The Efficacy of Foreign Exchange Market Intervention in Malawi.

Kisukyabo Simwaka*

and

Leslie Mkandawire*

Research and Statistics Department, Reserve Bank of Malawi

Abstract

The Malawi Kwacha was floated in February 1994. However, the Reserve Bank of Malawi has actively intervened in the foreign exchange market. Both the levels and volatility of the exchange rate have changed so much between January 1995 and December 2003, perhaps connoting that the market is not working so well or else a result of impromptu management.

Using the daily exchange rate and official intervention data from January 1995 to December 2003 the paper is intended to examine the effects the Reserve Bank of Malawi foreign exchange operations have had on the level and volatility of the Malawi Kwacha exchange rate.

The direct effects on the level of exchange rate will be assessed using an event study approach. Policy intervention effects on the exchange rate volatility shall be examined over the period of floatation of the exchange rate..

* Authors are Economists in the Research and Statistics Department of the Reserve Bank of Malawi. 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
Email address: ksimwaka@rbm.malawi.net (K. Simwaka)
lesmkandawire@rbm.malawi.net (L. Mkandawire)

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1. Introduction and background

1.1 Concept of Foreign Exchange Intervention

Intervention in foreign exchange market can be an important tool for central banks, particularly in developing countries. However, it can put the central bank's credibility and scarce foreign exchange reserves at risk. Operational aspects of intervention, including the timing, frequency, amounts, modalities of intervention, are among the most important decisions taken by monetary authorities.

In this paper, intervention is defined as official purchases and sales of foreign exchange to achieve one of the following three objectives: moderating exchange rate fluctuations and correcting misalignment, accumulating foreign exchange reserves and supplying foreign exchange to the market. Our definition includes reserve accumulation and supplying foreign exchange because they are common objectives of intervention in many developing countries. Reserve accumulation is particularly important for countries intent on building investor confidence and strengthening their debt repayment capacities and external liquidity positions.

1.2 Rationale for central bank intervention

There are four broad based reasons why central banks intervene in the foreign exchange market.

- **Misalignment**. Central banks intervene in the foreign exchange market to influence the level of exchange rate. Usually, central banks believe that the market is driving the exchange rate away from its 'equilibrium' value and intervenes to break the momentum.

- **Calming a disorderly market.** Central banks intervene to calm the market and so it from becoming disorderly. Rapid movement in the exchange rate may at times threaten the orderly functioning of the market, leading to a widening of spreads and at times loss of liquidity. This action serves to discourage the market from becoming one-sided.

- **Signaling/accommodating monetary policy.** Intervention may be used to signal future changes to monetary policy or possibly calm expectations if monetary policy is changed unexpectedly, which might otherwise lead to a loss in confidence and thereby induce an unwarranted move in the exchange rate.

- **Reserve building**. Central banks intervene to maintain an inventory of net foreign currency assets.

1.3 Divergent views on effectiveness of foreign exchange intervention

There are three main views on the effectiveness of foreign exchange rate intervention by central banks. In one view, intervention policy is believed to be not only ineffective in altering the level of exchange rate ('leaning against the wind' to return the spot exchange rate to some target level) but also counterproductive, as it can increase the volatility of the exchange rate. Another view is that intervention operations can influence the level of the exchange rate, and can also 'calm disorderly markets,' thereby reducing exchange rate volatility. Finally, a skeptical group argues that intervention operations are of little import, as they do not affect either level or the volatility of exchange rate (Dorminguez, 1998).

1.4 Earlier studies on exchange rate in Malawi

Mathisen (2003) computed Malawi's equilibrium real exchange rate as a function of its fundamentals as derived from economic theory. It found evidence in favour of the equilibrium approach to exchange rate determination. Government consumption, excluding wages and salaries, had a positive impact on the real exchange rate, consistent with most government spending being directed towards non-tradables. In contrast, the long-run impact of wages and salaries on the real exchange rate was negative, indicating that a large wage bill in terms of GDP tends to put pressure on the external current account. The terms of trade of goods appear to be positively correlated with the real exchange rate, confirming the impact of wealth effect. Also real per capita growth and investment were positively correlated with the real exchange rate. Finally, a loose monetary policy was associated with a depreciating real exchange rate.

The results also indicated a rapid adjustment of any deviation of the real exchange rate from its equilibrium value. The paper showed that, in the absence of further shocks, about half the gap between the actual value of the REER and its equilibrium values could be eliminated within about 11 months.

1.5 Current behaviour of the Reserve Bank of Malawi regarding reserve management and exchange rate market operations:

The exchange rate has been fairy floating since 1994. The RBM intervenes to manage the exchange rate path through smoothening seasonal fluctuations (mainly from tobacco auctions which take place between May and September) and to meet the net official reserves target but has also in the past intervened to support the Kwacha and to allow a faster depreciation of the

Kwacha. In nominal terms the exchange rate has experienced a large overall depreciation since 1994 initially reflecting the transition and thereafter worsening terms of trade and other economic fundamentals. Sharp devaluations occurred in 1994, 1998 and 2000 followed by periods of relative stability and even nominal appreciations. However, as a result of high inflation in Malawi and large depreciations of the currencies of its major trading – South Africa and Zimbabwe – competitive gains have been eroded fairly quickly. The currency had been quite unstable during the first half of 2003 and has been stable since the latter part of the year.

Section 2 looks at the purpose of the study, while section 3 gives a brief review of the empirical literature. The VAR model based on Mc Carthy (1999) is developed in section 4 where also the pass-through estimates are made.

2. Purpose of the Study

The main objective of the study is to examine the efficacy of official intervention in the foreign exchange markets using data on the Malawian experience over the period from 1995 to 2003. The important issues being addressed are: first, does intervention affect the direction of exchange rates? Secondly, can intervention calm the volatility of exchange rate movements? Data on the Reserve Bank of Malawi daily purchases of foreign exchange undertaken for intervention purposes to try and affect exchange rate was used.

3. Literature Review

There is a broad consensus in the literature that unsterilized intervention can affect nominal exchange rates by changing money supply and domestic

interest rates. However, there is very little in the way of consensus regarding the effects of sterilized intervention. Sterilized intervention (where the authorities take action to offset the effects of a change in official foreign assets on the domestic monetary base, leaving interest rates unchanged) alters the currency composition of domestic and foreign assets, and has been seen to affect the exchange rate through two principle channels (Mussa, 1981). First, the portfolio balance channel (where a change in the reserve holdings of the central bank induces private agents to revalue their portfolios of domestic and foreign assets); and second, signaling channel (where the central bank uses foreign exchange operations to signal forthcoming changes in monetary policy). Dominguez and Frankel (1993) conclude that central bank intervention can be effective by changing expectations of future exchange rates.

Using daily exchange rate and official intervention data from January 1984 to December 2001, Hali Edison, Paul Cashin and Hong Liang (2003) examined what effects, if any, foreign exchange operations by the Reserve Bank of Australia (RBA) have had on the level and volatility of the Australian Dollar exchange rate. Their results indicated that over the period 1997-2001, the RBA had some success in its intervention operations, by moderating the depreciating tendency of the Australia dollar. The results also indicated that intervention operations tend to be associated with an increase in exchange rate volatility, suggesting that official intervention may have added to market uncertainty. Overall, the effects of the RBA intervention were quite modest on both the level and volatility of the Australia dollar exchange rate.

Jonathan Kean and Roberto Rigobon used a novel identification assumption, a change in Reserve Bank of Australia intervention, that allowed them to estimate a model that includes the contemporaneous impact of intervention. They used a simulated Generalized Methods of Moments (GMM) to estimate

the model. Their point estimates suggested that central bank intervention has a substantial effect. They found that a sterilized purchase of US$100 of Australian dollars by RBA would be associated with an appreciation of between 1.3 and 1.8 percent. Second, an intervention was shown to have its largest effect on the exchange rate on the day in which it was conducted, with smaller effects on subsequent days. , of its conduct. This finding has not previously been demonstrated in the literature due to the problem of endogeneity and confirms the belief of central banks of the immediacy of the effects of intervention. Finally, they confirmed findings that intervention policy can be characterized by 'leaning against the wind' concept.

4. Data

The data to be used in this study are daily interbank mid-rate quotes expressed as U.S. dollars per Malawi kwacha (US$/MKW), in which case a rise in the exchange rate is an appreciation of the Malawi kwacha. Offcial intervention is depicted as any sale (negative) or purchase (positive) of foreign assets (US dollars) against domestic assets in the foreign exchange market, measured in current Malawi kwacha. All data are daily in frequency and are sourced from the Reserve Bank of Malawi covering the period from January 1994 to December 2003.

5. Theoretical Framework

One rationale for central bank intervention is calm the market and so prevent it from becoming disorderly. Rapid movements in the exchange rate may at times threaten the orderly functioning of the market, leading to a widening of spreads and at times loss of liquidity. To address this issue, it is necessary to measure volatility. There are broadly two ways to measure exchange rate

volatility: using two econometric techniques (see Dominguez, 1997 and 1998; and Kim, Kortian, and Shen, 2001) or using market determined option prices (see Bonser – Neal; and Tanner, 1996; Murray et al., 1997; and Edison, 1998).

Both approaches have their merits, but owing to lack of readily available options data, the effects of RBM intervention are modeled by investigating the statistical properties of changes in the daily exchange rate on the days of intervention, using a GARCH model. The null hypothesis in this analysis is that intervention has no effect on the volatility of the exchange rate with two alternative possibilities:

(i) intervention is associated with lower volatility; or (ii) intervention is associated with higher volatility.

We will look at the daily intervention operations and unconditional volatility of the exchange rate (as measured by the square of the percentage change in the logarithm of the exchange rate). Since the expected sign on the impact of intervention is ambiguous, we will also examine the basic trends of exchange rate volatility (as measured by the square of the percentage change in the logarithm of the exchange rate) around intervention days. In particular, the model will examine the percentage of days volatility increases following intervention; the percentage of days volatility increases above the previous trend average prior to intervention; the percentage of days volatility increases both prior to and following intervention.

6. Methodology

(a) Analyzing the effectiveness of Intervention Using an Event Study

There are many ways in which the effectiveness of official intervention can be evaluated. Some studies have used a case/event study to make such an

assessment. In the case study approach, an episode 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 intervention activity between the initial and subsequent intervention transactions. To evaluate the effectiveness of intervention, and in line with previous empirical work, two criteria are used: (i) intervention leads to an immediate reversal of exchange rate trend (referred to as a 'short-term' effect); and (ii) intervention leads to a continued reversal of the exchange rate trend one month after the intervention episode has ended (referred to as 'long-term' effect). Given these two criteria, there are four possible outcomes.

- **Definite Success (DS)**. Both a short-term and a long-term reversal of trend in the exchange rate occur after an intervention episode.
- **Failure (F)**. There is neither a short-term nor long-term reversal in the trend in the exchange rate after an intervention episode.
- **Short-term Success (STS)**. There is only a short-term effect on the exchange rate, but no long-term effect after an intervention episode
- **Long-term Success (LTS**). There is a short-term effect on the exchange rate, but there is a long-term effect after an intervention episode.

(b) The empirical model

In this paper we follow Baillie and Bollershev (1989) and Dominguez (1998) and use a univariate generalized autoregressive conditional heteroskedastic (GARCH) model to account for time-varying conditional variance structure of the errors in the first-differenced exchange rate series. The hypothesis of interest is the extent to which changes in the conditional mean and variance of the Malawi Kwacha exchange rate are associated with changes in the intervention variables.

The basic regression model, with GARCH (1,1) errors, is as follows:

$$\Delta kd_t = \Phi_0 + \Sigma^4_{i+1}\Phi i\ dw_{it} + \Phi_5\ intev_t + \varepsilon_t \qquad (1)$$

$$\varepsilon_t \mid I_{t-1} \mid \sim N(0, h_t) \qquad (2)$$

$$h_t = \alpha o + \Sigma^4_{1+i}\ d_{it+}\ \alpha\ |interv| + \theta\varepsilon^2_{t-1} + \lambda h_{t-1} \qquad (3)$$

where Δkd_t is the log change in the Malawi Kwacha - US dollar exchange rate between period $_t$ and $_{t-1}$ (a positive value is a depreciation of the Malawi Kwacha); dw_{it} are day of the week dummy variables (that is dw_{it} = 1 on Mondays); $intev_t$ is the variable capturing RBM reported intervention operations (a positive value indicates net purchases of foreign currency); | | is the absolute value operator; I_t is the information set through time $_{t-1}$; and ε_t is the disturbance term. Equation (1) measures the direct effect of official intervention on exchange rate changes; equation (2) states that regression residuals will be modeled as a GARCH process; and equation (3) describes the conditional variance. Following Dominguez (1998), in the Garch conditional mean equation the intervention variables are included in a manner such that a negative coefficient on intervention indicates a net purchase of foreign currency depreciates the Malawi Kwacha. In the GARCH conditional variance equation, intervention variables appear in absolute value form. The parameters of the model were estimated using the quasi-maximum likelihood approach of Bollerslev and Woodldrige (1992), which yields standard errors that are robust to normality in the density function underlying the residuals.

7. Empirical implementation

The first step of the time series analysis will be to investigate the properties of the series individually. Trend stationarity of the data will first be determined by plotting of the variables and then the results will be confirmed by the unit root tests based on Dickey and Fuller (1979, 1981) and Phillips and Perron (1988). The purpose of this stage of analysis is to determine the number of times the series have to be differenced in order to arrive at stationarity. Supposing the data was found to be non-stationary, the associated results of the estimate will be, in general, spurious and any conclusion derived will not be robust. The variables will initially be in level and then later tested in logarithmic form. In carrying out the unit root the variable will first be tested in level terms and if the test statistic is more negative than the critical value the null hypothesis of non-stationarity is rejected and the alternative hypothesis of stationarity is adopted. But if it has been concluded that the variable in level terms contains a unit root, the test is repeated for the first differenced form. If it has been concluded that the variable in first differenced form is stationary, it means that the variable must be differenced once for it to be stationary. In this regard the variable is integrated of order 1 (or $X \sim I(1)$). It is expected that if the ADF test results indicate that the data used in the inflation equation are trend stationary then, the application of standard econometric methods will produce robust results. The ADF test equation is in the form:

$$\Delta \ln X_t = a X_t + \Sigma \beta_i \Delta \ln X_{t-i} + \xi t \qquad (3)$$

After establishing the existence of unit root in the variables, the next step is to assess whether the variables are cointegrated. This is done using the Johansen cointegration test.

The study further assesses the existence of week exogeneity by examining the endogenous variables against other variables not specified in the analysis and using appropriate lags. The study also examines the existence and direction of causality between the dependent variable on the one hand and the explanatory variables on the other. The purpose of this assessment is to establish the existence of endogeneity between the explanatory variable (dw and intev) and the dependent variable (kd). The Granger (1969) test is used for this purpose. If there is no endogeneity, then the use of Ordinary Least Squares (OLS) technique is appropriate. It is important to know which variable influences which. For instance, do exchange rate depreciations / appreciations influence overall inflation or it is the other way round ? Granger causality does not exist between x and y when $f(x_t | x_{t-1}, y_{t-1})$ equals $f(x_t | x_{t-1})$. This means that lagged values of y_t do not add any information to the explanation of x_t. This concept is useful in the construction of forecasting models because if x_t is granger caused by past values of y_t, then taking into account past values of y_t in forecasting models improves predictions of x_t. In this study, Eviews will be used to perform pair-wise tests on money supply variable and the key explanatory variables used in the model.

8. Expected Results, Policy Implications and Conclusion

The results will show the effects of foreign exchange operations by the Reserve Bank of Malawi (RBM) on the level and volatility of the Malawi Kwacha exchange rate. First, the event study will evaluate the effectiveness of intervention by examining the direct effect on the level of the exchange rate. We will find out whether over the period 1994 – 2003, the Reserve Bank of Malawi has had some success in its intervention operations, by moderating the depreciating tendency of the Malawi Kwacha. Second, we will investigate

the effects of RBM intervention policies on the exchange rate volatility over the floating period. The results will indicate whether or not intervention operations tend to be associated with an increase in exchange rate volatility (i.e. whether official intervention may have added to market uncertainty.

Policy makers will be in a position to identify appropriate aspects and direction in the foreign exchange intervention and its effects on the exchange rate volatility.

APPENDIX A.

Table A(1)

Variable name	Variable description
kdt	log change in Malawi Kwacha – United States Dollar
dw	are the day of the week dummy variables
Interv	the variable capturing RBM reported intervention operations
$\|\|$	the absolute value operator
I_t	the information set through time t-1
ε_t	the disturbance term

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