Monetary Policy Effects and Output Growth in Malawi: Using a Small Macroeconometric Model

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Abstract

This study tries to develop and use a small macroeconometric model to capture the main short-term macro dynamics and to forecast major macroeconomic variables of the Malawian economy. The results show that a reduction in the policy rate leads to a fall in the lending rate, but with an increase in money supply, and with an insignificant impact on output growth. The results suggest that monetary authorities in Malawi have to make a choice between the objectives of maintaining lower money supply and lowering the lending rate. The results suggest also that, despite the Reserve Bank of Malawi Act of 1989 stipulating that monetary authorities should pursue both price and high growth and employment objectives, our results reveal that price stability is the principal objective of monetary policy in the country. Suggesting that monetary authorities in the country should not only place more emphasis on the objective of stabilization and achieving low inflation, but also focus on supporting strong, sustained and shared growth. To some extent further suggesting that emphasis should be placed on policies and strategies aimed at structurally transforming the Malawian economy so that the monetary policies' impact should translate into an increase in the country's output and growth. Further suggesting enhanced effective coordination between fiscal and monetary policies.

Keywords

Macroeconometric Models, Policy Rate, Policy Simulations, Malawian Economy

1. Introduction

Conventional wisdom has generally held that macroeconomic policy should create an enabling environment for industrial policy and should also maintain conditions which facilitate the structural transformations necessary for economic development (Heintz, 2013) [1]. However, it has been widely argued that African countries' macroeconomic

policies have for long placed emphasis on the objective of stabilization and achieving low inflation, instead of focusing on supporting strong, sustained and shared growth (Brixiova and Ndikumana, 2010 [2]; ECA, 2015) [3]. The monetary policies pursued by most African countries have managed to bring down inflation over the last two decades, with the continent experiencing significant and robust growth rates over the period (Figure 1). However, no studies have been carried out to assess to what extent the different monetary policy instruments being used could have affected the different macroeconomic variables especially a country's output growth despite some literature looking at the monetary policy's transmission mechanisms in developing countries.

As is the case with most developing countries, the main objective of the monetary policy in Malawi is to achieve low and stable inflation with output being an indirect outcome as it mainly aims at having low and stable prices that preserve the value of the Kwacha (the local currency), and encourages the investment needed to achieve sustainable economic growth and employment creation (Reserve Bank of Malawi (RBM), 2015) [5]. This study is expected to develop a model that could aid in the process of providing evidence-based monetary policy decisions, as to what policy makers should put emphasis on in order for the monetary policy to have the desired effects on the country's growth. To the best of the author's knowledge there is no functional model for Malawi that is regularly updated to provide a scientific basis for monetary policy decisions and their effects on growth.

The model used in the study is essentially a small scale macroeconometric model with a considerable theoretical content that is typically designed for policy analysis. The model will assist in examining the interactions among key macroeconomic variables, evaluating the response of these variables to adjustments in monetary policy rate and reserve money, and providing some criteria for judging the various policy outcomes especially those related to monetary policy's impact on output growth. The model focuses on examining the interactions among key macroeconomic variables, evaluating the response of these variables to adjustment in monetary policy rate, and providing
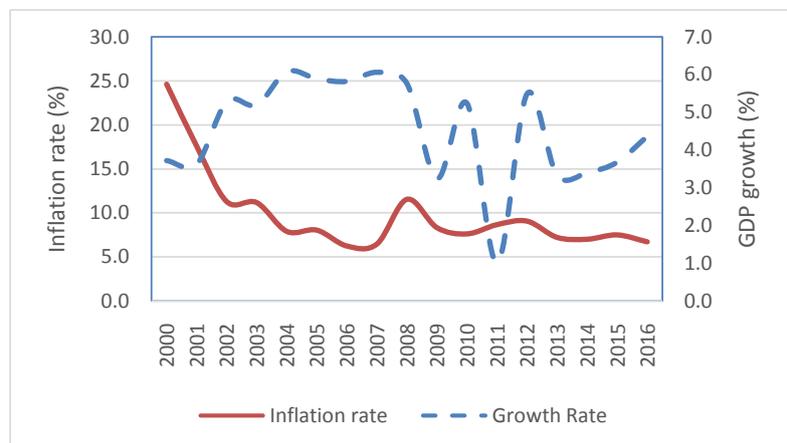
Figure 1. GDP growth and inflation rate trends in Africa, 2000-2016. Source: UN-DESA 2016 [4].

some criteria for judging the various possible policy outcomes. Based on the estimated results and outcomes of model simulations on alternative policy options covering the period 2002 M1 to 2015 M3, some meaningful policy decisions and choices are generated based on some rigorous analytical framework. Hence the study analyses the effects of three policy options or scenarios based on the assumptions that the RBM is likely to make to the monetary policy rate (MPR). The potential impacts of these scenarios are identified mainly based on the selected key macroeconomic variables which include, output, inflation, exchange rate, interest rate and money supply. In other words these policy simulations should assist in determining what the likely impacts might be on the economy, if the scenarios under consideration are implemented. To the best of the author's knowledge the monetary authorities in Malawi do not have a model that could be used as the basis for carrying out the country's monetary policy and/or utilization of the different monetary instruments being implemented. Hence monetary policy decisions have been to some extent ad-hoc in nature with minimal consideration for evidence-based monetary policy decision making. In this regard this paper aims to support the decision making process by the monetary authorities by offering a reliable starting point in the assessment and justification in choosing monetary policy instruments to achieve the country's development objectives.

The rest of the paper is organized as follows. The next section briefly summarizes the country's macroeconomic performance by looking at selected key macroeconomic variables (in relation to changes in monetary policy) perceived to be of significance to this study. Section 3 presents a brief review of some previous studies in the area. Section 4 presents the theoretical framework underlying the model and the methodology employed. Section 5 presents the results of the analysis and the effects of the scenarios while Section 6 concludes the paper.

## 2. Monetary Policy and Macroeconomic Performance in Malawi

Malawi is among the world's least developed countries, which is heavily agricultural-based, with around 85% of the population living in rural areas. More than one-third of GDP and 90% of export revenues come from agriculture. Monetary policy plays a prominent role in the management of the country's economy. The RBM Act of 1989 outlines the principal objective of the country's central bank as to "implement measures designed to influence the money supply and the availability of credit, interest rates and exchange rates with the view to promote economic growth, employment and stability in prices". Achieving this objective requires not only an understanding of the process through which monetary policy affects economic activity (Ngalawa and Viegi, 2011) [6], but also the extent to which these measures affect the fundamental outcome of these impacts, which is economic growth. Which actually does not feature directly and prominently as the fundamental objective in monetary policy in many African countries (RBM, 2015 [5]; Ayubu, 2013 [7]; Fofack and Ndikumana, 2014 [8]). Under the monetarist framework, containing inflationary pressures and anchoring inflation expectations have been the primary objective of monetary policy, regardless of a countries

initial conditions and irrespective of potential distortions in the monetary transmission mechanism that may originate factors such as capital flight and withdrawal of donor support. Monetary policy in most African countries puts emphasis on achieving and maintaining price stability in the interest of sustainable and balanced economic development and growth. This is based on the understanding that price stability reduces uncertainty in the economy and, therefore, provides a favourable environment for growth and employment creation. Furthermore, low inflation contributes to the protection of the purchasing power of all households, particularly the poor who have no means of defending themselves against continually rising prices. However, it has been argued that the implementation of such a broad mandate could be practically challenging, since some of the policy objectives could be in conflict with each other (Kwalingana, 2007) [9].

In Malawi, monetary policy is set by the Central Bank's Monetary Policy Committee (MPC), which conducts monetary policy within a flexible inflation-targeting framework. This allows for inflation to be out of the target range as a result of first-round effects of a supply shock and for the Central Bank (RBM) to determine the appropriate time horizon for restoring inflation to within the target range.

In line with the RBM Act, the central bank introduced two new instruments of monetary policy, namely liquidity reserve requirement and a discount window facility. The discount window facility led to the introduction of the bank rate, which has since become a very powerful indicator of the stance of monetary policy. A change in the bank rate is usually followed by near instantaneous corresponding changes in both lending and deposit rates, with average yields on government securities following the same direction (Ngalawa and Viegi, 2011 [6]). However, by May 1990 and February 1994 interest rates and exchange rates, respectively, became fully liberalized in Malawi (Kwalingana, 2007 [9]; Mlachila and Chirwa, 2002 [10]; Mangani, 2011 [11]).

Monetary policy implementation in Malawi continues to be underpinned by inflation dynamics especially by the dominance of the agricultural sector activities and the country's reliance on donor funding which contributed about 40% of the country's budget. Inflation is observed to improve with improved food availability and tobacco sales from April to September every year. It then accelerates with food scarcities and excessive demand for foreign exchange from October to March. However, it is claimed that the country's monetary policy does not seek to address these dynamics but rather to achieve balance between output growth and monetary aggregates as well as to smoothen the exchange rate movements. With the belief that these inflation dynamics will improve over time as production structures respond to macroeconomic stability in the context of a market-determined exchange rate (RBM, 2015 [5]).

Figure 2 shows interest rates declining from as high as 52 per cent, levels reached in 2000, mainly due to increased deficit financing as the IMF stopped aid disbursements due to corruption concerns in December 2000, and many individual donors followed suit, resulting in an almost 80% drop in Malawi's development budget. The deficit financing led to an increase in liquidity in the economy, exerting pressure on both
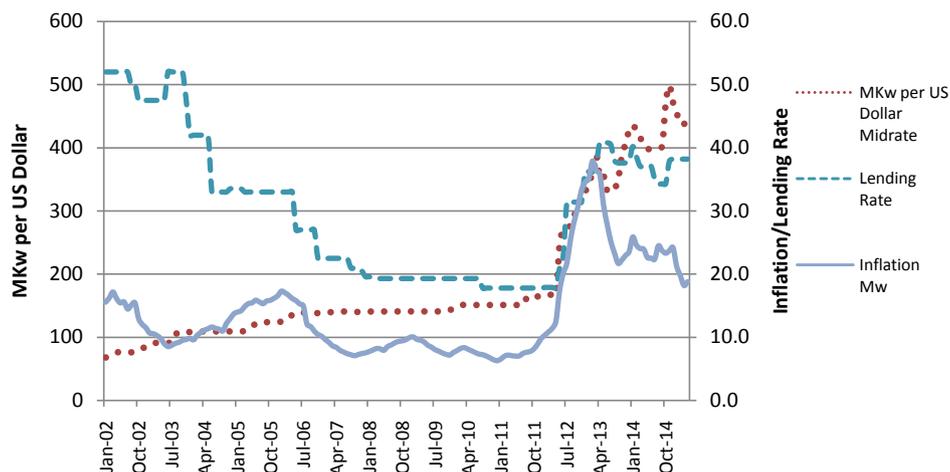
Figure 2. Inflation, exchange rate and interest rate dynamics, January 2002-March 2015. Source: Reserve Bank of Malawi.

interest rates and domestic prices. Since then both interest rates and inflation declined significantly due to improved fiscal management and increased real growth, with interest rates, inflation, money supply and GDP growth averaging 24.3 per cent, 10.9 per cent, 1.9 per cent and 6.3 per cent respectively over the period 2005-2009.

However, since 2005, Malawi enjoyed price stability as inflation declined from 16% to 7.2% in March 2011. Overall, inflation remained moderate and in single digits since 2007, mainly due to a relentless adherence to a tight monetary policy, heavily buttressed by fiscal discipline and stable exchange rate up-to January 2012 when it jumped to 10.3% and never returned to single digits (Figure 2). Hovering to as high as 37.9% by February 2013, mainly driven by food prices, especially maize prices following poor agricultural performance and depreciation of the exchange rate as it was devalued and subsequently floated during the period (RBM, 2015 [5]).

During this period, especially by mid-2012 inflation rate increased significantly, mainly due to the depreciation of the exchange rate in Malawi, which depreciated by 49 per cent in May 2012 against the major currencies. As a consequence, to contain the depreciation-induced inflationary pressures, and to contain the build-up in inflationary expectations observed before this stage, interest rates were adjusted upwards. During this period, apart from the inflationary expectations arising from the continued uncertainty in the exchange rate policy, increasing food prices, especially maize exacerbated the situation (RBM, 2015 [5]). Over the period May 2012 and May 2013, inflation rates, interest rates and nominal exchange rates reached as high as 38 per cent, 41 per cent and 355 Kwacha per US/$, the highest levels since long time. Figure 2 shows that after this period both inflation and interest rates begun to decline, but the exchange rate continued to depreciate.

Despite the decline, inflation rate has remained relatively high since mid-2014 as a result of monetary tightening, fiscal slippages and continued exchange rate depreciation which further resulted into inflationary pressures, exacerbated by the substantial increase in government domestic borrowing due to donor suspension of direct budget

support to the Malawi Government due to the Cash gate scandal[1] (RBM, 2015) [5]. This raised domestic financing requirements by government, hence creating more liquidity in the economy. This also heightened pessimistic inflation expectations by the public and precipitated exchange rate depreciation. These developments have led to an increase in the growth rate of money supply and inflation (RBM, 2015 [5]). It should also be noted that despite the continued decline in the global oil prices, the Malawian economy has not fully benefitted from this decline as the automatic pricing mechanism on energy prices has not consistently been reflecting this decline in order to translate the impact to the economy (RBM, 2015) [5]. Food prices especially maize during the harvesting seasons, have also of late not significantly been declining to have an impact on inflation.

As observed by Simwaka *et al.*, (2012) [12], **Figure 3** shows that the relationship between inflation and money growth that broke down in 2001 continues to be observed even in recent months, which could be suggesting that the movement of these variables reflects the effect of factors which are outside the control of monetary authorities, such as being a reflection of the underlying structural demand for money. Suggesting further that while monetary policy tightening (with fiscal policy not being very supportive of the monetary policy) remain central to lowering inflation, structural measures to boost productivity in the economy are necessary in ensuring a more sustainable disinflation path.

Figure 3 shows also that growth in real money supply is relatively higher between March and July every year. This to some extent suggests the impact of the improved food availability and tobacco sales in the country which occurs from April to September every year, increasing the stock of money hence increasing aggregate demand and prices. Though the movement is not in line with inflation trends as stipulated above. However, money supply growth declined at a monthly average growth of 1.93 percent over the period 2005-2009 from a monthly average growth of 2.78 percent over the period 2000-2004. However, it increased at an average of 2.01 percent over the period 2010-
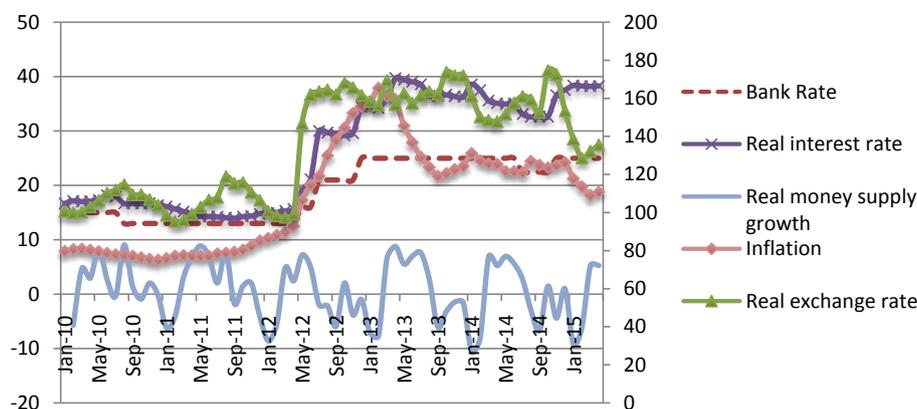
Figure 3. Movements of selected monetary policy related variables, January 2002-March 2015. Note: Only real exchange rate is read from the secondary x-axis. Source: Reserve Bank of Malawi, 2015.

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[1]"Cashgate" is a financial scandal involving looting, theft and corruption that happened at Capitol Hill the seat of Government of Malawi.

2015, implying increasing demand pressures in the economy. Nonetheless, there seems to be a closer relationship between the movements of the inflation rate, real exchange rate, the real interest rate, and the policy rate.

From the late 1990 s to 2005, deficit financing accounted for injections of massive liquidity in the Malawian economy, and exerted pressure on interest rates and prices (Mangani, 2011) [11]. Inflation averaged 41.8% between 1995 and 1999, while the average interest rate was 42.4% (Table 1). Despite inflation rate declining to 18.5% over the period 2000-2004, interest rates averaged 49.1% over the same period. It is important to note that, during thus period the bank rate reached its historical pick of 50.23% in 2000, pushing the base lending rate to 52%. However, since 2005, interest rates and inflation plummeted due to improvements in fiscal discipline and real growth. Also inflation and interest rates were low largely because of good crop harvests and a defacto peg exchange rate which locked out imported inflation. With inflation rates and lending rates averaging 10.9% and 24.3% respectively between 2005 and 2009, while real GDP growth reached an average of 6.3%, with a relatively lower money supply growth rate of 1.93% over the same period (Table 1). Money supply growth declined over the period 2005-2009, as the period experienced a significant economic growth which averaged 6.3% as the country experienced significant improvements in fiscal management and discipline (Mangani, 2011) [11].

The nominal exchange rate depreciated at an average monthly rate of 2.8 per cent between June 2012 and April 2015, however it depreciated by more than 107 per cent between 200-2009 and 2010-2015 periods (see Table 1). A close look at the relationship between nominal exchange rate (NER) and net foreign assets (NFA) in Figure 4, data reveals that each and every decline in NFA is associated with an appreciation of the nominal exchange rate and *vice versa*, which is in line with economic theory. It is also observed from the Figure that a significant decline occurred between July and November every year[2] before the trend disappeared towards the last quarter of 2013 onwards, as donor support was being withdrawn due to the Cash gate scandal since November 2013.

Table 1. Changes in selected key macroeconomic variables in Malawi, 1990-2015.

Time periods	GDP growth	Nominal exchange rate (% change)	Lending rate	Inflation rate	M2 growth	NFA growth (% change)	Net domestic credit (% change)
1990-1994	1.32	4.47	24.7	23.59	2.38	63.95	2.3
1995-1999	6.94	24.13	42.43	41.8	2.70	3.06	1.72
2000-2004	1.87	82.95	49.12	18.5	2.78	4.35	−25.75
2005-2009	6.30	135.22	24.32	10.9	1.93	7.43	2.94
2010-2015	4.52	280.22	28.13	17.86	2.01	17.71	1.39

Source: Reserve Bank of Malawi, 2015.

[2]Usually during this period, demand for foreign exchange is high, as agricultural inputs are imported during this period while supply is low, and monetary authorities intervene in the market by selling forex during this period to meet key import needs.
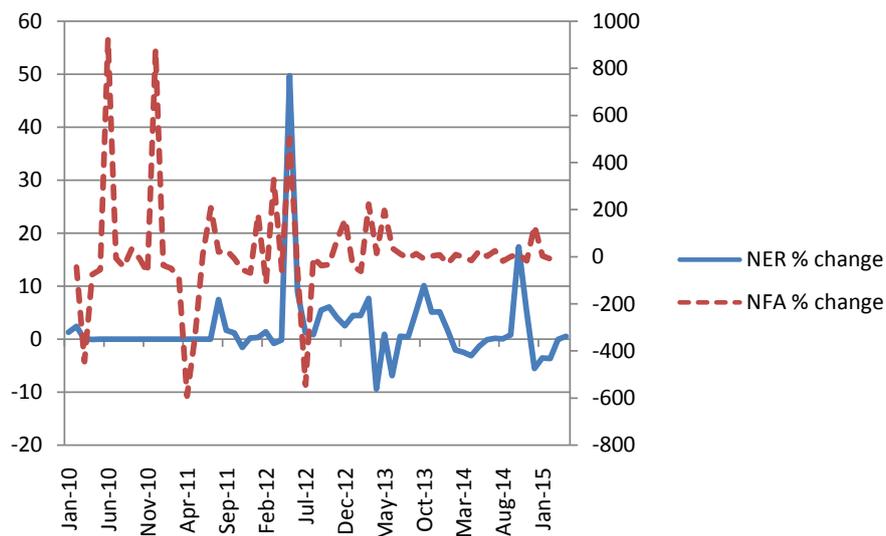
Figure 4. Movements in nominal exchange rate (NER) and net foreign assets (NFA), Jan. 2010-Apr. 2015. Note: Nominal exchange rate (NER)% is read from the primary axis. Source: Reserve Bank of Malawi, 2015.

Monetary policy remains tight due to inflationary pressures, as the monetary authorities recently raised to 27 per cent in October 2015 from 25 per cent, due to resurgence in inflation. This has to a greater extent been influenced by the government's increased domestic borrowing including from the Central Bank through monetization and issuance of government securities.

3. Literature Review on Previous Studies

Small scale macroeconometric models are aggregated models with a considerable theoretical content that provides a stylized representation of the whole economy as they contain fewer equations as compared to large scale models, although they stull share the same underlying economic paradigm with large scale models. These models are less complex (despite capturing the whole economy), as compared to CGE models and Dynamic Stochastic General Equilibrium models. In addition they allow for a more restrictive structure, hence ensuring a high degree of flexibility in model simulations mostly in the form of restrictions on coefficient signs and equation dynamics (Olofin *et al.*, 2014) [13]. With these characteristics, these models appear to be having a veritable framework for dealing with macroeconomic dynamics and inter-linkages in a small open economy like that of Malawi.

Application of small macroeconometric models in modeling macroeconomic dynamics has been carried out in both developed and developing countries (see Olofin *et al.*, 2014 [13] and Valadkhani, 2004 [14] for more details). Most of these studies have looked at the interaction of the different identified economic blocks in an economy. Generally these blocks have included the private consumption, investment, government expenditure, trade, production, price and wages, monetary and employment blocks, covering countries and regions such as China, Phillipines, the United Kingdom, Kenya

and Nigeria just to mention a few (see Cagas, *et al.*, 2006 [15]; Garrat *et al.*, 2003 [16]; Dreger and Marcellino, 2007 [17]; Qin *et al.*, 2007 [18]; Asteriou *et al.*, 2011 [19]; and Olofin *et al.*, 2014 [13] for more details). In Malawi however, developments in this are just emerging, with one of the initial functional models so far being the one developed under the auspices of the Norwegian Government. The model consists mainly of the government sector, the household sector, the external sector, the business sector, with emphasis on the effects of increased government expenditure and imported prices. The model had little emphasis on the effects of the changes in a country's monetary policy instruments such as interest rates and money supply.

However, a number of studies have looked at the effectiveness of monetary policy in Malawi or the effect of selected monetary policy variables on the economy. For example, Ngalawa and Viegi (2011) [6], investigate the process through which monetary policy affects consumer prices and output in Malawi. Using the structural vector autoregressive model, the results show that the bank rate is a more effective measure of monetary policy than reserve money. The results also show that price stability is the principal objective of monetary policy despite monetary authorities pursuing also high growth and employment objectives. The results also reveal that except for exchange rates, consumer prices respond weakly to monetary impulses, suggesting that inflation in Malawi may not be dominated by monetary factors.

Mangani (2011) [11] investigates the effectiveness of monetary policy in Malawi with bank rate and reserve money as the potential measures of monetary policy stance, while lending rate and broad money were intermediate targets. The results revealed that despite the lending rate responding instantaneously to bank rate adjustments and although the lending rate somewhat influenced money supply, the effects were hardly ever transmitted to prices. Suggesting the ineffectiveness of the Keynesian interest rate view of the monetary policy transmission mechanism. Also money supply was found to be effect on prices, against the classical view of the policy transmission mechanism. The results showed also that prices were largely influenced by the exchange rate, while the exchange rate itself was affected by money supply. Hence it could be argued that the effect of the exchange rate on prices could be attributed to the exchange rate channel of the monetary policy transmission. However, further analysis shows that the effects of the exchange rate on prices were not necessarily induced by monetary policy.

Jombo *et al.* (2014) [20], using the augmented Phillips curve and vector autoregressive approaches, estimate the exchange rate pass-through to domestic inflation, and they found that the results suggest a modest influence of exchange rate movements on domestic prices. However, it is argued that the dynamic exchange rate pass-through of 0.2 still puts exchange rate as a potentially important source of inflation in Malawi, hence need for attention by monetary authorities. Mwabutwa C. *et al.* (2013) [21] estimates an empirical macroeconomic model that generates changes in output and price level in response to bank rate, exchange rate and private credit shocks using the TVP-VAR model with stochastic volatility that allows for the capturing of the variation of macroeconomic structure and changes in the transmission mechanism overtime. The

model is used to estimate and calculate the impulse responses of output and price level to financial and monetary policy shocks. The results revealed that changes in the transmission mechanism became more clearer after 2000, with monetary policy transmission performing consistently with economic theory predictions without price puzzles as was the case before the financial reforms carried out between 1988 and 1994. However, the results indicate that the transmission mechanism through the credit channel (through loan supply) remains weak, calling for more financial initiatives to improve the credit market system.

Mangani (2009) [22] and Ngalawa (2009) [23] both examine the relationship between money supply and price levels in Malawi using VAR models. The findings show that the conventional monetary policy theory of inflation, where an increase in money supply leads to an increase in price levels does not hold in the case of Malawi. In fact periods of falling inflation are associated with an increase in money supply in most of the periods. In addition these studies show that while lending rate instantaneously respond to bank rate adjustments and though the lending rate somewhat influence money supply, the effects were hardly ever transmitted to prices. So the Keynesian interest rate view of the monetary policy transmission mechanism also does not apply to Malawi, as interest rates affect inflation through the cost of production effect rather than through money supply effects. However, these studies show that exchange rate has the most powerful effect on price levels in Malawi, reflecting the country's high level of openness and import dependence, and a highly vulnerable foreign reserve situation due to a reliance on a narrow range of sources, most notably foreign aid and tobacco exports (Deraniyagala and Kaluwa, 2011) [24]. Matchaya, Greenwell (2011) [25] looks at the possible sources of inflation in Malawi and finds out that changes in money supply, exchange rates, past values of inflation, recessions and booms were the main determinants of inflation.

4. Framework and Methodology

The macroeconometric model that is adopted in this study is a small, dynamic open-economy model. Essentially, it is a simple New Keynesian monetary model and thus has a monetary orientation suitable for monetary policy analysis. Therefore the implications for output, inflation and exchange rate of different monetary policy rules can be effectively evaluated (Batini and Haldane, 1999 [26] and Berg *et al.*, 2006) [27]. The model allows for the evaluation of the performance of any monetary policy rule whether backward or forward-looking, examination of the interactions among main macroeconomic variables, including the monetary policy instruments, and it also provides a criteria for judging the various possible policy outcomes.

Adopting Olofin *et al.*, 2014 [13] approach, the model has five equations; An IS curve or aggregate demand equation that captures the effects of real interest rate and real exchange rate on real output, and an LM curve or money demand equation that relates the demand for real money balances to real income which is a measure of transactions and nominal interest rate which is a measure of the opportunity cost. It also includes a

Phillips curve (aggregate supply) or a price-setting equation that evaluates the effect of past and expected inflation, output gap (measured as output relative to its potential output) and exchange rate on inflation, and an uncovered interest parity (UIP) or exchange rate equation which is usually incorporated when dealing with an open economy. The UIP equation captures the dynamic relationship between exchange rate and interest rate differential measured as the spread between domestic and foreign interest rates.

4.1. The Aggregate Demand (IS) Function

Malawi being a low-income country which is relatively a small-open economy, the aggregate demand function could be expressed as a function of real interest rates and the exchange rate as follows:

$$y_t = \lambda_1 y_{t-1} + \lambda_2 y_{t+1} + \lambda_3 \left(i_{t-1} - \pi_t^e \right) + \lambda_4 s_{t-1} + \varepsilon_t \tag{1}$$

where y_t is the output gap, i_t is the nominal interest rate, π_t^e is the expected inflation rate making $\left(i_{t-1} - \pi_t^e \right)$ the real interest rate and s_t is the real exchange rate. Theoretically, real interest rate is expected to have a negative impact on economic activity since a higher level of interest rate discourages investment activities, hence $\lambda_3 < 0$ An appreciation of the exchange rate (captured by a decrease in s_t is expected to reduce the level of real output in an economy as it reduces exports while making imports cheaper, meaning $\lambda_4 < 0$ in this model output depends also on its lagged value $\left(y_{t-1} \right)$ as well as its expected value in the next period $\left(y_{t+1} \right)$. Following Batini and Haldane (1999) [26], the restrictions $1 > \lambda_1 \leq 0$ and $1 \geq \lambda_2 \leq 0$ are usually evaluated to see if output is predetermined or forward looking. For instance, if $1 > \lambda_1 < 0$, and $\lambda_2 = 0$, then output is predetermined indicating that its value in period t is not affected by unanticipated events in that period, meaning that monetary policy actions today cannot affect current output. However, if $\lambda_2 > 0$, then aggregate demand can be assumed to be forward-looking and by implication, monetary policy can affect output today by affecting expectations of future output. In addition, further restriction that $\lambda_1 + \lambda_2 \leq 1$ can also be tested to evaluate any probable existence of dynamic stability in relation to the influence of monetary policy on output (see Batini and Haldane, 1999 [26]).

4.2. The Money Demand (LM) Function

Money demand remains one of the monetary policy instruments used by developing countries. It is especially important for countries such as Malawi where monetary authorities continue to put emphasis on the role of money demand on their monetary policy operators. It has been argued that apart from the interest rates channel, monetary policy works also through the money demand function which provides useful information about portfolio allocations (Lungu *et al.*, 2012) [28]. The RBM targets money supply by focusing on monetary aggregates as intermediate targets. Money demand function postulates that demand for money in a country makes aggregate money supply

conventionally assumed to be influenced by the level of income, consumer prices and interest rates, which are usually postulated to be influenced by three motives of holding money, which are: transactional, precautionary and speculative motives. This relationship can be depicted as follows:

$$m_t = \delta_1 y_t + \delta_2 i_t + \delta_3 \pi_t + \delta_4 e_t + \delta_5 fd_t + \varepsilon_t \tag{2}$$

where m_t is the real money demand, y_t is the real GDP, π_t is the inflation rate, e_t is the nominal exchange rate, and fd_t is the financial depth m_t/y_t. Conventionally an increase in income leads to an increase in money demand, $\delta_1 > 0$ and the demand for real money balances is expected to respond negatively to the opportunity cost of holding money, $\delta_2 < 0$. Higher inflation may lead to high demand for money because of the time value for money, $\delta_3 > 0$. It has been argued that exchange rate could either have a positive or negative influence on demand for money (Arago and Nadiri 1981) [29]. An increase in exchange rate (depreciation) may lead to an increase in wealth hence an increase in money supply, $\delta_4 > 0$, however it may also lead to currency substitution, hence a decrease in demand for money, $\delta_4 < 0$. Improved technology or financial products (capturing financial depth) are expected to have a negative impact on the demand for cash balances, thus $\delta_5 < 0$.

4.3. Aggregare Supply Function (Phillips Curve)

A small open economy with log-linear calibrated rational expectations macro model is used following Batini and Haldane (1999) [26]. The model encompasses both the open economy dimension which is important when characterizing the behavior of inflation-targeting countries, and the exchange rate dimension which has an important bearing on output-inflation dynamics. In essence the model involves both the monetarists' and the structuralists' approach to inflation determination, for instance the conventional output gap term capturing the tightness in the labour market (Akinboade *et al.*, 2004) [30]. The model also implies full and immediate pass-through of imported prices (and hence exchange rate changes) into consumption prices. The real exchange rate terms reflect the price effects of exchange rate changes on imported goods in the consumption basket which is common in small open economies like that of Malawi. After manipulation of the different equations involved, Batini and Haldane (1999) [26] come up with the reduced-form Phillips curve of the model represented as:

$$\pi_t = \chi_0 \pi_{t+1}^e + (1 - \chi_0)\pi_{t-1} + \chi_1 (y_t + y_{t-1}) + \mu\left[(1 - \chi_0)\Delta s_t - \chi_0 \Delta s_{t+1}^e\right] + \varepsilon_t \tag{3}$$

where $\mu = 2(1 - \phi)$, Δ is a difference operator and ε_t is the error term, while the rest are as defined above. The model has a conventional real interest rate channel, through the output gap (y_t), and thence onto inflation. However, there is also an exchange rate effect operating through an indirect output gap route running through net exports and hence onto inflation, and a direct price effect through the cost of imported consumption goods and through wages, and hence onto output prices.[3]

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[3]See Batini and Haldane (1999) [26] for more details.

4.4. Exchange Rate Function

The exchange rate of a country captures the international effect of domestic monetary policy, mainly by being the major channel through which interest rates affects inflation. It is argued that monetary policy has a contemporaneous effect on exchange rate which in turn affects inflation rate (Batini and Haldane, 1999) [26]. For instance, assuming a flexible exchange rate regime, an increase in real interest rates reflecting a tight monetary policy, makes deposits denominated in domestic currency more attractive than those denominated in foreign currency (Mangani, 2011) [11]. An increase in net capital inflows resulting from the high interest rate differential leads to domestic currency appreciation, which might intern reduce exports, export-oriented investment and output. Also, monetary policy can affect the current and expected values of inflation through its effects on expected exchange rate changes. Hence, by employing the Uncovered Interest Parity theory to show that higher interest rates today relative to those abroad, will tend to produce an exchange rate appreciation today, leading to an expected depreciation in the future see Equation (4). For instance for a small-open economy like Malawi, which is heavily dependent on tobacco exports, one expects an appreciation of the exchange rate during the tobacco selling season as there will be an increase capital flows.

However, as argued by Ngalawa (2011) [6], the financial sector in Malawi lacks depth and is weakly integrated into the global markets. This is expected to lead to information delays forcing players in the foreign exchange market to respond with lags to changes in interest rates, bank lending and monetary aggregates.

$$s_t = \gamma_1 s_{t+1} + \gamma_2 \left(r_t^d - r_t^f \right) + \varepsilon_t \tag{4}$$

where s_t is the real exchange rate and s_{t+1} is the expected real exchange rate in period $t+1$ given information in period t, while r_t^d and r_t^f are the real domestic and foreign interest rates respectively.

4.5. The Interest Rate Function

A monetary policy rule that involves setting monetary policy rate by the Monetary Policy Committee as it is referred to in Malawi is set as a function of output gap and expected inflation. With the objective of monetary policy in Malawi as stated in the Act, this approach assumes that the monetary policy instrument is based on short-term nominal interest rate (Bank rate in the case of Malawi), and that the RBM sets the instrument in order to achieve a target level of inflation, while it may also react to deviations of output from equilibrium. Therefore, interest rate $\left(i_t \right)$ (nominal) is formulated as a function of output gap $\left(y_t \right)$, nominal exchange rate $\left(e_t \right)$, expected inflation $\left(\pi_t^e \right)$, and the monetary policy rate $\left(mpr_t \right)$—see Equation (1) below. Exchange rate is included because it matters a lot to policy makers in Malawi as the economy is heavily dependent on imports of goods and services. It is also assumed that the RBM smoothens interest rates, adjusting them quite slowly to the desired value based on deviations of inflation and output from the equilibrium, which is in line with Woodford (2003) [31].

$$i_t = \phi_1 y_t + \phi_2 \pi_t^e + \phi_3 e_t + \phi_4 mpr_t + \varepsilon_t \tag{5}$$

Basically this model captures the main monetary transmission channels. Monetary policy affects inflation in three distinct ways. First interest rates directly affect aggregate demand, through borrowing costs which in turn affects inflationary pressures. The second key channel is through exchange rate. Interest rates directly influence the exchange rate, which then has a pass-through on inflation. And finally, monetary policy can affect inflationary expectations which have a direct impact on contemporaneous inflation. While the nominal interest rate is the actual instrument of policy, our variable of interest is real interest rate in the model since it is the primary transmitter of policy (Cavoli and Wilson 2015) [32]. It is theoretically expected that higher interest rates will lower investment in countries like Malawi and hence output $\left(\phi_1 > 0 \right)$, while leading to higher expected inflation following the Fisher theorem $\left(\phi_2 > 0 \right)$. An increase in domestic interest rates relative to those abroad will lead to exchange rate appreciation $\left(\phi_3 > 0 \right)$, and since the monetary policy rate (the bank rate in this case) serves as one of the monetary policy instruments used by the RBM to control the level of interest rates, hence there exists a positive relationship between two variables $\left(\phi_4 > 0 \right)$.

4.6. Methodology

Several techniques have been used in macroeconomic modeling mainly based on their appropriateness, simplicity, consistency of the estimates and efficiency of the estimators just to mention a few (Arreaza, Blanco and Dort, (2003) [33]; Dreger Christian and Marcellin (2007) [17]; Asteriou, *et al.*, (2011) [19]. In the present study, the Ordinary Least Squares (OLS), Two Stage Least Squares (2SLS) and Three Stage Least Squares (3SLS) are applied. To confirm the robustness of the estimates as well as their goodness of fit, diagnostic tests are performed such as the satisfaction of some a priori values estimated coefficients and by plotting and evaluation of the actual against the simulated values of the endogenous variables. The Theil's inequality coefficient (U) and the Root Mean-Squared Percent Error (RMSPE) on forecast statistics are also computed. The Theil's inequality coefficient is defined as:

$$U = \frac{\sqrt{(1/N)\sum_{t=1}^{N}\left(Y_t^S - Y_t^a\right)^2}}{\sqrt{(1/N)\sum_{t=1}^{N}\left(Y_t^S\right)^2} + \sqrt{(1/N)\sum_{t=1}^{N}\left(Y_t^a\right)^2}}$$

and

$$RMSPE = \sqrt{(1/N)\sum_{t=1}^{N}\left(\left(Y_t^s - Y_t^a\right)\middle/ Y_t^a\right)^2}$$

where Y_t^s and Y_t^a are the simulated and actual values of the endogenous variables respectively at time t, while T is the time period. U varies between 0 and 1, and the values are either the worst possible when $U = 1$ or the best possible when $U = 0$. While RMSPE represent the best forecast performance when the smaller the values. After the establishment of the accuracy of the model for forecasting, some policy simulations are carried out, mainly based on the changes that the RBM is likely to make to the monetary policy rate which is the Bank rate in this regard. The scenarios are based on

maintaining the existing levels of the *mpr*, increasing the *mpr* and reducing the *mpr* to some levels. The impact of these changes is then evaluated based on how they affect the key macroeconomic variables such as inflation rate, output, exchange rate, and interest rate.

5. Estimations Results

Three different techniques have been applied to estimate the system of equations developed in the framework above, and to compare the performance of the different techniques, the Hausman test is used to identify the most appropriate technique. In comparing the three different techniques, the results in Table 2 show that the Hausman test

Table 2. Estimated coefficients using the three different techniques.

Aggregate demand equation	OLS	2SLS/IV	3SLS
Lagged output gap	0.5389*** (0.000)	0.5892*** (0.000)	0.5663*** (0.000)
Expected output gap	0.5135*** (0.000)	0.4307*** (0.000)	0.4462*** (0.001)
Real interest rate	0.0385 (0.900)	0.1879 (0.608)	0.1508 (0.675)
Real exchange rate	−0.2278 (0.745)	0.5549 (0.598)	0.3651 (0.724)
Constant	1.0526 (0.765)	−2.7936 (0.593)	−1.8574 (0.718)
Money demand equation			
Real output gap	0.0027 (0.429)	−0.0003 (0.973)	−0.0085 (0.205)
Nominal interest rate	−0.6039*** (0.000)	−0.6120*** (0.000)	−0.6280*** (0.000)
Nominal exchange rate	0.8380*** (0.000)	0.8418*** (0.000)	0.8363*** (0.000)
Constant	3.9334*** (0.000)	3.9354*** (0.000)	3.9972*** (0.000)
Aggregate supply equation			
Expected inflation rate	0.4882*** (0.000)	0.5014*** (0.000)	0.5255*** (0.000)
Lagged inflation rate	0.4957*** (0.000)	0.5036*** (0.000)	0.4860*** (0.000)
Output gap (current+lagged)	−0.0003 (0.259)	0.0001 (0.850)	0.0002 (0.731)
Real interest rate	−0.0372 (0.003)***	0.0049 (0.736)	0.0036 (0.794)
REER	0.0256 (0.303)	−0.0073 (0.829)	−0.0216 (0.510)
Real money supply	0.0226 (0.007)***	−0.0035 (0.707)	0.0021 (0.817)
Constant	0.0883 (0.348)	0.0483 (0.712)	0.0589 (0.642)
Exchange rate equation			
Expected REER	0.9576*** (0.000)	0.9978*** (0.000)	0.9884*** (0.000)
Interest rate differential (domestic-foreign)	−0.0058 (0.360)	−0.0045 (0.489)	−0.0054 (0.393)
Net foreign assets	−0.0004 (0.920)	−0.0013 (0.724)	−0.0012 (0.749)
Constant	0.2009* (0.105)	0.0067 (0.961)	0.0521 (0.698)
Interest rate equation			
Expected inflation rate	0.0906*** (0.000)	0.0929*** (0.000)	0.0904*** (0.000)
Nominal exchange rate	0.0952*** (0.000)	0.0925*** (0.000)	0.0947*** (0.000)
Bank rate	0.9042*** (0.000)	0.9022*** (0.000)	0.9085*** (0.000)
Constant	−0.1478* (0.030)	−0.1344*** (0.119)	−0.1584** (0.044)
No of observations	158	158	158
Hausman test	Ols vs 2 sls 2.45 (0.6532)	2 sls vs 3sls 1.25 (0.8703)	Ols vs 3 sls 2.17 (0.7038)

statistics in comparing the three techniques are all found to be insignificant at conventional levels. This could be implying that the coefficients obtained by using the three different techniques are not significantly different from each other. Hence it could be concluded that there is no endogeneity which would have required endogenous techniques to be rectified.

The results of the IS equation are in line with the theoretical a priori as both real interest rates and real exchange rates are found to have a negative but insignificant impact on output. The results show also that the lagged output gap coefficient is relatively larger than that of the expected output gap coefficient, revealing, to some extent, that the Malawian economy is not forward looking. Indicating that output is predetermined since its value in period t is not significantly affected by unanticipated events in that period, so monetary policy actions today could not effectively affect current output.

Output is found to have an insignificant impact on the demand for money, while interest rates and real exchange rate are found to have a highly significant negative and positive impact, respectively, on money demand. The results suggest that an increase in the opportunity cost of holding money reduces money demand in Malawi, while the depreciation of the Kwacha (an increase) increases the demand for money. However, this does not agree with economic theory which stipulates that depreciation of the domestic currency induces the expectation of further depreciation which forces economic agents to hold more of foreign currency than domestic currency. But with the restrictions on the country's foreign exchange market this could not be the case. However, the results could be suggesting that a depreciation of the domestic currency raises the domestic currency value of foreign assets that are held domestically. Since this will also increase the stock of wealth, the demand for domestic currency will rise. The results support the findings of Olofin *et al.* (2014) [13], which are plausible for the small open economies like Malawi.

The results suggest also that in Malawi inflation is more influenced by future inflation expectations than the past inflation, which is common in high inflation prone countries like Malawi (Arreaza and Dort, 2003) [33]. However, inflation is insignificantly affected by both output and real exchange rate. The results fail to support the underlying theoretical a priori behind the augmented Phillips curve which stipulates that current inflation will be affected by past inflation and expected inflation, and also to output gap where a negative output gap reduces inflation rate and *vice versa*.

In terms of the exchange rate equation, expected inflation is observed to have a pronounced and significant impact on the current real exchange rate, reflecting the forward-looking exchange rate behavior in Malawi. The results indicate also that, though not significant (mainly due to controls on the capital account), higher domestic interest rates relative to foreign interest rates may lead to an appreciation of the domestic currency, as it will be more profitable to shift resources to the domestic economy. However, the net foreign assets themselves are found to lead to a depreciation of the domestic currency. However, with reference to the interest rate equations, the results show that all the three endogenous variables (expected inflation rate, nominal exchange rate and

bank rate) exhibit a positive and highly significant impact on interest rates which is in line with the theoretical a priori as indicated above.

5.1. Model Performance

The model is evaluated for both within-sample and out-of-sample predictive power using the Theil's inequality coefficient (U) and the Roots Mean-Squared Percent Error (RMSPE). The results in Table 3 show relatively low values of these statistics, implying that the model tracks each of the 5 macroeconomic endogenous variables reasonably well.

This is further supported by the graphical illustration of the model performance in terms of the actual versus the fitted values in Figures 5(a)-(e). The figures show that the simulated values track the actual values well, thereby justifying the model for policy simulations.

5.2. Simulations

Three scenarios on the 5 macroeconomic variables were carried out and the corresponding effects observed over the period 2015: M3 and 2016: M3, by maintaining the bank rate at 25%, then reducing it to 23% and 20%. The results show that the different policy scenarios do not have a significant impact on output Figure 6(d), inflation Figure 6(c), and real exchange rate Figure 6(e), implying that changes in monetary policy in Malawi, especially the bank rate do not have an impact on the country's output growth, inflation or real exchange rate. This is while taking congnizant of the fact that inflation in Malawi is mainly driven by supply side factors such as the significant role played by food prices, and also monetary policy inconsistencies, varying policy regimes and data quality issues in the country. However, the results show that a reduction in the bank rate will lead to a reduction in the commercial banks lending rate Figure 6(a), but leading to an increase in money supply in the economy Figure 6(b). Since there is no change in output and inflation, these results could be suggesting that, with the current structure of the Malawian economy, reduction in bank rate to even below 15% could not be enough to trigger demand and economic growth in Malawi.

6. Conclusions

The study has tried to build and use a fairly robust but small macroeconometric model to capture the main short-term macro dynamics and to forecast major macroeconomic variables of the Malawian economy. Real-time forecasts and empirical investigation of a

Table 3. Statistical evaluation of model performance.

Variable	RMSE	U
Real output	1.0936	0.2608
Inflation rate	0.0288	0.0096
Real exchange rate	0.0460	0.0088
Real interest rate	0.0544	0.0142
Real money supply	0.1704	0.0257
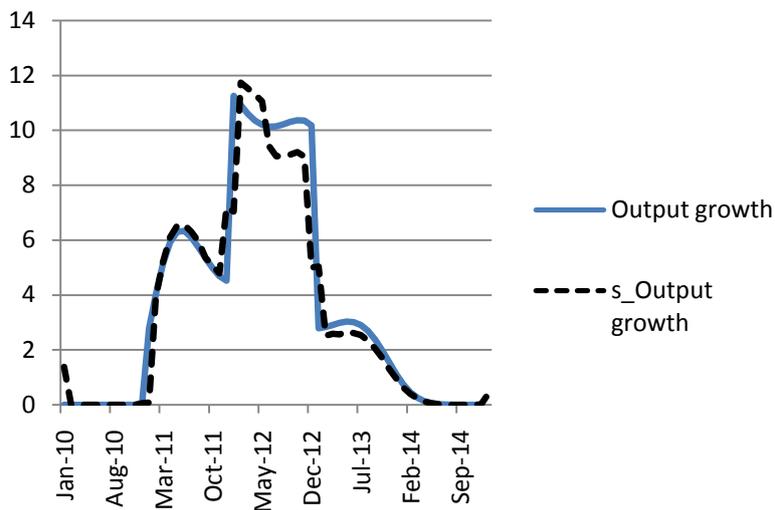
(a)
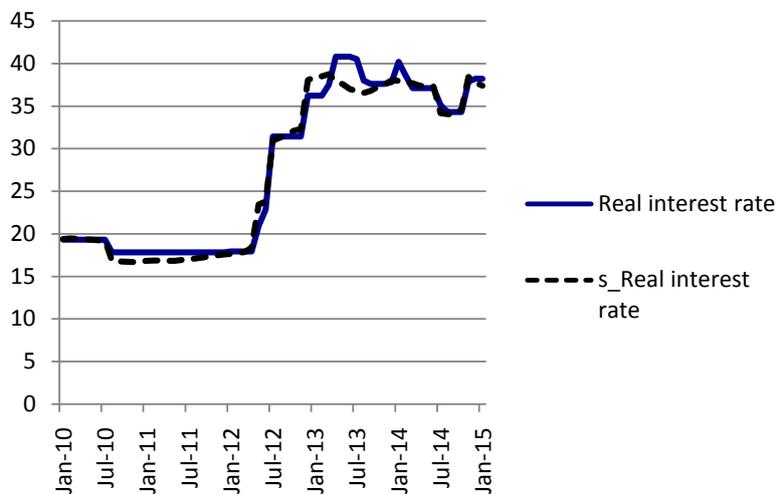
(b)
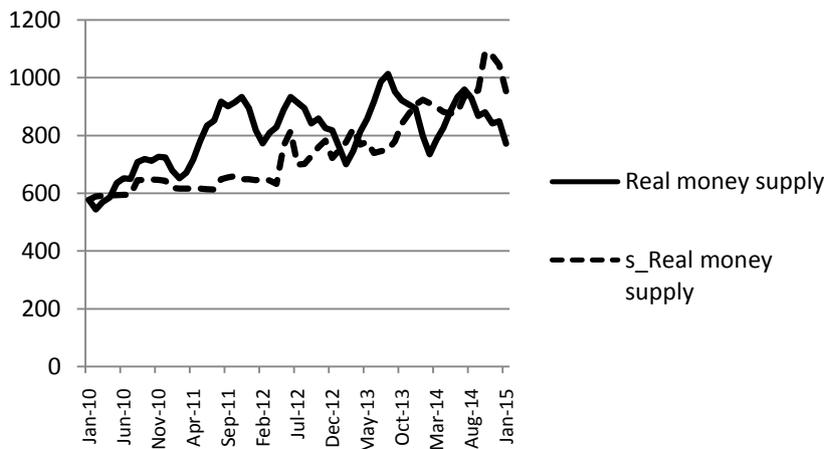
(c)
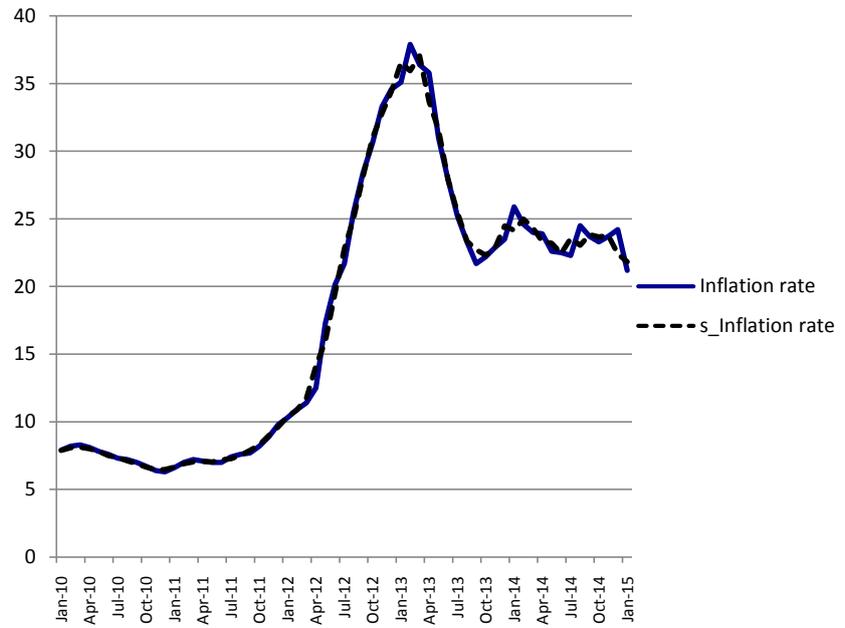
(d)
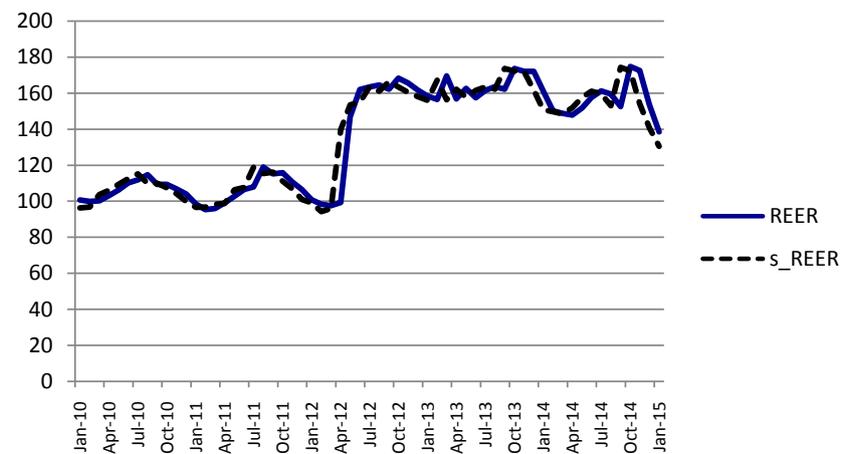
(e)

Figure 5. Model performance. (a) Output gap; (b) Real interest rate; (c) Real money supply; (d) Inflation rate; (e) Real exchange rate.

number of topical macroeoconomic issues have shown that the model could be useful in the country's policy formulation process.

The results show that monetary authorities in Malawi have to make a choice between the objectives of maintaining lower money supply and lowering the lending rate. This is because a reduction in the policy rate leads to a decline in the lending rate, but with an increase in money supply. However, the results reveal that changes in monetary policy variables have an insignificant impact on output growth. Suggesting that, despite the RBM Act of 1989 stipulating that monetary authorities should pursue both price and high growth and employment objectives, our results reveal that price stability remains the principal objective of monetary policy in the country, supporting the results found
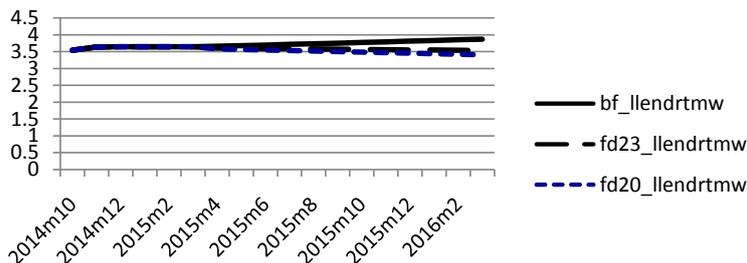
(a)
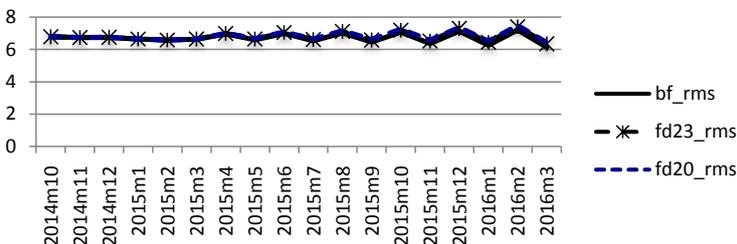
(b)
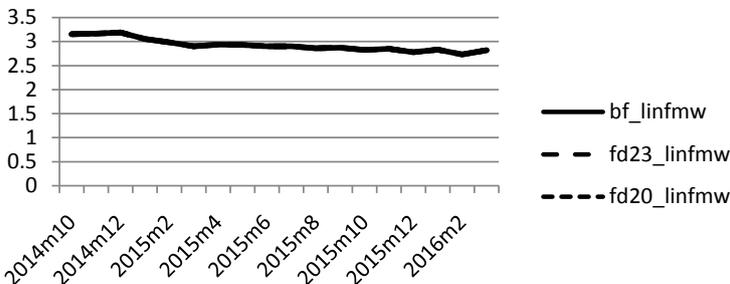
(c)
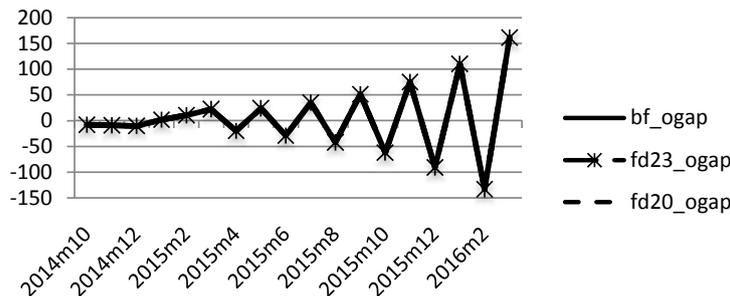
(d)
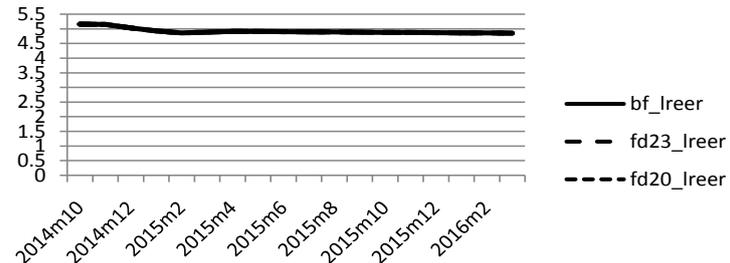
(e)

Figure 6. Effects of scenarios on selected macroeconomic variables. (a) Interest rate; (b) Real money supply; (c) Inflation rate; (d) Output; (e) Real exchange rate.

by Ngalawa and Viegi (2011) [6]. This calls for monetary authorities in the country to not only place more emphasis on the objective of stabilization and achieving low inflation, but also focus on supporting strong, sustained and shared growth. Supporting growth in this case could imply a cut in interest rates, which many believe would boost growth. However, cutting rates works only in the short term, and if an economy does not produce enough goods and services to provide for the higher demand, then lack of supply could cause inflation to rise, forcing monetary authorities to raise rates again.[4] In line with the findings of Mangani (2011) [11], the results from this study also show that the quantity theory of money does not seem to hold in Malawi: as the rising money supply seems to lead to a decline in prices and the increase in real interest rates seems to lead to a significant decline in prices. To some extent this could also be implying that the RBM should focus on reserve money and money supply to control inflation. However, in recent years, the RBM has been focusing on interest based monetary policy framework, which affects the cost of credit and for an import dependent economy like Malawi, high interest rates could control import growth.

Acknowledgements

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[4]It should be noted that producers respond to interest rates cuts much slower than consumers, due to issues of idle capacity, production constraints, and other factors that affect the cost of production.

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