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# **The Effectiveness of Official Intervention in Foreign Exchange Market in Malawi**

Kisu Simwaka and Leslie Mkandawire \*

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## **Abstract**

The Malawi Kwacha was floated in February 1994. Since then, the Reserve Bank of Malawi has periodically intervened in the foreign exchange market. This paper analyses the effectiveness of foreign exchange market interventions carried out by the Reserve Bank of Malawi. We use a GARCH (1, 1) model to simultaneously estimate the effect of intervention on the mean and volatility of the Malawi kwacha.

Using monthly exchange rates and official intervention data from January 2002 to February 2006, the empirical results suggest that intervention activities of the Reserve Bank of Malawi affect the kwacha. In line with similar findings elsewhere in the literature, the paper finds that net sales of dollars by the Reserve Bank of Malawi depreciate, rather than appreciate, the kwacha. This effect is very small, however. Moreover, the paper also finds that the Reserve Bank of Malawi intervention reduces the volatility of the kwacha. This shows that the Reserve Bank actually achieves its objective of smoothing out fluctuations of the kwacha. This can be evidenced by the stability of the kwacha during a greater part of 2004. Thus intervention is, to some extent, used as an effective tool for moderating fluctuations of the kwacha. However, its effectiveness is constrained by the amounts of foreign exchange reserves, which are usually low.

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\* The authors are Senior Economists in the Research and Statistics Department of the Reserve Bank of Malawi and MEFMI, respectively. Their present address: Reserve Bank of Malawi, Convention Drive, P.O. Box 30063, Capital City Lilongwe 3, Malawi. Tel.: +265 01 770 600; Fax: +265 01 770 593; MEFMI, Social Security Centre 12<sup>th</sup> Floor, J.Nyerere Way/S.Nujoma Street, P.O. Box 66016, Kopje, Harare, Zimbabwe. Tel.: 263 4 252 166/7; Fax: 263 4 252 164/735 074.  
Authors' Email address: [ksimwaka@rbm.mw](mailto:ksimwaka@rbm.mw) (K. Simwaka); [Leslie.Mkandawire@mefmi.org](mailto:Leslie.Mkandawire@mefmi.org) (L. Mkandawire)

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## 1. Introduction

Most central banks, especially in developing countries use foreign exchange market intervention<sup>1</sup> as a policy tool for macroeconomic stabilization. In Malawi, the exchange rate was floated in February, 1994. Since then, the Reserve Bank of Malawi (RBM) has periodically intervened in the foreign exchange market. In line with the International Monetary Fund (IMF) conditions under the structural adjustment package, the RBM has also intervened to buy foreign exchange in order to build up reserves for the Government and moderate exchange rate fluctuations.

There has been a lot of debate in literature on the question of whether these interventions affect the value of the kwacha. The main objective of the study is to examine the efficacy of the official intervention in foreign exchange market. Basically, the paper tries to answer the following questions: Floatation of the kwacha was intended to be market determined, but has it really been market determined? Has intervention influenced movements of the kwacha? Has intervention dampened and smoothed the volatility of the Malawi kwacha? What is the role of the balance of payments pressures on the direction and volatility of the Malawi kwacha?

The issue of the effect of intervention on the exchange market in Malawi is significant on both research and policy fronts. Research front, because very few such papers have been done on Africa and only one is known to the authors. It is of policy interest because, if sterilized intervention has an effect on the kwacha, this offers the monetary authorities an additional policy tool independent from general monetary policy.

In Section 2, we discuss monetary and exchange rate policy in Malawi. Section 3 gives theoretical underpinnings and reviews recent results in recent contributions to empirical literature on effectiveness of central bank interventions. Section 4 outlines the methodology used in the paper. Section 5 summaries the main findings of our empirical research. Section 6 concludes the paper and offers some policy recommendations.

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<sup>1</sup>Intervention refers to official sales or purchases of foreign exchange to influence exchange rate. In this paper, we have used net sales of foreign exchange as our intervention variable.

## 1.2 Monetary and Exchange Rate Policy in Malawi

### 1.2.1 Monetary Policy

Up until late 1980s, monetary policy in Malawi was characterized by repressive procedures such as direct credit, interest rate ceilings, and strict controls on foreign exchange and capital flows. Supported by the International Monetary Fund (IMF), Malawi went into structural adjustment programs beginning in the second half of 1988. The programmes included liberalization of the financial sector, which meant that monetary policy had to shift from direct to indirect methods. This facilitated the conduct of monetary policy in line with macroeconomic objectives of maintaining sustainable growth, viable balance of payments position and stable prices. The central bank keeps a close eye on all indicators that would entail price developments including Consumer Price Index (CPI) inflation, growth in Gross Domestic Product (GDP), monetary growth and expansion of credit.

**Table 1: Selected macroeconomic Indicators**

	2000	2001	2002	2003	2004	2005
Real GDP <sup>1</sup>	0.2	-4.1	1.8	3.9	5.1	1.9
CPI inflation <sup>2</sup>	29.3	27.5	14.8	9.6	11.5	16.5
M2 (money supply) <sup>3</sup>	47.1	22.1	25.2	29.3	29.8	14.3
MK/USD rate <sup>3</sup>	80.09	72.15	76.69	108.57	108.94	123.63

Source: Reserve Bank of Malawi Monthly Economic Review, July 2003 and January 2006

1. Annual percentage change

2. Year-on-year of inflation

3. Period average

In trying to attain its goal of price stability, the Reserve Bank of Malawi establishes an annual inflation rate target, announced by the Minister of Finance in his Budget Statement to Parliament and monetary aggregates as an intermediate variable.

The choice of monetary policy stance adopted by a country, by and large, depends on the economic, financial and institutional environment within which the policy is operating. Currently, Reserve Bank of Malawi (RBM) pursues a monetary targeting regime, whereby the authorities aim at regulating money stock (broad money, M2), to levels required to support the relationship between price level and output. Broad money stock (M2), therefore is a nominal anchor to control inflation. Open market type operations remain the primary policy levers to influence liquidity. The objective of monetary policy is to reduce inflationary pressures by bringing inflation to the neighbourhood of 5-8 percent over the medium term. In this range, inflation is deemed less likely to distort savings and investment decisions. The conduct of monetary policy is under the overall leadership of the Monetary Policy Committee, which meets once in a month to take stock of the performance of the economy vis-à-vis the economic program and takes a view on the expected level of inflation in the short to medium term. On the basis of its assessment, the Committee gives broad guidelines to the Open Market Desk of the Bank on what it views as the appropriate reserve money target by the end of the month or quarter. The information given is consistent with monetary policy targets. The Open Market Desk uses this information and other available information such as expected sales and purchases of foreign exchange by the Bank, maturities and new issues of Treasury bills and Government expected revenue and expenditure to map out a path for monetary policy intervention for the month.

### **1.2.2 Monetary Policy Targeting**

The Reserve Bank of Malawi attempts to directly control money stock through a number of instruments. Although the RBM has a statutory responsibility to achieve a low and stable inflation at predetermined level for a given time, the nature of its functions make inflation targeting not an option. Inflation targeting requires some level of independence of the RBM, a high degree of cooperation between the Bank on the one hand and the Government, private sector and trade unions on the other.

In order to achieve the price stability objective, the Bank exerts stricter controls over reserve money, employing for this purpose quarterly growth targets (usually agreed with the International Monetary Fund under the supported programmes). While more emphasis was initially put on growth in M2 aggregate, recent developments have indicated that M2 can better be influenced by monitoring growth in reserve money aggregate because the central bank has better control over the latter than the M2 money stock.

In order to influence growth in the money stock, the central bank increases or decreases the amount of reserve money by managing both the domestic and foreign sources of reserve money (credit from the central bank, and acquisition of foreign exchange by the Bank that has impact on local money creation). The central bank's daily monetary management involves making estimates of banking system liquidity situations. Based on the outcome, the central bank decides how to intervene i.e. inject or withdraw liquidity from the system.

In line with direct monetary control, RBM manages monetary conditions in the economy by using three main instruments namely the bank (discount) rate, Liquidity Reserve Requirement (LRR), and Open Markets Operations (OMO).

#### **1.2.2.1 Bank or Discount Rate**

The bank rate or discount rate is the rate at which the Reserve Bank charges on funds borrowed from it by commercial banks and the government. The rate imposes limitations on the capacity to borrow from the central bank. The bank rate had previously been set administratively but for a brief period, and during each month it would be set at a mark above the average 273-day Treasury bill (TB) rate of the previous month. As a result, increases in the Treasury bill rates would immediately be reflected on the bank rate. For instance in February 2001, the Bank rate had increased to more than 75 percent. In June 2001, the bank rate was de-linked from the TB-rate and begun to be set administratively by the RBM. Following this move, the RBM has succeeded in providing a broad benchmark for market interest rates. The effect of this policy is that Treasury bill rates have declined relative to their values of over 50

percent in early 2001 to around 25 percent in 2005. But the large drop in Treasury bills rate is, to an extent, attributed to fall in inflation due favourable food harvests as food inflation accounts for 58 percent of the inflation basket. The discount rate is an important barometer of monetary policy stance and its adjustment has successfully tended to influence lending rates in the financial system. Operationally, borrowing by banks is done through standing facilities window. RBM discount window was established in line with the 'lender-of-last-resort' role. Accordingly, it has continued to provide loans of a short-term nature (overnight) to banks in need of liquidity. Recently, repurchase agreements have been used quite often in order to fine-tune banking system's liquidity. A commercial bank may borrow funds for a period of 7 days maximum. The discount rate is also a penalty rate as it is usually above the market rates to discourage banks.

#### **1.2.2.2 Liquidity Reserve Requirement (LRR)**

LRR is one of the instruments available to RBM for controlling base money. LRR works by affecting the proportion of assets that banks are required to hold, and hence their ability to expand liquidity. In Malawi, all commercial banks are subject to the LRR requirement on all their domestic liabilities, and discount houses on all their collateralized deposits. Failure to oblige by the requirement attracts a penalty from the RBM.

LRR was first applied in 1989. Initially, commercial banks were required to maintain a minimum equal to 20 percent of their total local currency deposits (including government deposits). In 1995, the LRR was increased to 35 percent. In June 2004, the rate was adjusted downwards to 27.5 percent to-date with the callable deposits also adjusted to 14.5 percent.

The use of the LRR is limited, as focus has tilted more to open market operations (OMO). The LRR remains generally high and this has adverse implications in the conduct of monetary policy. In effect the high LRR is regarded as an implicit tax on these institutions equivalent to interest rates that they could have earned on these



balances. This implicit tax on reserves when adjusted for other intermediation costs partly explains the wide spread between deposit and lending rates.

But the authorities could not just ascribe to the idea of maintaining a lower LRR as its reduction could fuel inflationary pressures unless it is offset by other monetary instruments like aggressive sales of securities. It is against this reason that RBM did not fully comply with its previously announced LRR reduction scheme in 2004. Cumulative monetary overhang led to suspension of the scheme.

### **1.2.2.3 Open Market Operations (OMO)**

Open Market Operations involves the deliberate buying and selling of paper by RBM to inject and withdraw liquidity from the financial system. OMO is conducted through RBM bills and repurchase agreements (repos) using Treasury bills as the major monetary policy instruments. Of the two, the RBM bills are the most commonly used. Prior to RBM bills, Treasury bills were issued for monetary policy purposes in addition to government finance. The Reserve Bank assumed responsibility over monetary Treasury bills and the proceeds were frozen till maturity. But in view of policy conflicts that arise from government debt management and monetary policy needs through issuance of Treasury bills for dual considerations (monetary and fiscal), the monetary policy Treasury bills were gradually phased out. Since 2000, RBM has been conducting OMO through primary market auctions of RBM bills. Since 2000, RBM has been conducting open market type operations through primary market auctions for liquidity management purposes to meet its reserve money targets.

### **1.2.3 Challenges to execution of monetary policy**

Monetary targeting in Malawi, however, faces some problems such as non-guaranteed expectation that the relationship between the supply of money and inflation is stable and predictable. This is manifest in the apparent missing of targets more frequently. But despite being imprecise, the relationship has been judged to be sufficiently stable

to serve as a useful guide to policy. This therefore justifies the medium term inflation objective of 5-8 percent.

Fiscal overruns have been associated with monetization of the deficit, crowding-out of credit to the private sector and worsening inflation position. Associated with fiscal overruns also, have been massive increases in banking system credit, especially in the context of donors curtailing support because of concerns about governance. In simple terms, fiscal expansion and the related large fiscal deficits have affected the efficacy of monetary policy.

### **1.3.2 Exchange rate policy**

#### **1.3.2.1 Evolution of the Exchange Rate**

Malawi's exchange rate 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

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.

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.

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.

### **1.3.2.2 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.

### **1.3.2.3 The Crawling band**

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.

### **1.3.2.4 An unannounced crawling peg**

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.

### **1.3.2.5 The 'free-floating' system**

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.

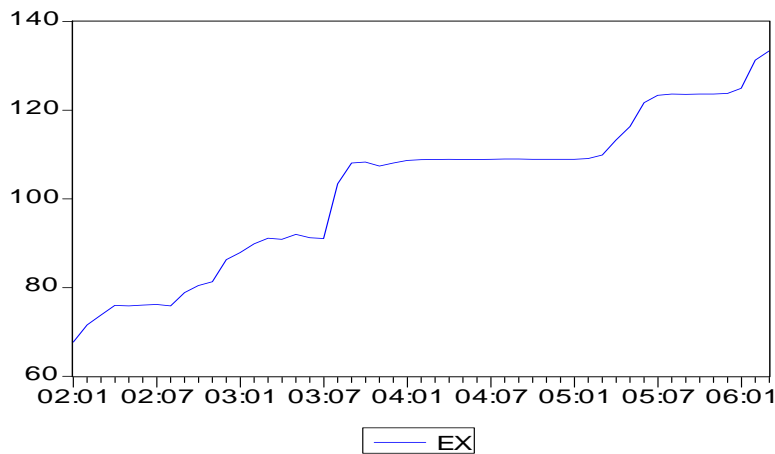
A short period of exchange rate instability followed. In 2002, developments on both the local and international scene adversely affected the nominal value of the Malawi kwacha against the currencies of other trading partners. On the domestic market, despite improved receipts of from tobacco sales as 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.

#### **1.3.2.6 The Managed float**

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)**



<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.



### **1.3.2.7 The Current Exchange Rate Policy**

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 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.

### **1.3.3 Foreign Exchange Market Intervention**

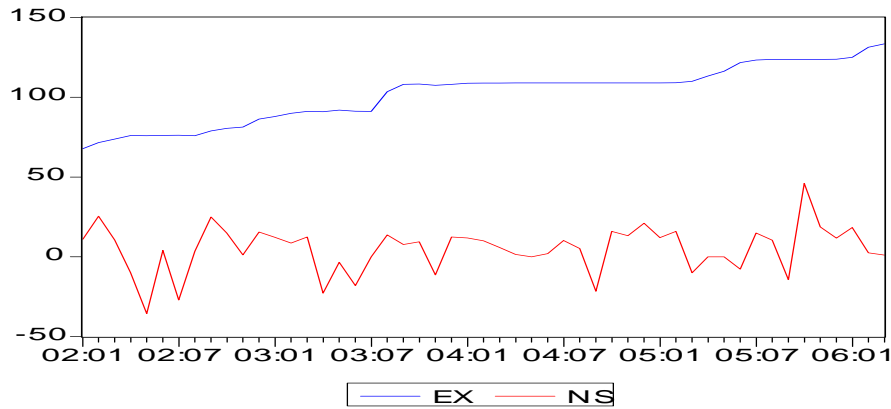
The medium term objective of the Reserve Bank is to have the kwacha fully market determined and build foreign exchange reserves, but at the same time the monetary authorities do recognize the importance to investors, of a predictable currency value.

In a liberalized foreign exchange market, the RBM cannot dictate the value of the Malawi kwacha. However, the RBM can only influence the value of the kwacha by buying foreign exchange when there is an excess supply in the market and selling when there is shortage. This means that in theory, the RBM can maintain a stable exchange rate by intervening in foreign exchange market. In practice, however, the RBM has to consider the monetary implications as well as implications on the position of official foreign reserves. As the Bank buys foreign exchange from the market, the supply of the Malawi kwacha in the economy increases and this has potential for inflationary pressures. For the Reserve Bank to sell foreign exchange to the market, it must have adequate reserves in the first place. And, as a source of its own foreign exchange reserves, the Reserve Bank also relies on whatever it is able to buy from the market and/or, if there were any inflows of donor funds. Any constraints

on these two sources, means inadequate capacity for the Bank to support the market effectively, thereby affecting the surplus/demand balance in the market. The major players in the foreign exchange market in Malawi are the two major commercial banks (Authorized Dealer Banks), the tobacco companies (Limbe Leaf, STANCOM), the Sugar Company (ILLOVO), and the foreign exchange bureaux.

Overall, since the floatation of the kwacha in 1994, there has been limited to meeting net international reserve target moderating seasonal fluctuation related primarily to the agricultural cycle. Due to the seasonal nature of our foreign exchange earnings coupled with the fact that tobacco exports account for about 60 percent of the foreign exchange earnings, the Malawi kwacha is normally expected to appreciate during the tobacco marketing season (April to August), reflecting increased supply of foreign exchange on the market, and depreciate during the off-season reflecting increased demand for foreign exchange as the economy imports farm inputs such as fertilizer. This seasonal pattern may vary if during that time of the year, the country has received substantial donor inflows. Daily purchases or sales are limited to 10US\$mn, while on weekly and monthly basis, they go up to 15US\$mn and US\$35mn, respectively. The size and frequency of daily net purchases range from (-) US\$1.0 million to US\$10.0 million. On weekly basis the net purchases range from (-) US\$16 million to US\$15 million while on monthly basis they range from from (-) US\$25.0 million to US\$35.0 million.

**Figure 2: Monthly Exchange rates and Net foreign exchange sales**



Activity in the foreign exchange market is divided into segments – transactions between banks and their clients, and inter-bank activity including the RBM’s intervention in the market. Average daily turnover volume in the first segment of foreign exchange market was about US\$13.5 million in 2002. Inter-bank activity was much lower however, more than 75 percent of which was characterized by official intervention.

### **1.3.4 The Parallel Market**

The parallel market has existed for a long time. This market exists to meet the needs of foreign exchange customers whose needs cannot be satisfied in the authorized dealer banks (ADB) or bureaus. Continuation of activities in the parallel market reflects that there are distortions in the official market and its exchange rates should reflect the actual market rates. The activities in this market cannot objectively be measured; however, the gap between the bureau exchange rates and the parallel rates is not very large. The rates also tend to be stable following the movements in the official exchange rates. The parallel market is preferred because it allows for faster purchase or selling of foreign exchange without disclosing much information. However, there is a high risk associated with dealing with operators in this market mainly associated with obtaining the local or foreign currencies that are not genuine

and if the law catches with money changer, then prosecution will follow. This has made it difficult to obtain any information regarding operations in this market

Participants in the parallel market are not defined, especially as there is no legal recognition accorded to operators and there are no direct regulations, however there seem to be a lot of information sharing among dealers in this market. Usually the exchange rates in this market are similar among dealers in different places within the city of Lilongwe, for example and between the dealers in different cities of the country. The only marked difference in rates exist between dealers in major cities and those at the borders with neighbouring countries, with the latter having lower rates in most cases than the former.

### **Establishment of Foreign Exchange Bureaus**

In order to incorporate parallel market into the legal foreign exchange system in Malawi, foreign exchange bureaus were granted permission to operate from mid 1990s. Operators in the bureau de change are private entrepreneurs who have been formally recognized by government to deal in foreign exchange and provide access to foreign exchange in a convenient and informal manner.

Foreign exchange is primarily sourced from private individuals, including businesses people who are unable to deal at authorized dealer banks. From their inception there has been a general movement of exchange rates in the bureaus de changes towards that of parallel market. By June 2004, while the official rate was K108.8858 per US dollar, the bureau de change exchange rate and parallel rate were K110.0000 and K118.0000, respectively (see below). This trend continued, with the explanation for this as excess demand for foreign exchange in the foreign exchange market eventually transferred to the bureau de change to attract higher prices. Again, the very simple nature of transactions in this market compared with the foreign exchange market plus relative lower risk – e.g fake currency transactions – to the parallel market, make it attractive for consumers to prefer dealing with bureau de changes operators. This drives up demand and, consequently, the exchange rate.

**Figure 3: Official and Parallel exchange rate trends**

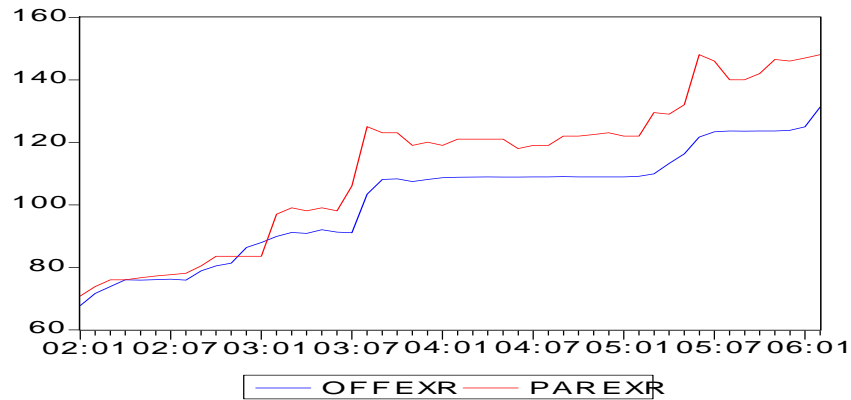
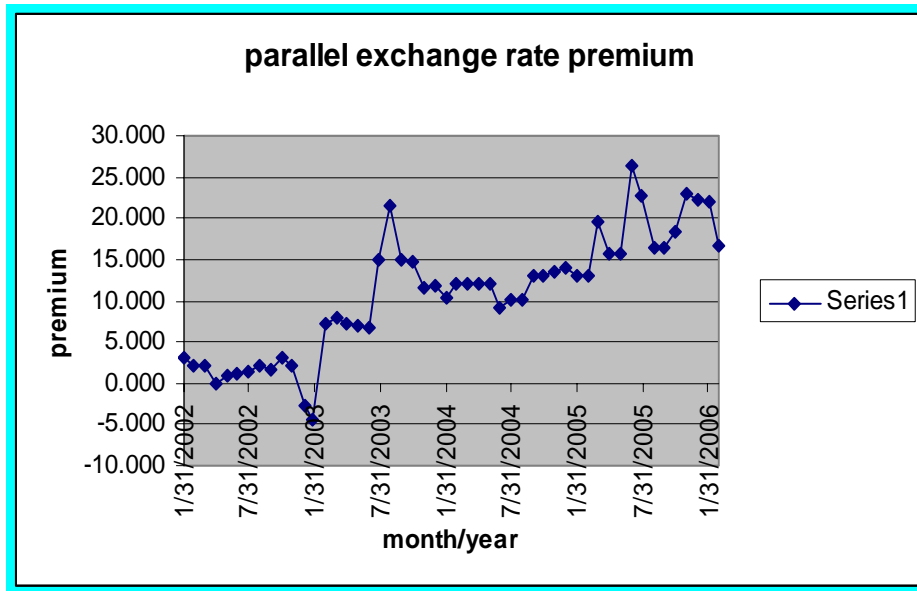


Figure 4 shows exchange rate premium. Exchange rate premium is measured by the difference between official exchange rate and parallel exchange rate. Other measures of premium are the difference between official exchange rate and bureau de change rates. It should however be noted that the suggestion that parallel rate is the optimal rate is controversial. Given the fact that the official market's share of the foreign exchange market is much larger, the realistic market rate may lie somewhere between the official exchange rate and parallel market rate. The increasing gap between official exchange rate and parallel exchange rate justifies some analyst's view that the Malawi kwacha is overvalued. Even though all markets are imperfect, the official market is the leading market.

**Figure 4: parallel exchange rate premium**



### 3.0 Literature Review

#### 3.1 Theory of Intervention<sup>3</sup>

There is general agreement in literature unsterilized sale of foreign exchange would be expected, other things being equal, to appreciate the exchange rate through contraction of money supply and therefore interest rates. Sterilized intervention is where the authorities take deliberate action to offset foreign exchange market intervention with an equal change in the net domestic credit and this happens either simultaneously or with some short lag, while leaving interest rates unchanged. On the other hand, intervention is non-sterilized when it is conducted without any action taken to offset the impact of intervention. The relationship between exchange rates and monetary control largely comes from central banks balance sheet. On the liabilities side, there is the base money (*BM*) which comprises reserves, currency and the central bank's net worth. On the assets side, there is net foreign assets (*NFA*) and

<sup>3</sup> This section relies heavily on Simatele (2004)

net domestic assets (*NDA*). Any intervention in the foreign exchange market will change *NFA* (Simatele, 2004). Assuming that net worth is insignificant, a summary of the balance sheet can be presented as:

$$BM = NFA + NDA$$

Sterilization needs the central bank to take deliberate action such as open market operation sales or purchases of securities. Once this is done, the result will be an equal change in domestic assets. Without sterilization, the monetary base also changes i.e.

$$\Delta BM = \Delta NFA$$

The size of sterilization largely depends on the extent to which simultaneous changes take place in *NDA* as *NFA* changes (Simatele, 2004). Full sterilization happens when changes in *NFA* are totally offset by changes in *NDA*, thus the expression:

$$-\Delta NFA = \Delta NDA$$

and

$$\Delta BM = 0$$

In this case there would be no impact on the monetary base. The changes will eventually result into changes in broader money aggregates and interest rates. This in consequent will affect expectations, capital inflows and eventually the exchange rate.

### **3.1.2 Sterilized Intervention**

Sterilised intervention<sup>4</sup> can affect exchange rate through two channels. These are the portfolio balance channel and the signaling channel.

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<sup>4</sup> The Reserve Bank of Malawi sterilizes its foreign exchange market intervention whenever it is perceived that intervention in foreign exchange market will affect reserve money targets to the extent that the targets will be missed. Since, money targets are usually tight; the Bank therefore often sterilizes its foreign exchange market intervention.

### **3.1.2.1 The Portfolio Balance Channel**

This one states that sterilising intervention through typical open market operations will change the currency composition of government securities held by the public (Humpage, 2003). A sterilised purchase of foreign exchange, for example, increases the amount held domestic bonds held by the public relative to foreign bonds, resulting in a depreciation of the local currency. Unfortunately, most empirical studies find the relationship to be statistically insignificant. The reason offered for the lack of a portfolio effect is that the typical intervention transaction is minor relative to the stock of outstanding assets. Dominguez (1998) is a notable exception to this conclusion.

### **3.1.2.2 Signalling Channel**

The second channel is the signalling or expectations channel. Mussa (1981) suggested that central banks might give indications regarding future, unanticipated changes in monetary policy through their sterilised interventions, with sales or purchases of foreign exchange implying, respectively, monetary tightening or ease. This would have direct implications for future fundamentals, and traders would immediately adjust spot exchange rate quotations. Mussa suggested that such signals could be particularly strong – more so than a mere announcement of monetary policy intentions – because interventions give monetary authorities open positions in foreign currencies that would result in losses if they failed to confirm their signal. Reeves (1997) has formalised Mussa's approach and has demonstrated that if the signal is not fully realistic, or if the market does not use all available information, then the response of the exchange rate intervention will be low. However, Edison (1993) argues that intervention is effective and occurs through both the portfolio balance and signalling channels.

## **3.2 Empirical Findings**

Andrew and Broadbent (1994) in their work on the effectiveness of official intervention in the Australian dollar market found out that in the first ten years of the



floatation of the Australian dollar (1983 – 94) the Reserve Bank of Australia foreign exchange operations resulted in the stability of the Australian dollar. Makin and Shaw (1997) concluded that the official intervention during 1983-93 had neither influenced the Australian dollar nor smoothed its volatility. Bonser - Neal et al. (1998) and Humpage (1999) show that the interventions undertaken together with changes in the federal funds rate do not have any effect on exchange rates. Both results attribute exchange rate responses mainly to the federal funds rate. However Kearns and Rogobon (2002) support the view that over the period 1986-93, RBA intervention did have an economically significant effect in moving the level of exchange rate. Using daily data covering the 1983-97 period, Kim and Sheen (2002) and Kim, Kortian and Sheen (2002) conclude that the RBA was cautious in choosing when to intervene and that its intervention stabilised the volatility of Australian dollar. In contrast, Kim (2003) claims important effects from intervention in a VAR model that allows for the possible interactions between exchange rate intervention and monetary policies. Kim's results are unusual and questionable, but they highlight the need for further research on this issue.

Even though most empirical studies do not provide the best theoretical model of intervention, economists usually interpret their results as evidence of a broad signalling channel. These results clearly show a high frequency (daily) relationship between foreign exchange intervention and exchange rates.

Simatete (2004) investigates the effect of central bank intervention on the Zambian kwacha. She used a GARCH (1,1) model simultaneously estimating the effect of intervention on the mean and variance. She finds that central bank intervention in the foreign exchange market increases the mean but reduces the volatility of the Zambian kwacha. The explanation supports the 'speculative bandwagon' and a 'leaning against the wind' strategy. Although there is no attempt to distinguish through which channel intervention works, she argues that this is more likely to be a signalling affect rather than a portfolio balance.

Many researchers also consider the second moment of the exchange rate process finding that intervention typically increases currency volatility. They often interpret this finding as evidence of a destabilising effect, but in a market that has information imperfections, volatility may be associated with transmission of new information. If so, one would expect an increase in exchange rate volatility around intervention periods.

#### **4.0 Methodology**

In both macroeconomic and financial economics, empirical research is based on time series, and time series is generally viewed as stochastic processes. The model builder is therefore allowed to use statistical inference in developing and testing equations that describe the relationships between economic variables. The two key properties of many economic time series that have been common in research work are nonstationarity and time-varying volatility. Foreign exchange market intervention falls under the second property, as such an action would result into unpredictable volatility. Researchers have attempted to model foreign exchange market intervention using various methodologies and approaches. The broad range of techniques present researchers with different types of problems about which anyone assessing their results needs to be careful. The main problem in all empirical research on intervention is the simultaneous determination of official intervention and exchange rate changes.

#### **4.1 Alternative approaches**

In this study we considered a number of approaches to modelling foreign exchange market intervention and economic responses.

*Event study*: an incident of intervention is defined as a period of days with official intervention in foreign exchange in one direction, including up to ten days of no further intervention between the initial and subsequent intervention transaction. It requires systematic intervention transactions (Humpage, 1999). A quick look at Malawi's experience shows that intervention transactions are not systematic. It takes long periods between one official purchase or sale of foreign exchange to the next.

*VAR models:* structural VAR models have been used to identify dynamic responses of an economy to particular shocks and this reveals the information about the dynamic properties of the economy that is being investigated. The results can be used to inform policy makers and economic forecasters how economic variables such as exchange rate and prices respond over time to changes in policy or other events. However, the discrete values and periodic nature of intervention make it difficult to estimate parameter values of reaction functions in a VAR (Kim, 2003).

*Econometric model:* lagged models are inappropriate since intervention appears to affect exchange rate movements within minutes and hours (Humpage, 1999).

*The GARCH/ARCH models:* ARCH Volatility in asset returns and exchange rates tend to gather around their marginal distributions. Modelling such time varying volatility was initiated by Robert Engle through autoregressive conditional heteroskedasticity (ARCH). In order to go around this problem Bollerslev (1986) proposed a generalised ARCH or GARCH (p, q) model. This is the model we adopt in this study, it is particularly favoured to take account of variance correlations typically found in financial data. The Generalised Autoregressive Conditional Heteroskedastic (GARCH) model is robust to various types of misspecification, can simultaneously model conditional mean and conditional (Edison, 1999).

## **4.2 The adopted methodology**

We adopt the GARCH methodology. The first-order (p=q=1) GARCH model, suggested by Taylor (1986), has since become the most popular ARCH model in practice. Compared to the Engle's basic ARCH model, the GARCH model is a useful improvement that allows a parsimonious specification. The GARCH (p, q) model on which the study is based takes the form:

$$h_t^2 = \alpha_0 + \sum_{i=1}^q (\alpha_i \varepsilon_{t-i}^2) + \sum_{i=1}^p (\beta_i h_{t-i}^2) \quad (1)$$

where  $\alpha_0 > 0$ ,  $\alpha_i \geq 0$  for  $i=1,2, \dots, q$  and  $b \geq 0$  for  $i=1,2, \dots, p$ . The GARCH (p, q) model successfully captures several characteristics of financial time series such as volatility.

The study estimates and tests ARCH models, that is, builds the ARCH into GARCH (p, q) model using the Eviews. Initially we regress y on x by OLS and obtain the residuals  $\{\varepsilon_t\}$ ; then we compute the OLS regression  $\varepsilon_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_p \varepsilon_{t-p}^2 + \text{error}$ ; and test the joint significance of  $\alpha_1 \dots \alpha_p$ . The hypothesis of interest is the extent to which changes in the conditional mean and conditional variance are associated with changes in the intervention variable. The general formulation of the model follows Edison and Liang (1999); but adjusted to suit the Malawi situation:

$$\Delta EX_t = \sigma_0 + \sigma_1 NS_t + \sigma_2 PDRSA + \sigma_3 EP + \sigma_4 DMV + \varepsilon_t \quad (2)$$

$$\varepsilon_t / I_{t-1} \sim N(0, h_t) \quad (3)$$

$$h_t = \beta_0 + \beta_1 NS + \sigma \varepsilon_{t-1}^2 + \delta h_{t-1} \quad (4)$$

Where  $\Delta EX_t = \log$  change in Malawi kwacha/United States dollar (MK/US\$),  $NS$  is net sales of foreign exchange (representing intervention),  $PDRSA$  is inflation differential between Malawi and Republic of South Africa (RSA),  $EP$  is parallel exchange rate premium,  $DMV$  is dummy variable for seasonal trends in exchange rates,  $\varepsilon$  is a regression disturbance (forecast error),  $| |$  is absolute value operator,  $I_{t-1}$  is information set through time  $t-1$ ,  $h$  is the time-varying variance of  $\varepsilon$ .

Equation 2 measures the direct effect of net sales of foreign exchange (US dollars), price differential, exchange rate premium and seasonal factors on exchange rate changes. A positive coefficient on intervention variable indicates that net sales of the foreign currency ( $NS$ ) depreciate the Malawi kwacha. Equation 3,  $(\varepsilon_t | I_{t-1} \sim N(0, h_t))$  states that the regression residuals will be modeled as a GARCH process. Equation 4 describes the conditional variance. The parameters of the model will be estimated using the quasi-maximum likelihood approach of Bollerslev and Wooldridge (1992), which yields standard errors that are robust to non-normality in the density function underlying the residuals. Parameters  $\sigma$  and  $\delta$  in equation 4 are for

the ARCH and GARCH terms, respectively. The ARCH term ( $\varepsilon_{t-1}^2$ ) measures volatility from previous period measured as a lag of the squared residual from the mean equation. The GARCH term ( $h_{t-1}$ ) measures the last period's forecast variance.

### 4.3 Data

We use monthly data series which includes exchange rate (*EX*), net sales of foreign exchange as intervention variable (*NS*), inflation differential between Malawi and RSA (*PDRSA*), parallel exchange rate premium (*EP*) and dummy variable for seasonality in exchange rate developments (*DMV*). We use nominal bilateral exchange rate of the Malawi kwacha against the US dollar. Parallel exchange rate premium is the difference between official exchange rate and parallel exchange rate. All variables are expressed in logs except for net sales.

## 5.0 Estimation and Results

### 5.1 Time Series properties of the data

We first conduct a descriptive analysis of the data for the first part of the study. Table 1 shows that the variables do not follow a normal distribution. The second step is to test for unit root in the variables.

**Table 1: Data distribution**

Variable	Mean	SD	Skewness	Kurtosis	Normality
NS	5.071250	14.606000	-0.467366	4.067161	4.192828
EX	101.4513	17.29165	-0.341316	1.957089	3.236769
PDRSA	4.950000	3.727463	0.680481	2.398785	4.612578
EP	10.82800	7.367356	-0.056362	2.293603	1.066048

**Table 2: Phillips Perron Unit root test**

<u>Variable</u>	<u>Level</u>	<u>1<sup>st</sup> Difference</u>
EP	-1.5877054	-7.391786*
EX	-2.289211	-5.096791*
NS	-6.293474*	
PDRSA	-1.486199	-5.478247*

Where \* implies that the variable is significant at 5 percent level of significance

The results show that variables such as exchange rate (*EX*), exchange rate premium (*EP*), and price differential between Malawi and South Africa (*PDRSA*) are non-stationary (integrated of order one) and thus become stationary after first difference. On the other hand, net sales of foreign exchange (*NS*) is stationary (integrated of order zero)

The next step is to find out whether RBM intervention (net sales of foreign exchange) in foreign exchange market in Malawi affects the kwacha. Seasonal dummies are introduced for seasonal trends in kwacha movements. We set off by running an OLS equation of the exchange rate depreciations on a constant, the net sales of foreign exchange, parallel exchange rate premium and inflation differential (to take care of balance of payments pressure) and seasonal dummy variable (to take care of seasonal trends in kwacha fluctuations). The results are indicated in table 2 below.

**Table 3: Conditional Mean Equation**

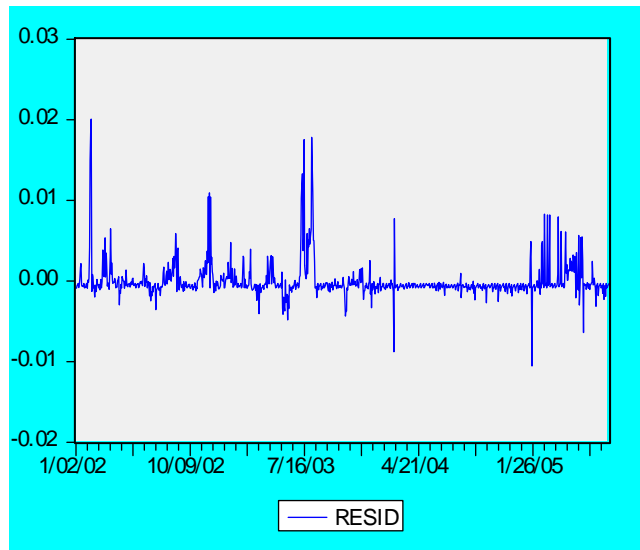
	Coefficient	Std. Error	t-statistic	prob
C	0.001440	0.006191	0.232587	0.6172
DMV	0.006142	0.00753	0.814969	0.2195
$\Delta$ LN <i>PDRSA</i> (-1)	0.006078	0.003003	2.024214	0.04452
$\Delta$ EP	0.000416	0.000922	20.451010	0.6822
NS	0.001467	0.000255	1.834534	0.0343
R-squared	0.414862			
D_W test	1.525484			

The results find that net sales of foreign exchange by the Reserve Bank of Malawi depreciate the kwacha. The results also indicate that price differentials between Malawi and South Africa affect the kwacha. As the price differentials widen, the kwacha tends to depreciate. It is also necessary to find out whether net sales of foreign exchange affect the volatility of the kwacha. We conduct ARCH tests on the residuals of the conditional mean equation to test for the presence of ARCH effects. The Results are presented below:

**ARCH Test**

F-statistic	0.26245	probability	0.0355
Obs*R-squared	0.28527	probability	0.0285

**Figure 5: The Residuals are heteroskedastic**



Results from the ARCH tests indicate that we reject the null hypothesis of no ARCH effects in the equation. Since there is presence of ARCH effects (i.e. presence of heteroskedasticity in the residuals), we then proceed to estimate a GARCH (1,1) model and simultaneously estimate the effect of net sales of foreign exchange on both the mean and volatility of the kwacha.

In this study, we use GARCH method to model the heteroscedastic errors in our conditional mean equation. Compared to the Engel’s basic ARCH model, the GARCH model is a useful improvement that allows a parsimonious specification (it is robust to various types of misspecification. This approach is also beneficial because it allows us to

simultaneously test the effect of intervention on both the mean and conditional volatility of kwacha. The results are indicated in the table below:

**Table 4: GARCH estimation of exchange rate**

	<b><u>Conditional mean equation</u></b>			
	Coeff.	Std.Error	z-statistic	prob.
NS	0.005180	0.000131	1.380607	0.0474
$\Delta \text{LNPD RSA} (-1)$	0.001694	0.001685	3.973908	0.0001
$\Delta \text{EP} (-1)$	0.000436	0.000558	0.780752	0.4349
DMV	0.004593	0.003486	1.139680	0.2544
C	0.004593	0.003393	1.353630	0.1759
	<b><u>Conditional variance equation</u></b>			
C	2.5206	1.298662	0.19415	0.6584
NS	-1.6289	0.35658	0.20635	0.0025
ARCH ( $\varepsilon^2_{t-1}$ )	0.056893	0.010376	-5.426136	0.0000
GARCH ( $h_{t-1}$ )	1.073047	0.031253	34.33400	0.0000

The results show that net sales of foreign exchange by the Reserve Bank of Malawi depreciate the kwacha. This effect is very small, however. When the RBM sells foreign exchange with the intention of appreciating the kwacha, the kwacha depreciates instead.<sup>5</sup> Since the Malawi economy has low levels of foreign reserves, and considering that most foreign exchange sales are conducted during the lean period of foreign exchange, the result suggests that the Reserve Bank foreign exchange sales are simply meant to reduce the rate of depreciation of the kwacha. In literature, this result is generally interpreted as ‘leaning against the wind.’ In other words, the Reserve Bank foreign exchange sales are simply meant to reduce the rate of depreciation of the kwacha.

<sup>5</sup> This reflects an endogeneity problem. In other words, we are picking up influences from an RBM reaction function rather than isolating the impact of intervention. This suggests that RBM is choosing a positive value for NS whenever it thinks EX is going to be too big. What we are estimating is some combination of intervention parameter and reaction function parameter.



We may also suspect that the results are reflecting speculation in the foreign exchange market. Typical of small economies, even after a Reserve Bank sale, the dollar tends to quickly dry out on the market due small magnitudes of foreign exchange sales. What happens is that market speculators tend to buy as much foreign exchange as is possible after foreign exchange sales by the Reserve Bank and then withhold the foreign exchange till the exchange rate rises again and then they sell afterwards<sup>6</sup>. This form of speculation may be the result of the fact that since the kwacha was floated in February 2004, the nominal exchange rate has on continuously been on the depreciating trend (from K4.5/US dollar in 1994 to K138.65/US dollar as of end August 2006).

It must however be noted that, while the effect of net sales of foreign exchange on the kwacha is statistically significant, it is not economically significant. In particular, for the full sample period, a US\$10 million sales of foreign exchange is associated with a rather 0.05 percent depreciation of the Malawi kwacha.<sup>7</sup>

The results also indicate that price differentials between Malawi and South Africa affect the kwacha. As price differentials widen, the kwacha tends to depreciate. It must be noted that South Africa is Malawi's major trading partners with a weight of about 48 percent. So any price differentials between the two countries have consequent effects on the kwacha. Similarly, higher exchange rate premium tend to depreciate the kwacha.

We also find that RBM intervention decreases the volatility of the kwacha as evidenced by the negative sign of net sales of foreign exchange variable in the variance model. This implies that the Reserve Bank of Malawi is able to achieve its goal of smoothing out fluctuations of the kwacha. From the graphical exposition of the exchange rate movements, it is clear that the Reserve Bank of Malawi was able to stabilize the kwacha successfully in the larger part of the year 2004. A policy decision was taken in August 2003 to stabilize the Kwacha at a rate of K108.94 against the United States dollar. The

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<sup>6</sup> See Simatele (2004)

<sup>7</sup> This result is consistent with findings by Edison (1999)

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 exchange rate 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 Kwacha then stabilized at those levels until early 2006, when economic conditions necessitated a further review. The ARCH ( $\sigma$ ) and GARCH ( $\delta$ ) terms are both positive and statistically significant.

## **6.0 Policy Implications and Conclusion**

The paper analyses the effectiveness of foreign exchange market interventions carried out by the Reserve Bank of Malawi. The paper uses monthly data of Reserve Bank of Malawi intervention (net sales of foreign exchange), and exchange rate data, among others, over a four year period. We start off by running a conditional mean equation using changes in exchange rate as regressor. The results show the presence of ARCH effects. With the presence of ARCH effects, we then move ahead to run a GARCH (1,1) model by quasi-maximum likelihood. In line with similar findings elsewhere in the literature, the paper finds that net sales of dollars by the Reserve Bank of Malawi depreciate, rather than appreciate, the kwacha. This effect is very small however. Moreover, the paper also finds that the Reserve Bank of Malawi intervention reduces the volatility of the kwacha.

This shows that the Reserve Bank of Malawi actually achieves its objective of smoothing out fluctuation of the kwacha. This can be evidenced by the stability of the kwacha in a larger part of 2004. Thus intervention is, to some extent, used as an effective tool for moderating fluctuations of the Malawi kwacha. However, its effectiveness is constrained by the amounts of foreign exchange reserves, which are usually low. In the short-term, therefore, the Bank has to do a lot of balancing in managing the exchange rate to ensure that the achievement of a stable exchange rate, which is good for the economy, does not come at the expense of inflation and the depletion of foreign reserves. In the medium to long-term, efforts must be directed at transforming the economy into a producing and exporting one so that enough foreign exchange is generated to ensure success of foreign exchange interventions.

**Appendix: Table A (1): Variables**

Variable name	Variable description
$Ex_t$	Malawi Kwacha – United States Dollar exchange rate
NS	Net sales of foreign exchange capturing Reserve Bank of Malawi interventions
DMV	dummy variable for seasonal trends in exchange rates
EP	parallel exchange rate premium
PDRSA	inflation differential between Malawi and RSA
$  $	the absolute value operator
$I_t$	the information set through time t-1
$\varepsilon_t$	the disturbance term
$\varepsilon^2_{t-1}$	ARCH term
$h_{t-1}$	GARCH term

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