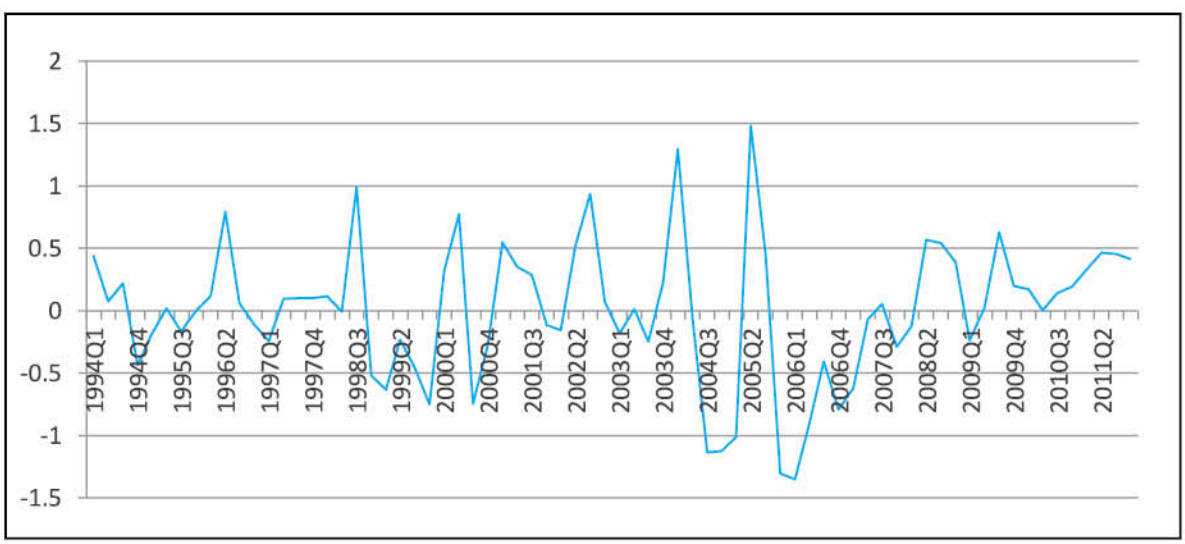
APPENDIX 5: WITHIN SAMPLE TRACKING PERFORMANCE: THE SHORT-RUN MODEL



APPENDIX 6: OUTSIDE SAMPLE FORECASTS



APPENDIX 7: REER INSTABILITY RELATIVE TO ACTUAL REER



i. Competitive value is meant to indicate an exchange rate value that is consistent with macro-economic fundamentals.

ii. An exchange rate is in equilibrium when the demand for and its supply are equal.

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