Equilibrium Real Effective Exchange Rate and Monetary Policy Implementation in Eswatini

By Ntobeko Dlamini[7] and Sive Kunene[8]

Abstract

The study estimates the equilibrium exchange rate for Eswatini based on the Behavioral Equilibrium Exchange Rate through the Autoregressive Distributed Lags (ARDL) approach using annual for the period 1990 to 2021. The long-run results indicate that government consumption expenditure, real GDP growth, real interest rate differential and the terms of trade have a significant effect on the country's real effective exchange rate and carried the correct signs. On misalignment, the study found periods of overvaluation and undervaluation with an average overvaluation of 0.1 per cent, indicating that the country's exchange rate has been largely consistent with economic fundamentals. The results from the ordinary least squares (OLS) model revealed that REER misalignment has an inertia effect and the real interest rate has a weak significance in influencing REER misalignment. Despite the weak significance of monetary policy in influencing the misalignment, the study recommends that the Bank should monitor the country's REER against its equilibrium.

***Keywords**: Real Effective Exchange Rate, Misalignment; Autoregressive Distributed Lags (ARDL)*

JEL Classification: E52, F31, F41

[7] Ntobeko Dlamini is an Economist, Modelling and Forecasting, in the Economic Policy Research and Statistics Department. Email: NtobekoD@centralbank.org.sz

[8] Sive Kunene is an Economist, Policy Research, in the Economic Policy Research and Statistics Department . Email: SiveK@centralbank.org.sz

1. Introduction

Maintaining a stable domestic and external position of a country is an important aspect and policy objective of an economy. One of the most important variables towards attaining such is the exchange rate which not only requires internal stability but also constant monitoring of external economic developments relative to domestic fundamentals. This is because the exchange rate has a major influence on economic activity mainly through the external sector. Being closely reflective of the country's competitiveness against other countries, the real exchange rate is thus monitored by economic policymakers, financial markets participants and industries involved in international trade.

Although not directly observable, it is important to establish an equilibrium level of the real exchange rate in order to determine whether the local currency is over or undervalued. Denoted as an exchange rate misalignment, the real effective exchange rate (REER) is expected to remain closer to it long run equilibrium as countries become more open and compete in the external market through trade. Elbadawi *et al*. (2012) states that keeping the exchange rate close to its equilibrium level is a necessary condition for economic growth, with countries that avoid currency overvaluation linked to export-led growth and export diversification.

Qayyum *et al.* (2005) asserts that prolonged and significant exchange rate misalignment can create severe macroeconomic instabilities and that the correction of external balance may require both exchange rate adjustment and demand management policies. Such deviations or persistent episodes of significant misalignments, are generally very costly to reverse. Hence, it is important that the REER does not deviate significantly from its equilibrium level determined by

economic fundamentals so that relative prices remain close to equilibrium over time and the country's external position is sustainable (Ajevskis *et al.,* 2014).

From the existing empirical literature, exchange rate misalignment prevails in either of the exchange rate regimes (ERR), that is, fixed exchange rate regime (hard peg) or flexible exchange rate regime or any hybrid of these two regimes. Dubas (2009) showed that for developing economies, intermediate regimes (regimes falling somewhere between a pure float and a hard peg) are more effective in reducing the size of misalignments. Holtemoller and Mallick (2013) found that the higher the flexibility of the regime, the lower the misalignment and, thus, the probability of an impending crisis. Coudert and Couharde (2009) found that misalignments were higher in the case of fixed ERR. Fixed exchange rate regimes are also prone to speculative attacks. Gouider and Nouira (2014) specifically argued that an overvaluation was a problem for most countries with fixed exchange rates since it leads to capital outflow as speculators anticipate that the currency will depreciate.

While there exists vast empirical literature on the determination of the equilibrium level of real effective exchange rates and misalignment thereto both in developed and developing countries in recent years, there are no similar recent studies about Eswatini. In trying to determine the extent to which the REER is misaligned from its equilibrium, various data sets and estimation techniques have been employed with most of the approaches linked with Behavioural Equilibrium Exchange Rate (BEER) framework proposed by Clark and MacDonald (1998). This paper therefore seeks to estimate Eswatini’s equilibrium REER in order to determine the corresponding degree of misalignment. For the purpose of assessment, the paper adopts the BEER approach which has become popular among researchers.

The paper is divided into five sections. Following the introduction is section 2, which presents stylized facts on the exchange in Eswatini. The review of related theoretical and empirical literature on real exchange rate determination is presented in Section 3 whilst the methodology is outlined in section 4. Section 5 focuses on empirical results and its discussion whilst section 6 presents the conclusion and recommendations.

2. Stylized Facts On Exchange Rate In Eswatini

2.1 Exchange Rate Regime for Eswatini

Eswatini is a member of the Common Monetary Area (CMA) where exchange rates between the member states[9] are fixed on a one-to-one basis with the South African Rand and South Africa (SA) is the anchor economy. The domestic currency, that is Lilangeni is therefore equivalent to the South African Rand and the Rand is legal a tender in Eswatini and the other member states. The smaller member states issue their own currency which circulates only within their domestic shores. Within the CMA arrangement there are free capital flows. Given the trilemma, Eswatini therefore has limited monetary policy independence (CBE, 2017 and Mabakeng & Sheefeni, 2014). Eswatini's policy rate therefore tracks the repo rate (SA policy rate), albeit with some deviations and to a large extent Eswatini maintains a positive differential to curb capital flight. In cases where, there is a negative differential, Eswatini uses other instruments to prevent capital flight like the call account, central bank bills and the special deposit facility.

The peg is an intermediate goal for the country and it helps Eswatini to import low and stable inflation as the Rand is less volatile (CBE, 2017). This is further reinforced by the fact that a bulk of Eswatini's imports comes from South Africa. Moreover, a

[9] CMA Member states include the Republic of South Africa, Eswatini, Lesotho and Namibia

bulk of Eswatini's exports goes to South Africa. Therefore, the country's equilibrium real effective exchange is not only affected by domestic economic fundamentals but also by economic developments in the South Africa.

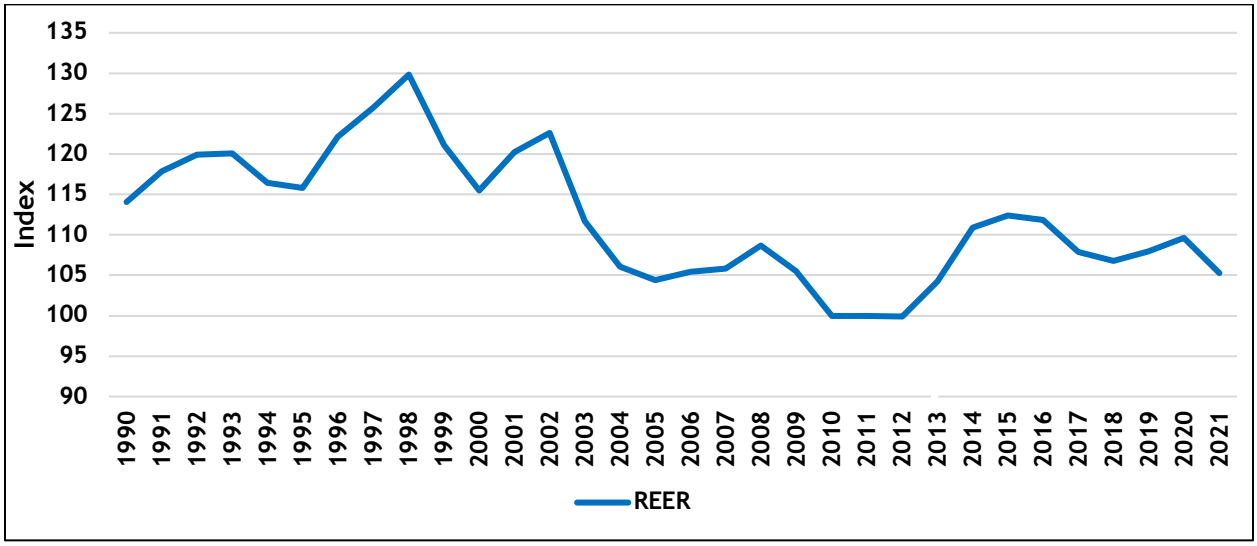
2.2 Exchange Rate Developments in Eswatini

Eswatini is a small and open economy that pursues a policy of private sector-led growth which mostly relies on merchandise exports. The goods exported mainly make their way to several countries among which is South Africa which accounts for 72 per cent of Eswatini's exports followed by the Euro Area and Mozambique which account for 5.1 and 4.1 per cent, respectively[10]. Other countries in the trade basket include the United Kingdom, Angola, Kenya, Nigeria, China and the United States. As shown in Figure 1, Eswatini's real effective exchange rate (REER) has generally appreciated on the overall since 1990. Despite the appreciation, it is evident that the index has undergone several periods of cyclical movement with appreciation periods followed by depreciation in the domestic unit when compared against its major trading economies.

Since being pegged to the South African Rand, Eswatini's Lilangeni in REER terms had a significant fallout in the market and depreciated by almost 10.2 per cent in the period 1990-1998; mainly on the back of low global commodity prices, the speculative attack on the Rand and the spillover effect from the 1997–1998 Asian financial crisis. Further weakening of the REER is observed around the periods preceding the 2008/09 global financial crisis and in 2015 when global commodity prices were under pressure. Eswatini's REER has also seen a depreciation trend as a result of the COVID-19 pandemic which hit hard on global economic activity and swayed investor sentiments against emerging market assets.

[10] Trade share from Central Bank of Eswatini REER estimation

Figure 1. Lilangeni REER Trend Analysis



Source: Central Bank of Eswatini

The observed periods of depreciation in REER are largely followed an improvement in global and regional economic conditions or higher inflation in the domestic economy against the major trading partners. During 2021, on an annual average basis, the REER index appreciated by 4.0 per cent.

3. Literature Review

3.1 Theoretical Review

Numerous methods for measuring exchange rate misalignments have been advanced by different proponents with each having its pros and cons. The equilibrium exchange rate models generally refer to real rate (Q) which is given by multiplying the nominal exchange rate (E) by the foreign price level (P*) and divided by domestic price level (Siregar, 2011). An increase in E and Q means a depreciation of the nominal and the real exchange rate of the domestic currency, respectively.

$$Q = \frac{E.P^*}{P} \quad \text{..... (1)}$$

However, a larger number of studies have considered the real effective exchange rate (REER) as opposed to the use of bilateral real exchange rate (Siregar, 2011). The formula for constructing the real effective exchange rate is as follows;

$$Q^{REER} = \sum_i \beta_i \frac{E.P_i^*}{P} \quad \text{.....(2a)}$$

$$\beta_i = \frac{EX_i + IM_i}{EX + IM} \quad \text{..... (2b)}$$

Where: (P_i^*) is the price of foreign country (i). β_i is the trade weight for each real exchange rate of domestic currency against foreign currency (i). The trade weight is calculated as the share of trade with country (i) in the overall total trade of the domestic economy. EX denotes exports whilst IM denotes imports. The general principle is to include a number of top major trading partners' currencies making up to at least 75 per cent of total trade of the domestic economy in constructing the real effective exchange rate (Siregar, 2011).

Below are some common methods for measuring exchange rate misalignment.

3.1.1 Purchasing Power Parity (PPP)

The purchasing power parity theory underlies much of modern literature on exchange rate determination. Its limitations have become the source of motivation for the development of more recent models of equilibrium exchange rate (Jongwanich, 2009). The PPP is based on the law of one price which assumes no impediments like trade barriers and capital controls, and it claims that price levels determine the equilibrium exchange rate. All else equal, a rise in local price level should increase the E^{ppp} i.e. a depreciation of the local currency (Siregar, 2011).

$$E^{ppp} = \left(\frac{P}{P^*}\right) \text{..... (3)}$$

Where; E^{ppp} is the purchasing power parity, and P and P* are as defined before. The PPP real exchange rate is assumed to be always constant and equal to one. However,

given price rigidities in the short-run, the PPP is normally referred to as the long-run equilibrium exchange rate (Hristov, 2002). In the short-run, the nominal exchange rate can deviate from the PPP rate. This deviation is considered as "under" or "over" valuation of the domestic currency. If the ratio of nominal exchange rate to E^{ppp} is great than 1, the currency is undervalued and if it is less than 1, it is overvalued[11] (Siregar, 2011).

There are a number of potential limitations coming from the basic concept of PPP in terms of its ability to capture sources of shocks to both the nominal and real equilibrium exchange rate. Some of the limitations of the PPP approach are described below;

- The law of one price may not hold because impediments such as trade barriers, both tariff and non-tariff barriers (Hristov, 2002). For example, in a World Bank survey, Brunetti, Kisinunko and Weder (1997) found that tax regulation and high taxes, inadequate infrastructure, financing and inflation, amongst others, are the biggest obstacles to doing businesses in Sub-Saharan Africa.
- The existence of non-tradable goods also compromises the PPP concept. The real PPP only captures the real exchange rate for the tradable sector and fails to capture shocks in the non-tradable sector (Siregar, 2011). Egert *et al.* (2006) found that the share of the non-tradable sector is quite significant in developing economies.
- The difference in the relative productivities of tradable and non-tradable sectors of the local and foreign economies also compromises the PPP concept. This is known as the Balassa-Samuelson effect (Siregar, 2011 and

[11] If $\left[\frac{E}{E^{ppp}}\right] > 1, undervaluation; \left[\frac{E}{E^{ppp}}\right] < 1, \ overvaluation$

Hristov, 2002). Furthermore, differences in government spending and demographic profiles across countries may also affect equilibrium real exchange rates and cause deviation from PPP (Hristov, 2002).

- Price indices are constructed using a representative basket of goods for consumers for that economy and this varies across countries. The difference in PPP therefore could be a result of different inflation across two country's distinctive baskets of consumption of goods rather than different prices for the same goods across countries (Hristov, 2002).

3.1.2 The Monetary Approach to Equilibrium Exchange Rate

The monetary policy approach to exchange rate equilibrium is a direct extension of the PPP motivated by the short comings of the PPP approach like its inability to explicitly determine other factors affecting the equilibrium exchange rate other than the relative prices and the productivity gaps between tradable and non-tradable sectors. It establishes the theoretical link between the nominal exchange rate and a set of monetary fundamentals (Siregar, 2011). Boughton (1988) asserts that under the monetary policy, changes in relative prices of goods are assumed to play a minor supporting role in the real exchange rate movements. Under the monetary approach, the exchange rate movement is influenced by excess money supply, output and nominal interest rate in the local economy relative to their levels in the foreign economy and can be specified as follows (Siregar, 2011 and MacDonald, 2000);

$$e_t = p_t - p_t^* = (m_t - m_t^*) - \alpha_1(y_t - y_t^*) - \alpha_2(i_t - i_t^*) \quad \text{..... (4)}$$

Where; e_t is the nominal exchange rate, and p_t and p_t^* are domestic and foreign price levels, respectively. m_t and m_t^* denote domestic and foreign money supply, respectively. y_t and y_t^* represent domestic and foreign output, respectively whilst

i_t and i_t^* represent domestic nominal interest rate and foreign nominal interest rates, respectively.

3.1.3 The Fundamental Equilibrium Exchange Rate (FEER)

Hristov (2002) asserts that the FEER was introduced by Williamson (Williamson, 1994) and it captures factors beyond the monetary variables in determining the exchange rate. Williamson (1994) asserts that the FEER is the real effective exchange rate that which simultaneously secures internal and external balance between a given number of countries. As opposed to the PPP approach, the FEER recognizes that the real exchange rate equilibrium varies over time (Siregar, 2011). Macdonald (2000) states that the FEER is a medium run concept in that it does not need to be consisted stock-flow equilibrium. Internal balance is achieved when the economy is at full employment output and inflation is low whilst external balance is described as the sustainable desired net flow of resources between countries when they are in an internal balance (Macdonald, 2000). Siregar (2011) states that the "external balance is characterized as a sustainable balance of payment position over a medium-term horizon, ensuring net flows of resource and external debt sustainability."

3.1.4 The Behavioral Equilibrium Exchange Rate Approach (BEER)

According to Macdonald (2002) the Behavioral Equilibrium Exchange Rate Approach of Clark and MacDonald (2000) tries to separate the purely normative aspects of exchange rate modelling from behavioral. As opposed to the PPP approach which assumes that the equilibrium REER is constant over time, the BEER allows the equilibrium REER to vary over time and respond to internal and external macroeconomic conditions. It approaches the equilibrium real exchange rate from the point of view of consistency with relevant fundamentals as opposed to internal and external equilibria (CBK, 2019).

The BEER adopts a two-step approach. The first step involves the estimation of a simple behavioral equilibrium exchange rate relationship whilst the second step this relationship is used to construct an assessment of whether the exchange rate is overvalued or not (CBK, 2019 and Adler & Grisse, 2017). Siregar (2011) and Macdonald (2000) state that the BEER attempts to explain the behavior of the exchange rate and considers the origins of cyclical and temporary movement of the real exchange rate and also taking values of the fundamental determinants of the real exchange rate. Exchange rate misalignments can come from inappropriate policies, transitory policy shocks, bubble factors and slow adjustment of predetermined variables (CBK, 2019).

3.2 Empirical Literature Review

Khomo and Aziakpono (2020) examined the extent of misalignment of the real effective exchange rate (REER) of the South African rand. The study used the Markov regime-switching (MSM) method to determine whether the exchange rate's departure from the equilibrium level is meaningful enough to be considered as either over- or undervalued. The results indicated that terms of trade, external openness, capital flows and government expenditure are key variables which influence the long-run equilibrium exchange rate in South Africa. The MSM correctly captures exchange rate misalignment as distinct episodes of exchange rate overvaluation and undervaluation.

Using annual data spanning from 1975 to 2012, Njingan and Odhiambo (2015) used the ARDL approach to determine the equilibrium exchange rate in South Africa. Similar to Khomo and Aziakpono (2020), the study found that terms of trade, trade openness, government consumption, net foreign assets and real commodity prices are part of the long-run determinants of the real exchange rate. The study further revealed that nearly 68.06 per cent of the real exchange-rate disequilibrium is

corrected annually. The estimated equilibrium revealed that the Rand has been over valued over the period.

Jager (2012) used a VECM approach to investigate the factors affecting the real exchange rate in South Africa using quarterly data spanning from 1982Q2 to 2012Q1. The long-run results revealed that a rise in the interest rate differential would result in an appreciation of the Rand. Openness of the economy and GPD lagged twice had a depreciation effect on the real exchange rate whilst productivity differential with the US, net capital inflow (per cent of GDP), government deficit (per cent of GDP) and the relative commodity prices had an appreciation effect on the real exchange rate. On the misalignment, the results revealed a severe undervaluation of the currency from 2001 to 2002 after which it corrected quickly in 2003. The currency was also severely undervalued in 2008 -2009 but reverted to its equilibrium quickly afterwards. Similarly, Macdonald and Ricci (2003) used the VECM and found that real interest rate differential, GDP per capita (both relative to trading partners), real commodity prices, trade openness, fiscal balance, and the extent of net foreign assets are key determinants of the real effective exchange rate in South Africa.

Bosupeng, Dzator and Nadolny (2019) used the ARDL approach to determine the exchange rate misalignment in Botswana using data from 1980 to 2015. The long-run results revealed that openness to trade has positive significant relationship with real effective exchange rate whilst domestic gross fixed capital formation had a positive but insignificant relationship. The terms of trade of trade, GDP, foreign aid and government debt all had a negative and significant relationship with the real effective exchange rate. In the short-run, terms of trade, GDP, foreign aid, government debt and domestic gross fixed capital formation have a negative and significant relationship with the real effective exchange rate whilst openness to trade and gross fixed capital formation had a positive but insignificant relationship.

Using the BEER approach, CBK (2019) used the ARDL to analyzed the exchange rate misalignment in Kenya from 2009Q1 to 2017Q4 and. The ARDL long run results revealed that the productivity differential, domestic investment, commodity terms of trade and government spending to GDP ratio have a significant negative effect on REER whilst openness to trade has a significant positive effect. Net foreign assets had a negative but insignificant relationship with REER. The results also revealed that the exchange rate misalignment over the period average 3.4 per cent and was on a decreasing trend, which indicates that the country's REER is consistent with economic fundamentals. Lastly, CBK (2019) reported that the BEER results were largely consistent with estimates from the other methodologies which are PPP, Trade Elasticities Approach and the Macroeconomic Balance approach.

Kiptuli and Ndirangu (2015) used a VECM to determine the exchange rate misalignment in Kenya from 2000-2014 and reported findings similar to the CBK (2019) in that the real exchange rate is largely driven by fundamentals. Kiptuli and Ndirangu (2015) reported that major misalignments occurred around major economic shocks such as the recent global financial crisis and the Euro zone economic crisis.

Adler and Grisse (2017) used panel data for advanced economies and selected Euro countries[12] to evaluate the BEER approach using different model specifications reported that the magnitude of the predicted values and the signs are sensitive to the combination of variables used. Adler and Grisse (2017) found the real interest rate, credit, GDP per capita, government consumption and net foreign assets to be robustly linked to the real exchange rate across several model specifications.

[12] Australia, Canada, Denmark, Japan, Norway, Sweden, Switzerland, United Kingdom, United States, and 11-euro area economies Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain

Vdovychenko (2021) applied the BEER and FEER approaches to estimate the REER trend on Ukrainian data. By employing the BEER the study was able to identify the long-run factors which explained the dynamics of the REER trend. The FEER approach on the other hand provided information on the determinants and measurements of the current account norm for Ukraine. Although the two approaches are different in their nature, both of them identified the periods of REER undervaluation in the first half of the 2000s, after the crises of 2008-2009 and 2014- 2015. Significant overvaluation was detected in the period 2011-2013. For more recent years, the estimates indicated moderate overvaluation of the REER which decreased in the second half of 2020.

Fiaz *et al* (2021) investigated the key determinants of exchange rate (RER) misalignment in Pakistan for the period 1991 to 2020 using the BEER technique. To explore the actual exchange rate misalignment and to assess the behaviour of variables that are different in different regimes of undervaluation and overvaluation, the nonlinear technique of Markov regime-switching (MSM) was applied. The findings showed that MSM accurately identified exchange rate misalignment in both regimes as separate incidents of overvaluation and undervaluation. Results further revealed that misalignment of the RER was affected by terms of trade, net foreign assets, interest differential, government investment, and consumption decision.

Nwachukwu et al (2016) analysed the relationship between relevant macroeconomic variables and the real effective exchange rate (REER) in Nigeria based on the Behavioural Equilibrium Exchange Rate (BEER) approach. Using data for the period 1990–2014 the Autoregressive Distributed Lag (ARDL) model was employed to obtained the equilibrium REER and the resultant levels of misalignment also computed. The result revealed that terms of trade and degree of trade openness were significant determinants of the REER, implying that trade policies matter for

Naira REER movements. On the average, the REER was found to be overvalued by 1.40 percent during the study period.

4. Estimation Methods

The study uses the BEER approach to determine the exchange rate misalignment in Eswatini since it is one of the most commonly used methodologies in similar recent studies like Njingan & Odhiambo (2015), Khomo & Aziakpono (2020) in South Africa, CBK (2019) in Kenya, and Bosupeng, Dzator & Nadolny (2019) in Botswana. There is extensive literature on the determinants of the BEER in developing countries based on REER. For example, Edwards (1989) proposed that exchange rate fundamentals in developing countries include terms of trade, government consumption, capital flows and technological progress. Gouider & Ridha (2014) list other factors such as external debt, trade openness and capital formation as important determinants of the real effective exchange rate. In practice, data availability constraints determine the choice of fundamentals to be used in assessing the exchange rate misalignment hence the variation of variables from one study to another (Chansa, 2019).

The general model for the study is therefore specified as follows;

$$REER = f(TOT, OPEN, GOVCONS,\ NFA,\ RGDP,\ RIR) \quad \text{..... (5)}$$

Where; REER is the real effective exchange rate; TOT is the terms of trade which is measured as net exports as percentage of GDP; OPEN is the ratio of exports and imports to GDP and measures openness to trade; GOVCONS is government consumption as a percentage of GDP; NFA is net foreign assets, RGDP is real GDP growth and RIR is the real interest rate differential between Eswatini and the Republic of South Africa.

The study uses the ARDL model approach and it is specified as follows;

$$\Delta lnREER_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i}\, ln\Delta REER_{t-i} + \sum_{i=0}^{n2} \beta_{2i}\, \Delta TOT_{t-i} + \sum_{i=0}^{n3} \beta_{3i}\, \Delta OPEN_{t-i} + \sum_{i=0}^{n4} \beta_{4i}\, GOVCONS_{t-i} + \sum_{i=0}^{n5} \beta_{5i}\, NFA_{t-i} + \sum_{i=0}^{n6} \beta_{6i}\, lnRGDP_{t-i} + \sum_{i=0}^{n7} \beta_{7i}\, RIR_{t-i} + \alpha_1 TOT_{t-1} + \alpha_2 OPEN_{t-1} + \alpha_3 GOVCONS_{t-1} + \alpha_4 lnNFA_{t-1} + \alpha_5 lnGDP_{t-1} + \alpha_6 RIR_{t-1} + u_t \quad \text{.....................................} \ (6)$$

Where; other variables are as defined before, ln is natural log, Δ is the difference sign operator and u_t are the errors or residuals. β_0 is the intercept, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7 are the short run coefficients and $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and α_6 are long-run coefficients.

Terms of trade (TOT): a deterioration in the country's terms of trade should result in a depreciation of the real exchange rate of that country. However, the priori expectation can be ambiguous since the sign would depend on a number of factors which include the income and substitution effect, and whether the trade shock is due to a change in import prices or export prices. An improvement in the country's terms of trade is expected to have an income effect (increases national income) which increase the demand for that country's goods and therefore result in an appreciation of the real exchange rate (CBK, 2019). However, if the improvement in terms of trade causes a substitution effect on the supply and demand sides, then it would cause a depreciation on the real exchange rate. According to Coppola *et al.* (2016), an alternative to proxy terms of trade is to use the trade balance or net exports as a percentage of GDP.

Trade openness (OPEN): trade openness is proxied by the ratio of imports and exports to GDP. CBK (2019) asserts that an increase in trade openness of an economy to international trade is expected to depreciate the real exchange rate.

Government consumption (GOVCONS): the effect of government expenditure is key in determining the equilibrium real exchange rate (Eita & Jordan, 2013). Its effects

depend on the composition of the expenditure between tradable and non-tradable goods. If a greater share of government expenditure is on non-tradables, this will increase the demand for non-tradables in the short-run and their prices would increase. In this case the exchange rate would appreciate. On the contrary, if a greater share of increase in government expenditure is on tradable goods, the relative price of non-tradable goods will fall and the currency will depreciate (Edwards, and Asfaha & Huda, 2002).

Net foreign assets (NFA): The net foreign assets inclusion as a determinant of the real exchange rate follows the portfolio-balance considerations. An increase in net foreign assets means an increase in wealth and is associated with an appreciation of the real exchange rate (Adler & Grisse, 2017 and Macdonald & Ricci, 2003). On the other hand, countries which are net creditors will eventually have to run trade deficits to satisfy their intertemporal budget constraints, which is facilitated by a real exchange rate appreciation (CBK, 2019).

Real gross domestic product growth (RGDP): Similar to Tensay (2006), the study uses GDP growth as proxy for technological progress. Technological progress appreciates the real exchange rate if the gains from the productivity enhancement in the tradable sector is higher than those in the non-tradable sector**.**

Real Interest Differential (RIR): the real interest rate differential is calculated as the differential in real interest rates between Eswatini and South Africa. Increased interest rates encourage capital inflows, causing the exchange rate to rise, whilst lower interest rates cause the exchange rate to fall.

The study uses the Augmented Dickey Fuller (ADF) test to determine the stationarity properties of the variables and the Akaike Information Criterion (AIC) test is used to determine the optimum lag length within the ARDL method in Eviews 11.

The study further uses the Bounds test for cointegration as espoused by Pesaran et al. (2001) to establish if there is a long-run relationship. The null hypothesis of no cointegration is rejected if the computed F-statistic is higher than the upper bound critical values. The null hypothesis is not rejected if the F-statistic is lower than the lower critical values and the test is inconclusive if the F-statistic falls in between the lower and the upper bound (Pesaran et al., 2001). Diagnostic tests are conducted to determine the stability of the model used. These include the; CUSUM and CUSUM of Squares test, Jarque Bera test for normality, LM test for serial correlation and the Breusch Pagan Test for heteroskedasticity.

To evaluate the extent of misalignment the study starts by estimating the long-run exchange rate fundamentals as specified in Equation 6. Similarly, to Bosupeng, Dzator and Nadolny (2019), the study uses the Hodrick-Prescott (HP) to separate permanent and temporally components of the exchange rate fundamentals to obtain the long-run trend. Since this paper uses the BEER approach, it defines the equilibrium REER as the REER that is consistent with the economic fundamentals. The REER misalignment is the percentage deviation of the actual REER from its long-run equilibrium.

$$REER_{Mis} = \left(\frac{Actual\ REER - Equilibrium\ REER}{Actual\ REER}\right) * 100 \quad \text{.....(7)}$$

Where $REER_{Mis}$ is the Real Effective Exchange Rate Misalignment.

4.1 Data Sources

The data used in the study was obtained from the Central Bank of Eswatini quarterly reports, Eswatini Central Statistical Office (CSO) and the South African Reserve Bank (SARB). To calculate the real effective exchange rate, the Central Bank uses a weighted average of the product of nominal bilateral exchange index and foreign

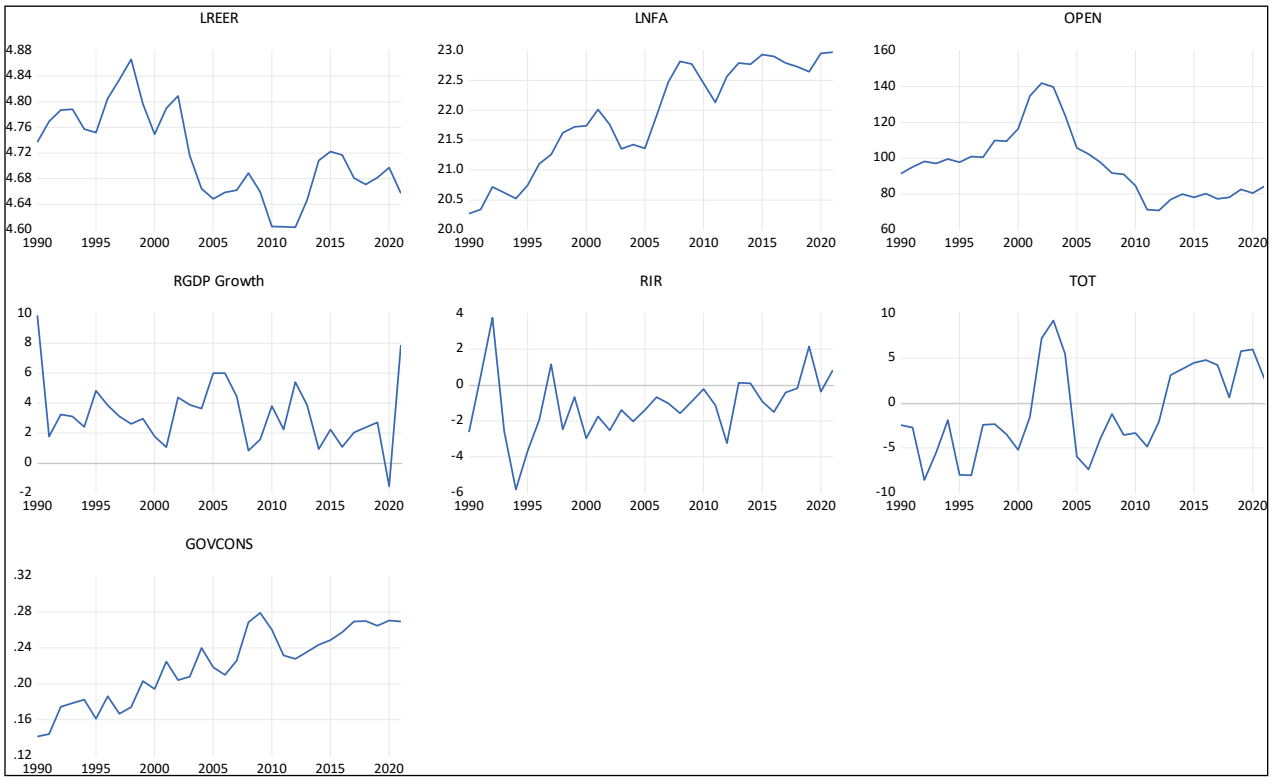
prices and then divide the product by domestic prices. The approach is like the description in equation 2(a) and 2(b).

5. Empirical Analysis

5.1 Data Analysis

Figure 2 shows the graphical presentation of the variables used in the study. The log of REER (LREER), log of Net Foreign Assets (NFA), openness to trade (OPEN), government consumption (GOVCONS) and terms of trade (TOT) appear to be non-stationary with an intercept and a trend whilst), real GDP growth (RGDP Growth) and real interest rate (RIR) appear to be stationary at levels with an intercept.

Figure 2: Graphical Presentation of Variables



The study used the Augmented Dicky Fuller (ADF) test and the Phillips-Perron test to determine the stationarity of the variables and the results are presented on Table 1.

The ADF test results indicate that the log of REER, the log of NFA, openness to trade (Open), and government consumption expenditure (GOVCONS) are integrated of order 1 whilst real GDP growth (RGDP), real interest rate differential (RIR) and terms of trade (TOT) are integrated of order 0. The Philips-Perron test results indicate that all the variable are integrated of order one except for the RIR which is integrated of order zero.

Table 1: Stationarity Test Results

	ADF Test			**Philips- Perron Test**		
Variable	**Level**	**1st Difference**	**Order of Integration**	**Level**	**1st Difference**	**Order of Integration**
LREER	-2.911	-5.174***	I(1)	-2.263	-5.191***	I(1)
LNFA	-3.472	-4.067***	I(1)	-1.974	-4.084**	I(1)
GOVCONS	-3.365	-3.754***	I(1)	-3.203	-14.196***	I(1)
OPEN	- 1.680	- 3.139**	I(1)	-1.861	-3.207**	I(1)
RGDP	-6.452***	-7.681174***	I(0)	-6.452***	-11.034**	I(0)
RIR	-4.201***	-7.056***	I(0)	-4.122***	-11.254***	I(0)
TOT	-3.053837**	-5.957369***	I(0)	-2.456	-6.664***	I(1)

NB: ***, ** and * indicates significance at 1%, 5% and 10%, respectively.

The Akaike Information Criterion (AIC) was used to determine the appropriate lag length within the ARDL model in eviews 11. The order of the ARDL model was selected to be (1,2,2,0,2,2,2) with maximum number of lags automatically set to be 2 lags.

5.2 ARDL Model Results

5.2.1 Diagnostic Tests

Table 2 presents the diagnostic tests for the model. The LM Test for serial correlation was insignificant indicating the absence of serial correlation and there was no heteroskedasticity as the Breusch-Pagan-Godfrey test was also insignificant. The Jarque Bera test was also statistically insignificant indicating that the residuals are normally distributed.

Table 2: Diagnostic Test Results

Test	F-Statistic	Prob
LM Test	1.8513	0.2263
Breusch-Pagan-Godfrey	0.6328	0.8117
Jarque Bera	1.1811	0.5540

5.2.2 Bounds Test Results

The Bounds test results are presented on Table 3 and the F-statistic is higher than the critical upper bound at 1 per cent level indicating the presence of cointegration. The study therefore rejects the null hypothesis of no cointegration.

Table 3: Bounds Tests Results for Cointegration

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	12.90335	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99
			Finite Sample:	
Actual Sample Size	30		n=30	
		10%	2.334	3.515
		5%	2.794	4.148
		1%	3.976	5.691

5.2.3 ARDL Model Long-run Results

Table 4 presents the long-run results of the ARDL model. The results indicate that government consumption expenditure (per cent of GDP), real gross domestic product growth (RGDP), trade openness (OPEN), terms of trade (TOT) and the interest rate differential (RIR) have a significant impact on Eswatini's REER. More specifically the coefficient for government consumption expenditure (GOVCONS) is statistically significant with a negative sign (P<0.01), which indicates that an increase in government consumption expenditure increases the demand for domestic goods, resulting in REER appreciation. In terms of literature this holds if a bigger portion of the expenditure is on non-tradables. Real GDP growth (RGDP) also has a negative effect (P<0.01) on the REER in the long-run which also results in the appreciation of the REER. The real interest rate differential (RIR) between Eswatini and South Africa also has a negative impact on the country's REER which indicates that an increase in Eswatini interest compared to South Africa leads to an appreciation. On the contrary, from the country's relative price perspective, the terms of trade (TOT) is found to impact the REER positively (P<0.01). This shows that the real effective exchange rate depreciates with an improvement in the country's terms of trade. This result could be true since Eswatini is a net-importer hence there is a substitution effect. Trade openness (OPEN) and net foreign assets (LNFA) were found to be insignificant determinants of Eswatini's real effective exchange rate.

Table 4: ARDL Long-run Coefficient Estimates

Dependent Variable: LREER				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFA	-0.020352	0.017920	-1.135711	0.2854
GOVCONS	-1.824333	0.382730	-4.766636	0.0010***
OPEN	0.000113	0.000268	0.422712	0.6824
RGDP	-0.035458	0.005789	-6.124772	0.0002***

RIR	-0.019980	0.006296	-3.173760	0.0113***
TOT	0.010358	0.001875	5.522841	0.0004***
C	5.636631	0.334829	16.83433	0.0000***

NB: *** indicates significance at 1% level.

5.2.4 ARDL Model Short-run Results

Table 5 below shows the short-run results of the ARDL model. The results indicate that net foreign assets (NFA), government consumption (GOVCONS), GDP growth (RGDP), real interest rate differential (RIR) and terms of trade (TOT) have a significant effect on REER in the short-run. The error correction term was negative and statistically significant (P<0.01), indicating that about 80.0 per cent of deviation from the long-run path is corrected in each year.

Table 5: ARDL Short-run Coefficient Estimates

Dependent Variable: D(LREER)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNFA)	-0.050955	0.013169	-3.869451	0.0038***
D(LNFA(-1))	0.144699	0.014215	10.17932	0.0000***
D(GOVCONS)	-1.566829	0.147218	-10.64288	0.0000***
D(GOVCONS (-1))	-0.984309	0.178587	-5.511644	0.0004***
D(RGDP)	-0.018119	0.001393	-13.01148	0.0000***
D(RGDP (-1))	-0.008217	0.001350	-6.087009	0.0002***
D(RIR)	-0.003408	0.001059	-3.218963	0.0105***
D(RIR(-1))	0.004779	0.001018	4.694618	0.0011***
D(TOT)	0.006688	0.000634	10.54434	0.0000***
D(TOT(-1))	-0.008835	0.000834	-10.59926	0.0000***
DUM2008	0.029411	0.011836	2.484895	0.0347**
DUM98	0.091939	0.014529	6.328063	0.0001***
DUM2018	0.048159	0.008749	5.504360	0.0004***
CointEq(-1)*	-0.800280	0.059075	-13.54675	0.0000***
R-squared	0.962426	Mean dependent var		-0.003754
Adjusted R-squared	0.931897	S.D. dependent var		0.037228
S.E. of regression	0.009715	Akaike info criterion		-6.125516
Sum squared resid	0.001510	Schwarz criterion		-5.471624
Log likelihood	105.8827	Hannan-Quinn criter.		-5.916330
Durbin-Watson stat	2.528964			

NB: *** and ** indicates significance at 1% level and 5%, respectively.

5.3 Computed REER Misalignment Levels

The main objective of estimating the BEER for the REER measure was to assess the level of misalignment. Similar to CBK (2019), the study started by estimating an ARDL model and obtained the coefficients which were used to determine the equilibrium REER. To obtain the long-run misalignment, the study used the Hodrick-Prescott (HP) filter to determine the long-run or equilibrium estimates of the fundamental determinants. The HP filtered fundamentals were then substituted in the estimated model to obtained fitted values of the equilibrium REER.

Figure 4 shows the computed misalignment in percentage form whilst Figure 5 plots the actual REER against equilibrium REER. The results indicate that the real exchange rate was overvalued and overvalued over the period under review but on average the exchange rate was overvalued by a marginal 0.1 per cent. Despite the marginal overvaluation, the computed series depicts high volatility over the period with wide variations in some years. Over this period the study identifies 15 periods of undervaluation with an average of 2.89 per cent and 17 periods of overvaluation with an average of -2.74 per cent. Periods of high undervaluation were observed in 1997-1998, 2002 and 2014-2016 whilst high overvaluations were observed in 1994-1995, 2004-2005 and 2010-2012.

In terms of trends, the misalignment results are similar to Khomo & Aziakpono (2020) who conducted a similar study in South Africa which is Eswatini's anchor economy under the CMA arrangement. This, in part, could be due to the country's very strong trade relations with South Africa. While the study finds that the REER was overvalued in 2018 by 1.0 per cent, the IMF's estimates present a contrary view, indicating that

the country's REER was undervalued by 23.16 per cent[13]. This is possibly because of the choice of variables used by the IMF and the methodology.

Figure 4: Exchange Rate Misalignment

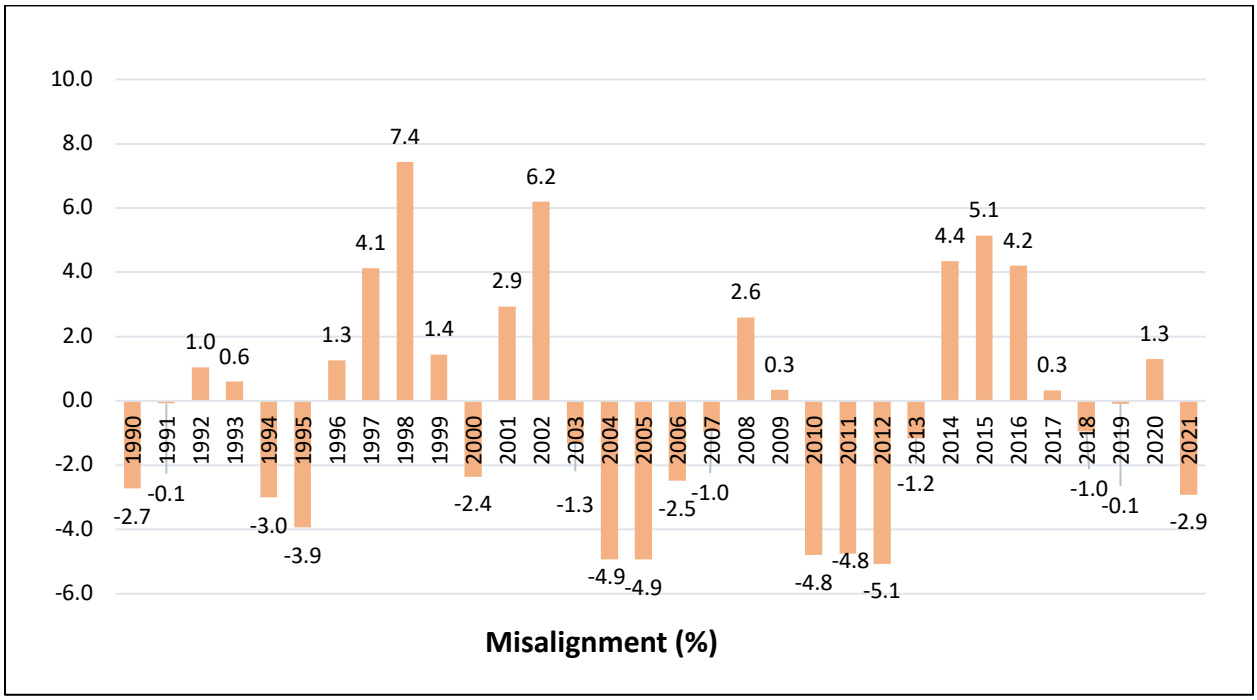
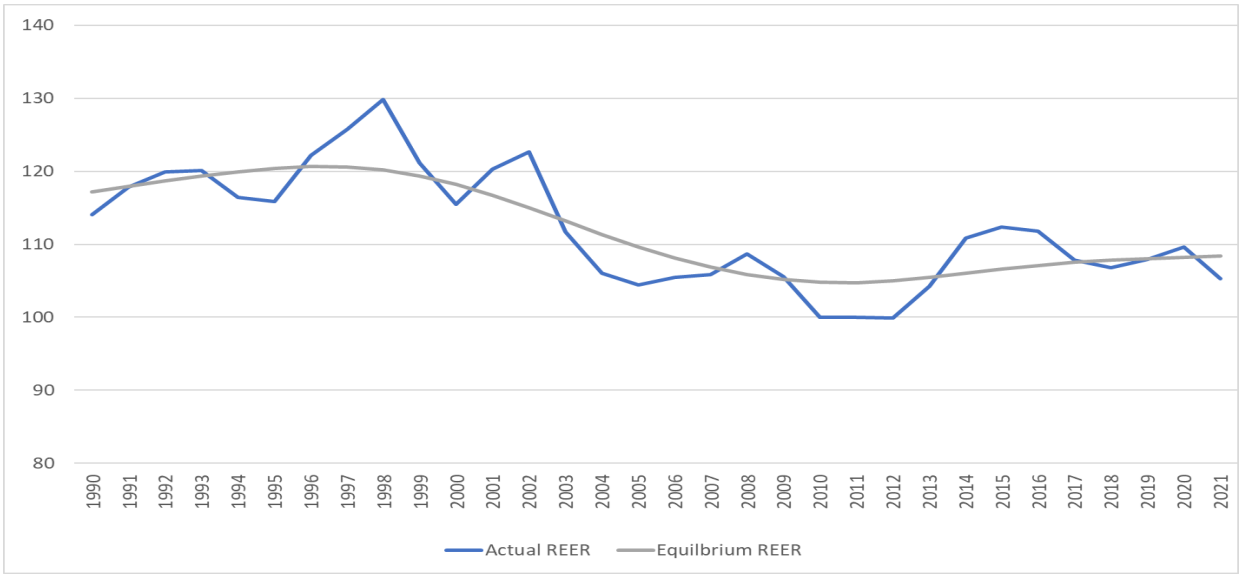


Figure 5: Actual REER versus Equilibrium REER



[13] Latest IMF Kingdom of Eswatini 2019 Article IV Consultation

5.4 The Empirical Link Between REER Misalignment and Monetary Policy

The study uses an Ordinary Least Squares (OLS) to determine the link between REER misalignment and monetary policy. The OLS model equation is specified as follows;

$$Misalignment_{REER} = C + \alpha_1 RIR + e \quad \text{.....(8)}$$

Where; misalignment$_{REER}$ is the per cent deviation from long-run REER equilibrium and RIR is the real interest rate which is calculated as the 91 days T-bill rate which is a proxy for monetary policy minus inflation. c is the constant, α_1 is the coefficient and e is the error term.

The study uses the ADF test to determine the stationarity of misalignment and the T-bill rate, and the results indicate that both variables are stationary at levels. The study therefore goes on to estimate an OLS model to determine the relationship between misalignment and the interest rate.

Table 6: Stationarity Test results

	ADF Test		
Variable	**Level**	**1st Difference**	**Order of Integration**
Misalignment	-4.732***	-5.810***	I(0)
RIR	-4.173**	-5.102***	I(0)

NB: ** and *** denote significant at 5% and 1%, respectively.

Table 7 presents the diagnostic tests for the OLS model. The LM Test for serial correlation was insignificant indicating the absence of serial correlation and there was no heteroskedasticity as the Breusch-Pagan-Godfrey test was also insignificant. The Jarque Bera test was also statistically insignificant indicating that the residuals are normally distributed.

Table 7: Diagnostic Test Results

Test	F-Statistic	Prob
LM Test	0.018	0.982
Breusch-Pagan-Godfrey	0.522	0.786
Jarque Bera	4.830	0.183

The OLS results are presented on Table 8 below. The study included lags of the dependent variables to address autocorrelation. The results indicate a weak significance level of the real interest (RIR) (P<0.10). A 1 per cent increase in policy rate would decrease (correct) misalignment by 0.39 per cent. The results further indicate that misalignment has an inertia effect. A 1 per cent increase in misalignment lagged once would increase current misalignment by 0.94 per cent whiles a one per cent increase in misalignment lagged twice would reduce misalignment by 0.51 per cent.

Table 8: REER Misalignment and Monetary Policy

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIR (-1)	0.311703	0.188525	1.653377	0.1118
RIR (-2)	-0.392822	0.204651	-1.919467	0.0674
MISALIGNMENT(-1)	0.949285	0.161683	5.871287	0.0000
MISALIGNMENT(-2)	-0.507059	0.144037	-3.520348	0.0018
DUM2003	-6.151831	2.652244	-2.319482	0.0296
DUM2010	-4.600783	2.448254	-1.879210	0.0729
C	0.330571	0.538057	0.614381	0.5450
R-squared	**0.668589**	**Mean dependent var**		**-0.012776**
Adjusted R-squared	**0.582133**	**S.D. dependent var**		**3.551278**
S.E. of regression	**2.295639**	**Akaike info criterion**		**4.700863**
Sum squared resid	**121.2090**	**Schwarz criterion**		**5.027809**
Log likelihood	**-63.51294**	**Hannan-Quinn criter.**		**4.805456**
F-statistic	**7.733357**	**Durbin-Watson stat**		**1.943323**
Prob(F-statistic)	**0.000124**			

In testing for long run cointegration among the variables, we use the Engle and Granger (1987) test. From the residuals derived from the long run model we use the

ADF test to determine whether the residuals are integrated of order zero or not. As shown in Table 9 the residuals are integrated of order zero, hence there exists a cointegrating or long-run relationship between the variables.

Table 9: REER Misalignment and Monetary Policy Cointegration

	ADF Test - Level			
Variable	**Constant**	**Constant & Trend**	**Trend**	**Order of Integration**
Resid_Misalignment	-5.103***	-5.028 ***	-5.197***	I(0)

6. Conclusion And Policy Recomendations

This study sought to determine reliable estimates of the equilibrium real effective exchange rate and the misalignment in Eswatini. In this study, the misalignment is estimated by calculating the gap between the actual REER and its equilibrium value and it is expressed in percentages. The estimation of the equilibrium REER has been carried out using the BEER approach through an ARDL model using annual data spanning from 1990 to 2021. The results revealed that in the long-run, government consumption expenditure, real GDP growth, real interest rate differential and the terms of trade have a significant effect on the country's real effective exchange rate and carried the correct signs. Net foreign assets and openness to trade had the correct signs but were insignificant. Generally, the estimated long run parameters of the real effective exchange rate were found to be in line with the theoretical expectations.

In terms of misalignment, the results revealed multiple phases of overvaluation and undervaluation with an average of a marginal 0.1 per cent overvaluation, suggesting

that the country's exchange rate has been largely consistent with the economic fundamentals. The significance of the real interest rate differential indicates that the monetary policy authorities in Eswatini can influence the real effective exchange rate and keep it closer to its equilibrium level, albeit to a limited extent. The results also revealed the high influence of government of government consumption expenditure on the REER, indicating that fiscal policy adjustment can help towards keeping the REER closer to its long-run path.

The study further run an OLS model to determine the relationship between monetary policy and REER misalignment. The results indicate that misalignment lagged once has an inertia effect whiles misalignment lagged twice has a corrective (negative) effect on current misalignment. Real interest rate lagged twice has a corrective (negative) significant effect on misalignment but was weekly significant. The weak significance of the real interest rate indicates the limited ability of monetary policy authorities in influencing the REER towards its equilibrium, given the CMA arrangement in which South Africa is the economy. Despite the weak significance on monetary policy in influencing the misalignment, the study recommends that the Bank should monitor the country's REER against its equilibrium.

References

Adler K. and Grisse C. (2017). Thousands of BEERs: Take your pick. *Review of International Economics*, 25(5): 1078-1104

Ajevskis V., Rimgailaite R., Rutkaste U. and Tkačevs O. (2014). The equilibrium real exchange rate: pros and cons of different approaches with application to Latvia. *Baltic Journal of Economics*, 14:1-2, 101-123

Asfaha S.G. and Huda S.N. (2002). Exchange Rate Misalignment and International Trade Competitiveness: A Cointegration Analysis for South Africa, A Paper Presented at the TIPS Annual Forum at Glenburn Lodge, Muldersdrift.

Boughton J. M. (1988). The Monetary Approach to Exchange Rates: What Now Remains? Essays in International Finance, No 171. Department of Economics, Princeton University

Bosupeng M., Dzator J. and Nadolny A. (2019). Exchange Rate Misalignment and Capital Flight from Botswana: A Cointegration Approach with Risk Thresholds. *Journal of Risk and Financial Management*, 12(101): 1-26.

Brahim M., Nefzi N. and Sambo H. (2018). Do Remittances Impact the Equilibrium Real Exchange Rate? The Case of MENA Countries. *Revue D'Economies DU Development*, 26 (3): 65-119.

Brunetti A., Kisinunko G. and Weder B. (1997). Institutional Obstacles to Doing Business: Region-by-Region Results from a Worldwide Survey of the Private Sector. Policy Research Working Paper, No. 1759, the World Bank.

CBE (2017). Monetary Policy Framework. Central Bank of Eswatini, Mbabane, Eswatini.

CBK (2019). An Assessment of Exchange Rate Misalignment in Kenya. Central Bank of Kenya.

Chansa F. (2019). Exchange Rate Misalignment in Zambia: A Behavioral Equilibrium Exchange Rate Approach. Bank of Zambia, WP/2019/2.

Coppola A., Lagerborg A. and Mustafaoglu Z. (2016). Estimating an Equilibrium Exchange Rate for the Argentine Peso. Policy Research Work Paper 7682, World Bank Group.

Coudert V. and Couharde C. (2009). Currency Misalignments and Exchange Rate Regimes in Emerging and Developing Countries. *Rev Int Econ*; 17(1):121–36.

Coudert V., Couharde C. and Mignon V. (2013). On Currency Misalignments within the Euro Area. *Rev Int Econ*; 21(1): 35-48.

Dubas J. M. (2009). The Importance of the Exchange Rate Regime in Limiting Misalignment. *World Dev*; 37(10): 1612–22.

Egert B. (2004). Assessing Equilibrium Exchange Rates in CEE Acceding Countries: Can We Have DEER with BEER without FEER? A Critical Survey of the Literature. BOFIT Discussion Paper No. 1.

Elbadawi I., Kaltani L. and Soto R. (2012). Aid, Real Exchange Rate Misalignment, and Economic Growth in Sub-Saharan Africa. *World Development*; 40(4), 681–700.

Fiaz A., Khurshid N., Satti A., Malik, M. S. and Malik W. (2021). Real Exchange Rate Misalignment in Pakistan: An Application of Regime Switching Model. *The Journal of Asian Finance, Economics and Business*; 8(12): 63–73.

Gouider A. and Ridha N. (2014). Relationship Between the Misalignment of the Real Exchange Rate and Capital Flight in Developing Countries. *Theoretical and Applied Economics*, 11: 121-140

Holtemoller O., and Mallick S. (2013). Exchange Rate Regime, Real Misalignment and Currency Crises. *Economic Modelling*; 34: 5–14

Hossain A. A. (2011). Exchange Rate Policy and Real Exchange Rate Behaviour in Bangladesh: 1972–2008. *Indian Economic Review*, 46: 191–216

Hristov K. (2002). Fundamental Equilibrium Exchange Rates and Currency Boards: Evidence from Argentina and Estonia in the 90s. Bulgarian National Bank.

IMF (2020). Kingdom of Eswatini 2019 Article IV Consultation. IMF Country Report No. 20/41

Jager S. (2012). Modelling South Africa's Equilibrium Real Effective Exchange Rate: A VECM Approach. South African Reserve Bank Working Paper, WP/12/02.

Jongwanich J. (2009). Equilibrium Real Exchange Rate, Misalignment, and Export Performance in Developing Asia. ADB Economic Working Papers Series No. 151

Juana S. J., Moaisi K. S. and Narayana N. (2015). Estimating the Determinants of Equilibrium Exchange Rate in Botswana. *Asian-African of Economic and Econometrics*, 15 (2): 147-161

Kiptui M. C. and Ndirangu L. (2015). Determinants of Equilibrium Real Exchange Rate and its Misalignment in Kenya: A Behavioral Equilibrium Exchange Rate Approach. Munich Personal RePEc Archive

Khomo M. M. & Aziakpono M. J. (2020). The Behaviour of the Real Effective Exchange Rate of South Africa: Is there a Misalignment? *Cogent Economics & Finance*, 8:1-16.

Loewald C. (2012). Modelling South Africa's Equilibrium Real Effective Exchange Rate: A VECM Approach. South Africa Reserve Bank.

MacDonald R. (2000). Concepts to Calculate Equilibrium Exchange Rates: An Overview, Discussion Paper No. 3/00. Deutsche Bundesbank.

MacDonald R. (2002). Modelling the Long-Run Real Effective Exchange Rate of the New Zealand Dollar. *Australian Economic Papers*, 519-537

MacDonald R. and Ricci L. (2003). Estimation of the Equilibrium Real Exchange Rate for South Africa. International Monetary Fund, WO/03/44

Njindan L. B. and Odhiambo N. M. (2015). "The Determinants of Long-run Real Exchange Rate in South Africa: A Fundamental Equilibrium Approach". *Global Economy Journal*, *15(3): 319-336*.

Pesaran M. H. and Shin Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. Department of Applied Economics, University of Cambridge, England.

Pesaran M. H., Shin Y. and Smith R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics,* 16: 289–326

Qayyum A., Khan M.A., Khair-u-Zaman and Saqib O. F. (2005). Exchange Rate Misalignment in Pakistan: Evidence from Purchasing Power Parity Theory. *The Pakistan Development Review*, 43(4): 721-735.

Siregar R. Y. (2011). The Concepts of Equilibrium Exchange Rate: A survey of Literature. The South East Asian Central Banks (SEACEN) Research Centre, Kuala Lumpur, Malaysia.

Tensay T. M. (2006). Measuring the Real Exchange Rate Misalignment of Ethiopia: A Dynamic OLS Approach. *Ethiopian Journal of Economics*, XV(2): 29-49

Vdovychenko A. (2021). Empirical estimation of REER trend for Ukraine. IHEID Working Papers 06-2021, Economics Section, The Graduate Institute of International Studies.

Williamson J. (1983). The Exchange Rate System. Institute for International Economics, Washington D.C.