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# **Modeling and Forecasting the Malawi Kwacha-US Dollar Nominal Exchange Rate**

Kisu Simwaka

25 May 2007

Online at <https://mpra.ub.uni-muenchen.de/3327/>

MPRA Paper No. 3327, posted 26 May 2007

# Modeling and Forecasting the Malawi Kwacha-US Dollar Nominal Exchange Rate

By

Kisu Simwaka \*

Research & Statistics Department

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## Abstract

This study develops a blended version of the monetary and portfolio models for the MK/USD exchange rate, and assesses the forecasting performance of the model against a simple random walk. The results indicate that the model performs better than the simple random walk on the 6, 12 and 24 months forecasting horizons. However, the model does not perform well on the 3-month horizon, which is supported by theory suggesting that exchange rate movements are not driven by fundamentals in the short term.

We also add a variable drift term to the random walk process and compare its performance against both the simple random walk and the fundamental model. The results show that random walk (with a variable drift) performs better than the other models in out-of-sample process at both short term and long term horizons. This result suggests that this (the random walk with a drift) process might be the best tool for exchange rate forecasting on all the forecast horizons. When it comes to exchange rate forecasting in the long term, a fundamental model might still be the best alternative.

Regarding the structural model (with fundamental determinants of nominal exchange rate), the empirical results indicate that a worsening current account balance and decreases in net external flows result the depreciation of exchange rates. This is in line with practical experience.

On the other hand, higher domestic interest rates have an insignificant impact on exchange rate. In an economy with several structural bottlenecks and poor infrastructural services, high interest rates cannot be expected to induce capital flows. A rise in domestic inflation is associated with a depreciated exchange rate. Lastly, consistent with theoretical expectations, another significant finding is that an easing in monetary policy (increase in money supply growth) is associated with a depreciation of the exchange rate.

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\* The author is a Senior Economist in the Research and Statistics Department of the Reserve Bank of Malawi. The views expressed in this paper are those of the author and not necessarily of the Reserve Bank of Malawi. Author's Email address: [ksimwaka@rbm.mw](mailto:ksimwaka@rbm.mw)

These findings lead us to make the following conclusions. Developments in the current account balance have implications on the exchange rate market. Measures aimed at improving the current account position, for example through exports, are also instrumental in stabilizing the exchange rate – through appreciation. Considering that Malawi has been traditionally depending on tobacco as its chief foreign exchange earner, and taking into account the anti-smoking campaign militating against the crop amidst low prices, it is imperative that Malawi should diversify into other foreign exchange earner (for instance tourism) in order to ensure macroeconomic stability, which itself is a pre-requisite for economic growth and therefore poverty reduction. Thus, policies that influence exports and imports of goods and services also determine exchange rate movements. Likewise, prospects concerning funding for a donor aid dependent economy like ours may influence the direction of market forces in determining the exchange rate movements. Big swings in external funding could cause instability. Therefore, government's credibility regarding the use of external public funds and implementation of related reforms is important in as far as stability of the foreign exchange market and overall macroeconomic stability are concerned.

The insignificant impact of higher domestic interest on attracting capital flows calls for the need for government to address some structural bottlenecks. For instance, infrastructure services such road network and utilities (electricity and water supply) require improvement. Otherwise, currently, Malawi needs lower interest rates in order to reduce the cost of credit necessary for private sector development.

The general picture from the results is that developments in the external sector of the economy, which are not under the ambit of domestic authorities, probably contributed more to fluctuations of the Malawi kwacha. If indeed the above diagnosis is accurate, the policy implications of government's ability in influencing the behavior of the exchange rate is limited. This is because the ability of a small economy like that of Malawi to fully insulate itself from external shocks is constrained. It will mainly be confined to limiting the contributions of inconsistencies in domestic policy and administering some confidence building measures, at least in the short-term-to medium term

It is worthy to note that divergent opinions exist as to the usefulness of devaluation (or depreciation) as a policy tool. There are those that believe devaluation as a policy tool can boost exports and so create jobs. It should be noted however that since the kwacha was floated in 1994, it has been on a depreciating trend almost continuously without corresponding gains from the export sector. Without losing sight of the interest of exporters, it should be noted that a depreciated kwacha has implications in terms of increased import expenditures (oil import bill), government debt service, domestic inflation and cost of imported intermediate inputs. In the short term, what we should strive as a nation is to have a stable Malawi kwacha exchange rate. In the long run, the viable option is in ensuring a competitive export market is increased productivity among exporting firms. This may include export diversification and implementing measures to limit market imperfections.

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## **1. Introduction**

Given the small and import dependent nature of the Malawi economy, exchange rate is undistiputably one of the most important macroeconomic variable. Movements in exchange rate have significant pass-through effects to consumer prices. The Malawi kwacha has depreciated almost continuously since it was floated in February 1994. This movement in the exchange rate has left analysts, policy makers and exchange market agents disturbed. The stability of the nominal exchange rate plays a significant role in the successful performance of the economy.

One of the key issues dominating literature is whether exchange rates can be predicted. The low ability to predict exchange rate movements appears to reveal a huge need for further research on the issue. Understanding the forecasting of exchange rate behaviour is important to monetary policy. More importantly, because of the thinness and volatility of the foreign exchange market, the policy makers focus on the information content of the short-term picture. That is, while the medium to long-term outlook is important, policy makers are also concerned about exchange rate movements in the very short run in deciding intervention policy. Despite the compelling facts, little has been done to understand the dynamism and identify those major economic fundamentals that drive the movement of the kwacha. This paper attempts to fill this gap. This paper thus attempts to estimate and forecast the Malawi kwacha-US dollar nominal exchange rate model using the Johansen (1988) cointegration technique. This will help in identifying the sources of nominal exchange rate fluctuations and also help in making short run forecasts for the exchange rate. The nominal exchange rate is of interest as it is more visible and therefore practical to the ordinary public than the real exchange rate.

The subsections immediately following provide background to the study and evolution of exchange rate policy in Malawi. Section 3 provides a brief review of literature. Section 4 provides the analytical methodology while section 5 provides the empirical results. The conclusion in section 6 summarizes the policy lessons and options.

## **2.0 Exchange Rate Policy in Malawi**

### **2.1 Evolution of the Exchange Rate**

Malawi's exchange rate<sup>1</sup> has evolved over time responding to the economic circumstances that have prevailed at particular times. The management of the exchange rate in Malawi has been pursued with three major policy objectives in mind. These are:

- i. Maintenance of a sustainable balance of payments position
- ii. attainment of stable domestic prices
- iii. Attainment of growth in real income

We periodize exchange rate developments as follows;

#### ***2.1.1 1965 to January 1973***

From 1965 to January 1973, Malawi operated within the sterling zone with the Malawi pound, later changed to Malawi kwacha in 1971, pegged at par to the British pound sterling. In November 1967, the British sterling was devalued by 14 percent and the Malawi pound followed suit by the same magnitude. During the same period the economy grew impressively and the balance of payments position was remarkable.

With the collapse of the gold standard par value system the major currencies, the British sterling included, in the currency market became very volatile as these currencies shifted from pegging to the gold to a generalized floating system. From November 1973 to June 1975, the Malawi kwacha was pegged to a trade weighted basket of the Pound and the US dollar. The Reserve Bank took an active exchange rate policy with announcements of devaluations and setting the daily buying and selling rates of the US dollar and the British pound sterling.

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<sup>1</sup> This passage relies heavily on material from the RBM website

### **2.1.2      *June 1975 to 1984***

There were persistent fluctuations in the two currencies, leading to authorities seeking a more permanent peg and the kwacha was pegged to the SDR in June 1975 until 1984. This allowed the kwacha some measure of stability until early 1980s when the SDR started appreciating rapidly in tandem with appreciation of the dollar, forcing authorities to devalue the local currency against the SDR by 15 and 12 percent on 24 April 1982 and 17 September 1983, respectively. The situation was exacerbated by external and internal shocks that rocked the Malawi economy, further worsening the country's terms of trade. Because of the continued appreciation of the SDR, and the fact that the SDR did not properly represent the currencies of Malawi's trading partners, the authorities decided to add the South African rand to the SDR basket in January 1984. Following this peg, the main thrust was to maintain external competitiveness by ensuring that real exchange rate (RER) was not appreciating. This was achieved by periodic devaluations of the kwacha especially that the rate of inflation in Malawi remained higher than that of trading partners' currencies such as South Africa, Zimbabwe and Zambia and also due unfavourable movements in relative prices.

### **2.1.3      *January 1984 to February 1994***

From January 1984 through to February 1994, in an effort to recover from the worsening balance of payments position, the authorities pegged the kwacha to a trade weighted basket of seven currencies. The signs of recovery were manifested by improvements in the balance of payments position from -11.8 percent of GDP in 1983 to -1.7 percent in 1984, but these were short-lived as increased transportation costs led to further deterioration in terms of trade. This resulted in authorities taking a series of active exchange rate policy stance. On April 2, 1984, the kwacha was devalued by 15 percent, followed by further devaluations by 10 percent on August 16, 1986, 20 percent on February 7, 1987; 15 percent on January 16, 1988; 7 percent on March 24, 1990; 15 percent on 28 March 1992; and further 22 percent on July 11, 1992. Progressively, it became apparent that the exchange rate was becoming heavily

politicized, with each devaluation becoming subject of intense speculation within the private sector. That led to weakening the level of confidence in the exchange system, and consequently a marked slowdown in repatriation of export proceeds. The situation was worsened by the cut in non-humanitarian assistance by bilateral donors and suspension of balance of payments support in 1992 because of governance issues.

#### ***2.1.4 The Floatation of the kwacha***

In February 1994 Malawi adopted a managed float exchange rate regime. This was aimed at resolving the foreign exchange crisis that had hit the country due to suspension of balance of payments support from donors, and the lagged effects of the 1992/93 drought. The switch from the fixed regime to the floating one was meant to achieve certain objectives which can be summed up as:

- i. Improvement of the country's export competitiveness,
- ii. Provision of an efficient foreign exchange allocation mechanism
- iii. Dampen speculative attacks on the Kwacha. Prior to the floatation, devaluations had become more frequent and very predictable thereby making the whole system very unstable.
- iv. Restoration of investor and donor confidence. The country's foreign reserves had dwindled to such low levels that it was difficult to do business with the rest of the world.

As a step towards market determination of the exchange rate, the monetary authorities authorized creation of a foreign exchange market administered by the RBM where weekly auctions of the foreign exchange market would take place. Buyers of the foreign exchange would bid through the commercial banks the price at which they wanted to buy a certain amount of foreign exchange. In the same way, sellers would determine their selling price and amounts. Successful bidders would then pay their bidding prices and not the clearing rate. This, therefore, was adoption of a managed float exchange rate regime. Consequently, the exchange rate of the Kwacha against the US dollar depreciated from around K4.5 to over K17 during the period February to September 1994.



### ***2.1.5 1995 to 1998***

During the period 1995-97 the exchange rate fluctuated within a very narrow fixed band and accordingly foreign reserves were used to support the exchange rate. The main objective of attaining low inflation rates was achieved towards the end of 1997 but at the expense of huge foreign exchange reserves and high interest rates, which were used to support the exchange rate. Consequently, the real exchange rate appreciated and had a negative impact on the current account balance. In other words the current account imbalance that emerged during the period of fixed exchange rates was being covered by a run down of reserves.

After achieving the inflation objective during 1997, the target of the monetary authorities was then to revive the lost competitiveness within a reasonable period of time. It soon became clear that the narrow band had to be abandoned in favour of an unannounced crawling peg. During this period, the authorities were not committed to defend the currency thus the central parity rate was adjusted every time the maximum level (i.e. the upper limit of the band) was reached. Thus between 1997 and 1998 the exchange rate moved from around K15 to K38 to the US dollar.

### ***2.1.6 1998 to 2003***

This adjustment in the exchange rate brought back some competitiveness in the country's foreign trade. Consequently, the system was abandoned towards the end of 1998 and the exchange rate started operating in a more market fashion – i.e. the 'free-floating' system. This system saw Authorized Dealer Banks taking a more active role in determining the path for the Kwacha. Consequently, and in part owing to the heavy depreciation of the kwacha in August, 1998, the kwacha dropped against the dollar by over 100.0 percent between January and December of that year. Developments in the exchange rates during 1999 reflected several factors, first ample supply of foreign exchange made possible by a health tobacco season which contributed to the relative stability of the currency. Second, mid-way, into the year, speculation about another possible devaluation of the kwacha died down, enabling the currency to remain

relatively stable. Third, the donor inflows, though lower than expected, also contributed much to the stability of the kwacha as these supported the foreign exchange reserve position. Finally, the recovery in the countries affected by the Asian crisis also helped achieve stability in the exchange rate as currencies of major trading partners stabilized. Notwithstanding these positive developments, the kwacha also came under pressure as the inflation differential between Malawi and her trading partners increased. In addition, the seasonal increase in demand for foreign exchange towards the end of the year also exerted a downward pressure on the currency. Reflecting these developments, the external value of the Malawi kwacha dropped by 6.5 percent against the US dollar between January and December, 1999. In 1999, the kwacha also depreciated by 4.1 percent against the British pound and 17.4 percent against the Japanese yen. Over the same period, the kwacha appreciated in relation to the Euro, largely owing to the latter's weakening vis-à-vis other currencies. The external value of the kwacha weakened substantially in 2000 particularly starting the second quarter of the year. Several factors accounted for this development, both external and domestic. On the international scene, one of the factors is the growth in the US economy which resulted into strengthening of the US dollar against all major currencies. Subsequently, the Malawi kwacha weakened in attempt to maintain its competitiveness. On the domestic front, the collapse of tobacco prices at the auction floors had an adverse impact on the country's reserve position. This together with the hoarding of foreign currency by some exporters and non-receipt of pledged donor support led to scarcity of foreign exchange on the market thereby putting pressure on the kwacha. Thus by end December, 2000, the external nominal value of the kwacha weakened by about 38.0 percent from the value observed at the end of 1999.

The free-float system, is perhaps remembered by the first ever appreciation of the Kwacha in 2001. Receipt of some donor inflows at the beginning of 2001 coupled with relatively higher average tobacco prices at the auction floor meant a favourable healthy foreign exchange position and this helped to dampen any speculative attacks on the kwacha. The kwacha consequently managed to firm up against most of other currencies. Similarly, the kwacha gained 18.3 percent, 19.9 percent and 26.6 percent against the British Pound, the Euro and Japanese Yen, respectively to reach K97.64

per pound, K59.56 per euro and K0.51 per yen. Thus at the end of 2001, the kwacha contrary to most speculative sentiments, settled at a modest K67.29 per US dollar when viewed against the rate of K80.08 per US dollar at the end of 2000.

A short period of exchange rate instability followed. In 2002, developments on both the local and international scene adversely affected the nominal value of the Malawi kwacha against the currencies of other trading partners. On the domestic market, despite improved receipts of from tobacco sales as compared to 2001, low donor inflows impacted negatively on the country's reserve position. On the international scene, the United States economy performed below its projected growth with significant drop in the second quarter of year. As a result, the dollar weakened against other hard currencies, notably the Euro and the British pound. Consequently, by the end of December 2002, the Malawi kwacha had shed 29.5 percent against the US dollar to close the year at K87.14 per dollar. Similarly the kwacha weakened against the Euro and the Japanese yen by 53.4 percent and 43.3 percent to K91.36 per euro and K0.70 per yen, respectively. Against the British pound, the kwacha slid to K139.73 per pound from K97.64 per pound as at end December 2001.

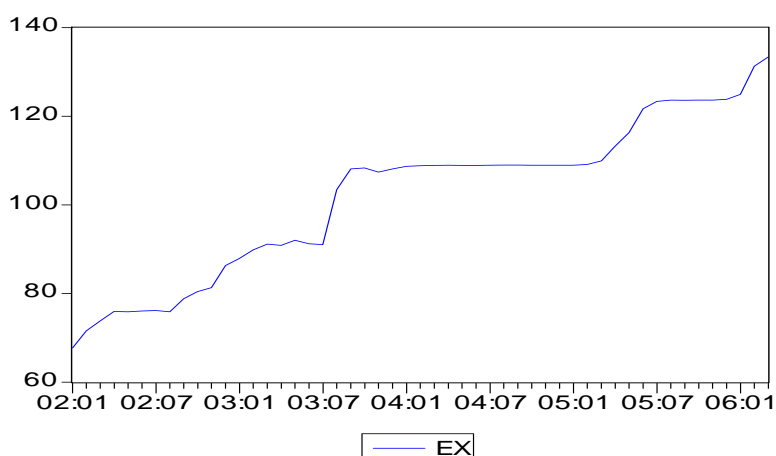
#### ***2.1.7 2003 to 2005***

A policy decision was taken in August 2003 to stabilize the Kwacha at a rate of K108 against the United States dollar. The decision was in response to serious economic disequilibrium or instability following the suspension of the first IMF PRGF and the resultant droughts in the early 2000s.

The kwacha –US dollar remained largely unchanged from August 2003 until mid-March 2005 when a series of adjustments saw the Kwacha resting at K123 against the United States dollar. The stability of the kwacha during the larger part of 2004 was as a result of the involvement of the Reserve Bank of Malawi in buying United States dollars direct from farmers at the auction floors. This arrangement was necessitated by the misunderstanding that arose between tobacco farmers and the commercial banks regarding delays in crediting the farmers' accounts after the sale of their tobacco and the exchange rate used in the conversions. This arrangement was, however, not

normal as it was not in keeping with the liberalized foreign exchange regime Malawi adopted in 1994. However, in view of the importance of the tobacco industry in the country, and in the face of a deadlock between farmers and the commercial banks, the Reserve Bank had to step in to save the situation. The Kwacha then stabilized at those levels until early 2006, when economic conditions necessitated a further review<sup>2</sup>.

**Figure 1: Daily exchange rates (2002-2005)**



### 2.1.8 The Current Exchange Rate Policy (2006 to date)

The current managed float exchange rate system was adopted in response to many economic challenges like persistent excess demand for foreign exchange, frequent droughts and market failures, among others, which rendered the free float system ineffective. The exchange rate is aligned with major objectives, that is, maintaining a sustainable BoP position, attaining stable domestic prices and attainment of growth in real income. It is the intention of monetary authorities to place more reliance on market based instruments in regulating the kwacha's value. However, moral suasion would be used if deemed necessary. It is not surprising therefore to see the kwacha on a weakening voyage – depreciating against all major currencies in May to average

<sup>2</sup> Currently, the Reserve Bank is no longer involved in the purchase of dollars from farmers on the auction floors. This follows an agreement between the two parties after their Reserve Bank-brokered discussions earlier this year. The farmers are now able to get their proceeds within 24 hours of the sale documents being submitted to their bankers and the exchange rate used in the conversion is the one displayed on the day of the sale.

K138.75 (K134.74 in April 2006) against the US dollar, K22.45 (K22.24 in April 2006) against the South African rand, and K176.61 (K165.03 in April 2006) against the Euro.

### 3.0 Literature Review

#### 3.1 The Exchange rate Models

This section discusses the purchasing power parity and the monetary models of exchange rate. We begin by defining a simple statistical process known as a random walk. Section 3.1.1 defines this process and discusses how it can be used to represent the exchange rate. In section 3.1.2, the concept of Purchasing Power Parity (PPP) is introduced. Section 3.1.3 introduces the monetary model of exchange rate and section 3.2 contains a short review of the relevant literature.

##### 3.1.1 The random walk with a variable drift

We compare the forecasts with a random walk which we define as follows;

$$ex_t = ex_{t-1} + e_t \quad [1]$$

and adding a drift variable term to the simple random walk process gives following:

$$ex_t = u_t + ex_{t-1} + \varepsilon_t \quad [2]$$

where

$$u_t = u_{t-1} + v_t \quad [3]$$

and  $ex_t$  is nominal exchange rate. The error terms  $\varepsilon_t$ ,  $e_t$  and  $v_t$  are white noise processes and should be independent and normally distributed. The term  $u_t$  defines the drift and  $ex$  is the exchange rate. If  $u_t$  would be a time dependent constant, we would have a normal random walk with a drift. The residual time series,  $\varepsilon_t$  and  $v_t$  are estimated using a kalmer

filter on time series data of exchange rate and the drift variable is computed from equation.a

### 3.1.2 The Purchasing Power Parity (PPP) Hypothesis

There are two forms of PPP and these are *absolute* PPP and *relative* PPP. The absolute PPP hypothesis states that the exchange rate between the currencies of two countries should equal the ratio of the price levels of the two countries. In logarithmic form, this is written as:

$$ex = p - p^* \quad [4]$$

where  $ex$  is the nominal exchange rate measured in units of domestic currency per unit of foreign currency,  $p$  is the domestic price level and  $p^*$  is the foreign price level. All variables in logarithms. The relative PPP hypothesis on the other hand states that the exchange rate should be proportionate to the ratio of the price level. Again, which again in logarithmic form, is stated as

$$ex = k + p - p^* \quad [5]$$

where  $k$  is a constant parameter. Since information on national price level is normally available in the form of price indices, absolute PPP may be difficult to test empirically. Thus we will use the relative PPP for the study in this paper, in line with earlier empirical studies. The PPP does not make any general assertion about the direction of Causality between the variables. It only states the relationship. Causality between prices and the exchange rate might very well run in both directions. The exchange rate may respond to a change in the ratio of national price levels, while exchange rate depreciation might feed inflation.

### 3.1.3 The Monetary Models of Exchange rate

Literature is awash with versions of monetary models of exchange rate determination all of which extensions of the basic Frenkel (1976) as well as Dornbusch's (1976) sticky-

price model. A reduced form specification of the models that has been widely employed when testing these models is stated as:

$$Ex_t = \beta_0 + \beta_1 (m - m^*) + \beta_2 (y - y^*) + \beta_3 (r - r^*) + \beta_4 (\pi - \pi^*) + \beta_5 (CA) + \varepsilon \quad [6]$$

Where  $Ex$  is exchange rate,  $m - m^*$  is money supply differential,  $y - y^*$  is income differential,  $r - r^*$  is interest rate differential,  $\pi - \pi^*$  is inflation differential, and  $CA$  is current account balance, variables with asterisk (\*) represent foreign country variables.

### **.3.2 Brief Review of Empirical Evidence**

There is huge empirical literature concerning forecasting nominal exchange rates using structural macro-econometric models over the recent floating rate period. The general consensus emerging from literature is that exchange rate movements are difficult to forecast at short horizons, although there exist some evidence of long horizon predictability. The most influential negative empirical evidence was documented by Meese and Rogoff (1983a, 1983b). These evaluated the forecasting performance of a variety of structural macroeconomic models of nominal exchange rate determination. Their finding was that no existing structural model could consistently forecast better than the naïve alternative of a random walk at short horizons, even when forecasts were generated conditional on observed macroeconomic fundamentals. It follows that nominal exchange rate movements are difficult to rationalise on the basis of movements in macroeconomic fundamentals. The exchange rate forecasting puzzle has never been resolved despite numerous attempts to do so and a random walk has since become the standard benchmark for evaluating the forecasting performance of structural models of nominal exchange rate determination.

At the time of Meese and Rogoff (1983a, 1983b) conducted their forecast performance evaluation exercise, the principal structural model was the monetary model, which remains influential in the analysis of target zones and balance of payments crises. The monetary model of nominal exchange rate determination consists of conditions characterizing equilibrium in the money, bond, and output markets. In the version of the monetary model developed by Frankel (1976) and Mussa (1976), output market

equilibrium is characterized under flexible prices, while the version of the monetary model developed by Dornbusch (1976) postulates that output market equilibrium under sticky prices.

More recently, Cheung *et al* (2003) argue that the dollar and euro fluctuations cannot be explained by traditional models proposed during the 1970s. They point out that the recent exchange rate movements can only be explained by empirical and theoretical results linked to such variables as the positions of external assets, the real exchange rate and the productivity differentials. They also argue that the forecasting performance of this new set of models (proposed during the 1990s) have not been systematically evaluated.

#### 4.0 Methodology

We use a blended version of the monetary and portfolio models. The model, which is different from the traditional sticky price monetary model (SPMM), is based on a specification form pioneered by Frankel (1979). He argued that in the short run, as in the SPMM model, prices are sticky and thus PPP does not hold continuously. Frankel reworked the basic assumptions of the original Dornbusch model to account for differences in secular rates of inflation.

$$LNex_t = \Sigma\theta_{1i}Lrd_{t-i} + \Sigma\theta_{2i}Lpd_{t-i} + \Sigma\theta_{3i}cab_{t-i} + \Sigma\theta_{4i}Lm2_{t-i} + \Sigma\theta_{5i}nei_{t-i} + \varepsilon_i \quad [7]$$

Where:  $Lex$  = logarithm of nominal exchange rate;  $Lrd$  is logarithm of interest rate differential, computed using the 91-day Treasury bill rate and short term London Interbank Offer (LIBOR);  $Lpd$  is logarithm of price differential, computed as the difference between the domestic price index and the US wholesale price index;  $LM2$  is the logarithm of money supply;  $cab$  is current account balance as a proportion of nominal (quarterly) GDP; and  $Nei$  is net external public inflows (official inflows and outflows) as a proportion of nominal GDP. Variables that are not in logs contain negative values that cannot be logged.

Therefore, equation 7 parameters are reset into equation 8 with the error correction terms in brackets.



$$\Delta Lex_t = \Sigma \theta_{1i} \Delta rd_{t-i} + \Sigma \theta_{2i} \Delta Lpd_{t-i} + \Sigma \theta_{3i} cab_{t-i} + \Sigma \theta_{4i} \Delta Lm2_{t-i} + \Sigma \theta_{5i} \Delta nei_{t-i} + \Sigma \theta_{6i} LNE_{t-1} + \theta_7 [Lex - a_1 Lrd - a_2 Lpd - a_3 Lm2] + \mu_i \quad [8]$$

#### 4.1 Empirical Results

We start off by testing the variables for unit root using the two main unit root tests, namely Philips-Perron and Augmented Dickey-Fuller tests. The results of unit rot tests are summarized in table 1.

**Table 1. Unit root tests: Philips-Perron and Augmented Dickey-Fuller tests**

Variable	PP Value (Intercept)	ADF Value (Intercept)	PP Value (Intercept & Trend)	ADF Value (Intercept & Trend)	Order of Integration
<i>ex</i>	-1.246974 (-2.9303)	-1.533784 (-2.9320)	-2.160073 (-3.5162)	-2.609958 (-3.5189)	
$\Delta ex$	-5.030934	-3.608720	-5.080513	-3.743311	I(1)
<i>ird</i>	-2.313162 (-2.9303)	-2.568050 (-2.9320)	-2.524452 (-2.9320)	-2.776547 (-3.5189)	
$\Delta ird$	-5.680410	-5.447708	-5.608682	-5.374622	I(1)
<i>pd</i>	-2.246974 (-2.9303)	3.951245 (-2.9320)	-1.862771 (-3.5162)	-2.856991 (-3.5189)	
$\Delta pd$	-5.030934		-6.374077	-6.211325	I(1)
<i>cab</i>	-2.246974 (-2.9303)	-1.650039 (-2.9320)	-5.348617 (-3.5162)	-3.875493 (-3.5189)	
$\Delta cab$	-5.030934	-8.273713			I(1)
<i>m2</i>	-2.246974 (-2.9303)	-1.077192 (-2.9320)	-3.614962 (-3.5162)	-4.64843 (-3.5189)	
$\Delta m2$	-5.030934	-10.18504			I(1)
<i>nef</i>	-5.006141 (-2.9303)	-3.835961 (-2.9320)	-6.120700 (-3.5162)	-5.245342 (-3.5189)	I(0)

The figures in brackets are McKinnon critical values for rejection of unit root at conventional 5 percent level of significance. The variables are tested at significant at 5 percent level of significance. The results indicate that variables such as exchange rate, money supply, interest rate differential, price differential and trade balance are non-stationary (integrated of order one) and thus become stationary after first difference. On the other hand, only net external inflows are stationary (integrated of order zero). The results lead us to the conclusion that trade balance, money supply, price and interest differential are non-stationary and integrated of the first order.

Having found that the exchange rate, trade balance, money supply, price and interest differential are integrated of the first order, the variables are then tested for cointegration.

The results of Johansen cointegration are reported in table 2.

**Table 2: The Johansen Co-integration Test**

Eigen values	Likelihood ratio	5% Critical value	1% Critical	Hypothesized No. of CE(s)
0.626006	88.59678	68.52	76.07	None**
04.38565	47.28915	47.21	54.46	At most 1*
0.283958	23.04429	29.68	35.65	At most 2
0.193177	9.015319	15.41	20.04	At most 3
6.56E-06	0.000276	3.76	6.65	At most 4

\*(\*\*) denotes rejection of the hypothesis at 5 percent (1 percent) significance level.

Results from cointegration test in table 2 indicate that there is one cointegrating vector at 5 percent significance level. This allows us to proceed with the determination of the longrun relationships between cointegrated variables through an ECM formulation. Based on the PPP condition, domestic and foreign prices are incorporated individually in the ECM instead of using price differential as a variable. This is in tandem with theoretical debate that PPP is likely to hold only in the very long run (Ndung'u 2000). Thus ECM is formulated using the interest differential, money supply, domestic and

foreign prices and exchange rate. This enables us to obtain a cointegrating vector of the form:

$$ecm = ex - 0.107826rd - 4.4394m2 + 1.359217pm + 20.62258pusa - 0.071040cab - 78.3160 \quad [16]$$

The regression results of the error correction model specified in equation 8 incorporate the error correction term in equation 9. The regression results are reported in subsection 4.2

#### 4.2 Estimation of the error Correction Models

We now proceed to the third step of in the Engle Granger methodology, the estimation of the error correction model. The estimation data range from 1993:1 to 2003:4. Table 3 shows the preferred model after eliminating the various lags to obtain a parsimonious model.

**Table 3. The exchange rate regression results**

Variable	Coefficient	Standard error	t-ratio
Constant	-0.043611	0.027383	-1.592617
$\Delta ex$ (-1)	0.297962	0.133125	2.238214
$\Delta ird$ (-4)	-0.062952	0.052293	-1.203816
$\Delta pd$	0.517846	0.078851	6.567364
$\Delta cab$ (-4)	-0.002141	0.002788	-0.768049
$\Delta m2$	0.229865	0.118745	1.935784
$\Delta nef$ (-5)	-0.004360	0.002161	2.017592
ect_1	-0.250027	0.141039	-1.772753

$R^2 = 0.628$ ; s.e. = 0.0871;  $F(7, 39) = 7.4839[0.00]$ ,  $n = 39$

ARCH  $F(2, 39) = 1.7034$ ; RESET  $F(2, 39) = 0.003561[0.9527]$

The regression results show that a worsening current account (at fourth lag) is leads to the depreciation the exchange rate. The key components that are likely to improve the current account balance are goods such as tobacco, tea and sugar.

Similarly, increases in net external inflows as a proportion of GDP (at fifth lag) lead to appreciation of the exchange rate. The main components of public capital inflows likely to be captured are multilateral and bilateral donor funding. This is an important finding and confirms what tends to be observed in practice.

On the other hand, interest rates have an insignificant impact on exchange rate. This is understandable for an economy like Malawi with poor infrastructural services, there is a limited capital inflows even in the face of high interest rates. Increases in current money supply in the domestic economy results in depreciation of the exchange rate. Likewise, a current rise in inflation differentials (that is a rise in domestic prices relative to foreign prices) is found to have a depreciating impact on exchange rate movements.

### **5.3.2 Forecasting Performance and Evaluation of the Forecasts**

In this section, we evaluate the forecasting performance of the fundamental model estimated in section (4). The forecasting power of the models is compared to a simple random walk process. The out-of-sample forecasts are measured by two statistics, root mean square error (RMSE) and mean absolute error (MAE). Table 5 shows statistics of the root mean square error and the mean absolute error for the forecasts of different models as well as for the spot rate (the forecast of a random walk model) for different time horizons.

The table presents some very interesting findings. It is apparent that the monetary model outperforms the random walk at both the 12 and 24 month horizon. What is striking however is the performance of the random walk model with a drift. The model outperforms the other two models on all the forecast horizons.

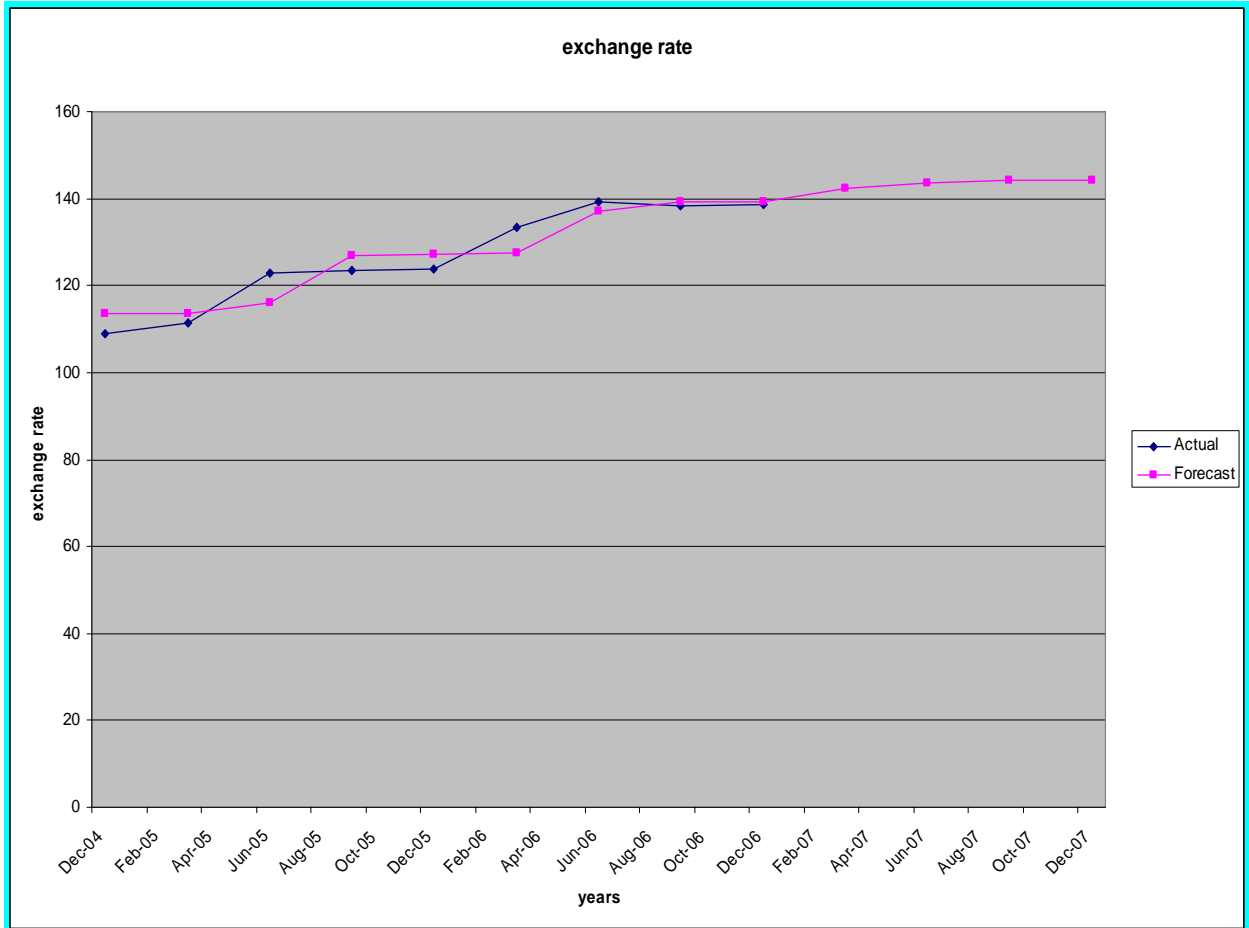
**Table 4 Forecasting Performance metrics**

	Forecasts horizon		
	<u>3 months</u>	<u>6 months</u>	<u>12 months</u>
<i>Random walk (without a drift)</i>			
RMSE	5.45	8.67	12.65
MAE	4.23	6.84	13.54
<i>Random walk with a Variable Drift</i>			
RMSE	3.76	4.53	7.45
MAE	2,13	318	6,66
<i>ECM on monetary variables</i>			
RMSE	6.32	7.45	8.56
MAE	5.07	6.32	7.65

It is apparent that the monetary model outperforms the random walk model on both 6 and twelve month horizon. The random walk model with a drift outperforms the other two models on all the forecast horizons.

An interesting observation is that the monetary model does not outperform a random walk model (without a drift) on the 3-month horizon. To forecast the exchange rate in the short term using fundamentals should indeed be more difficult than to forecast in the medium and long term. Studies have shown that due to incomplete information in the short term, the behaviour of foreign exchange market participants is to a large extent based on technical analysis of short term trends or other patterns in the behaviour of the exchange rate. The long term behaviour of exchange rate is however more governed by fundamentals.

**Figure 4: Observed and Forecasted MK/US dollar nominal exchange rate**



In 2007, the average exchange rate depreciation is expected to slow as the current account deficits narrows. During the year, the exchange rate is expected to fluctuate according to its usual seasonal pattern, although the fluctuations are expected to be smoothen somewhat on account of the managed float. Under this, it depreciates in the first quarter of the year, ahead of the tobacco auctions and again over the final quarter of the year, after the tobacco auctions have closed. Between these periods, the kwacha stabilizes and even occasionally appreciates, particularly if this coincides with the timing of donor disbursements. However, it is expected to remain vulnerable to sharp falls: potential triggers could be a further downturn in tobacco prices. We therefore forecast that the kwacha will close the year 2007 at K150/USD in 2007.

## **6.0 Policy Implications and Conclusion**

Exchange rate forecasting has turned out to be quite difficult. It has been difficult to challenge findings by Meese and Rogoff (1983a) that the main monetary models perform no better in exchange rate forecasting than a simple random walk, has been difficult to overturn.

This study develops a blended version of the monetary and portfolio models for MK/USD exchange rate, and in line with works by Meese and Rogoff (1983a), we test the forecasting performance of these models against a simple random walk. The results indicate the mode performs better than the simple random walk on the 6, 12 and 24 months forecasting horizon. However, the model does not do well on the 3-month horizon, which is supported by theory suggesting that exchange rates are not determined by fundamentals in the short term.

We also add a drift variable to the random walk process and compare its forecasts with the other two models. The results show that the random walk with a variable drift model performs better than the other models in out-of-sample process. This suggests that the random walk (with a variable drift) model is the best tool for exchange rate forecasting in the short term and medium term. However, for long term forecasting of exchange rates, a fundamental model might still be the best alternative.

Regarding the structural model (with fundamental determinants of nominal exchange rate), the empirical results indicate that a worsening current account balance and decreases in net external flows result the depreciation of exchange rates. This is in line with practical experience.

On the other hand, higher domestic interest rates have an insignificant impact on exchange rate. In an economy with several structural bottlenecks and poor infrastructural services, high interest rates cannot be expected to induce capital flows. A rise in domestic inflation is associated with a depreciated exchange rate. Lastly, consistent with theoretical expectations, another significant finding is that an easing in monetary policy (increase in money supply growth) is associated with a depreciation of the exchange rate.

These findings lead us to make the following conclusions. Developments in the current account balance have implications on the exchange rate market. Measures aimed at improving the current account position, for example through exports, are also instrumental in stabilizing the exchange rate – through appreciation. Considering that Malawi has been traditionally depending on tobacco as its chief foreign exchange earner, and taking into account the anti-smoking campaign militating against the crop amidst low prices, it is imperative that Malawi should diversify into other foreign exchange earner (for instance tourism) in order to ensure macroeconomic stability, which itself is a prerequisite for economic growth and therefore poverty reduction. Thus, policies that influence exports and imports of goods and services also determine exchange rate movements. Likewise, prospects concerning funding for a donor aid dependent economy like ours may influence the direction of market forces in determining the exchange rate movements. Big swings in external funding could cause instability. Therefore, government's credibility regarding the use of external public funds and implementation of related reforms is important in as far as stability of the foreign exchange market and overall macroeconomic stability are concerned.

The insignificant impact of interest rate differential on attracting capital flows calls for the need for government to address some structural bottlenecks. For instance, infrastructure services such road network and utilities (electricity and water supply) require improvement. Otherwise, currently, Malawi needs lower interest rates in order to reduce the cost of credit necessary for private sector development.

The general picture from the results is that developments in the external sector of the economy, which are not under the ambit of domestic authorities, probably contributed more to fluctuations of the Malawi kwacha. If indeed the above diagnosis is accurate, the policy implications of government's ability in influencing the behavior of the exchange rate is limited. This is because the ability of a small economy like that of Malawi to fully insulate itself from external shocks is constrained. It will mainly be confined to limiting



the contributions of inconsistencies in domestic policy and administering some confidence building measures, at least in the short-term-to medium term

It is worthy to note that divergent opinions exist as to the usefulness of devaluation (or depreciation) as a policy tool. There are those that believe devaluation as a policy tool can boost exports and so create jobs. It should be noted however that since the kwacha was floated in 1994, it has almost been on a depreciating trend almost continuously without corresponding gains from exports. Without losing sight of the interest of exporters, it should be noted that a depreciated kwacha has implications in terms of increased import expenditures (oil import bill), government debt service, domestic inflation and cost of imported intermediate inputs. In the short term, what we should strive to have a stable Malawi kwacha exchange rate. In the long run, the viable option is in ensuring a competitive export market is increased productivity among exporting firms. This may include export diversification and implementing measures to limit market imperfections.

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