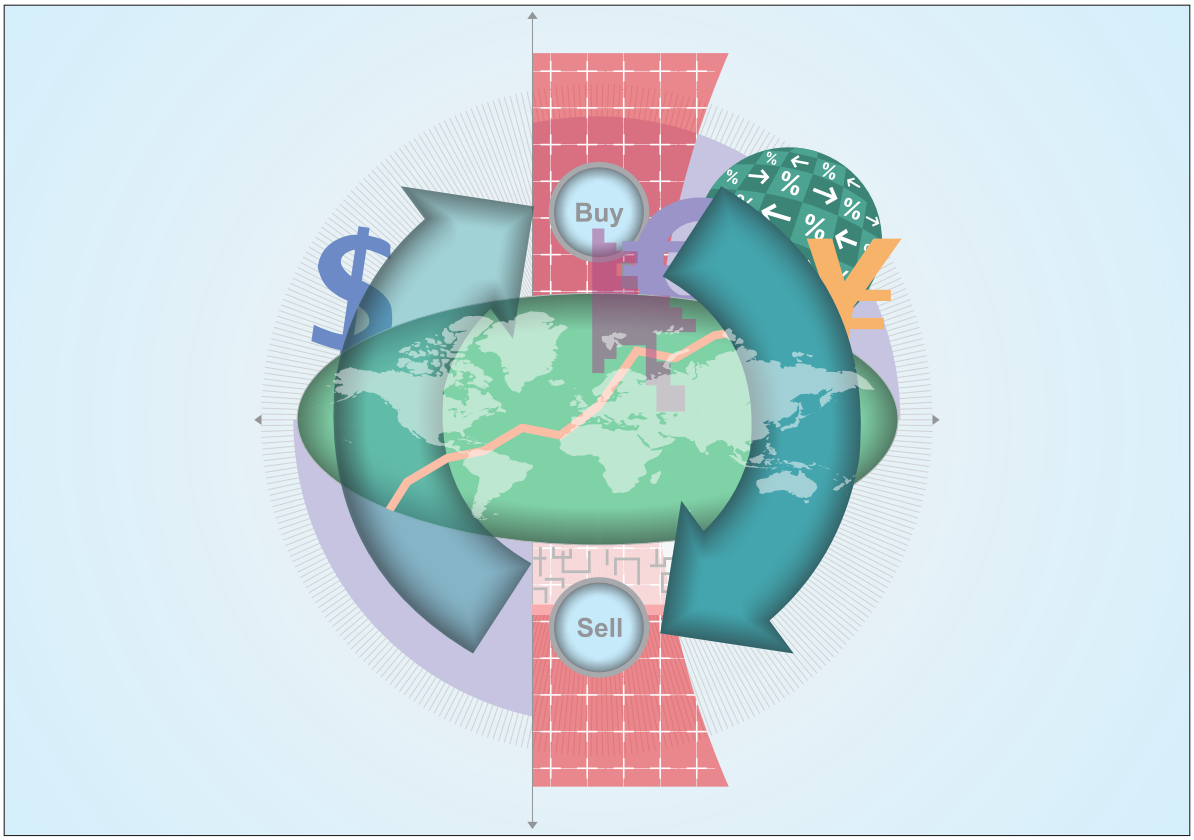

The International Journal of Applied Economics & Finance

ISSN 1991-0886

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The International Journal of Applied Economics and Finance 6 (3): 74-88, 2012
ISSN 1991-0886 / DOI: 10.3923/ijaef.2012.74.88

Money Supply and Inflation in Malawi: An Econometric Investigation

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ABSTRACT

This study examined the relative importance of monetary factors in driving inflation in Malawi. A styhzed inflation model is specified that includes standard monetary variables, the exchange rate and supply-side factors. The results indicated that inflation in Malawi is a result of both monetary and supply-side factors. Monetary supply growth drives inflation with lags of about 3 to 6 months. On the other hand, exchange rate adjustments play a relatively more significant role in fuelling cost-push inflation. It is further observed that slumps in production generate inflationary pressures. At policy level, the Reserve Bank should ensure that broad money supply expands in line with nominal gross domestic product. However, it must be emphasized that monetary policy alone might not address other exogenous structural shocks considered as additional causes of inflation. What monetary policy can do is to slowdown the rate of inflation expectations by ensuring that prices in other categories of non-food items slow down. For example, it has been shown that exchange rate shocks have a strong effect on inflation. Given this finding, exchange rate stability is key to anchoring inflation expectations, as the exchange rate pass-through in Malawi is relatively high. Finally, measures to control inflation must also emphasize enhancing production and supply, especially of food. Thus inflationary control should aim at policies which are directed at both monetary and supply factors.

Key words: Inflation, money supply, nominal exchange rate, monetary policy

INTRODUCTION

As Malawi has succeeded in reducing inflation to very low levels, understanding the driving forces behind the behaviour of the price becomes increasingly important for designing monetary policy. Different views, both empirical and theoretical, have emerged in the literature as far as modelling inflation is concerned. The monetary approach stresses the relationship that exists between money supply and prices. Accordingly, monetarists tend to emphasize the importance of monetary policy and the view that inflation is essentially a domestic phenomenon stemming from excessive money supply relative to the growth and supply of goods and services. Summing up the evidence, Milton Friedman coined the saying: "inflation is always and everywhere a monetary phenomenon." Monetarists therefore argue for policies that aim at curbing money supply growth. Other authors have pointed to supply-side developments in explaining inflation. This structuralist school of thought contends that supply constraints and cost-push factors drive up prices of specific goods and have wider repercussions on the overall price level. The structuralist dwells on structural factors and cost-related pressures including import prices. Yet another group emphasize that monetary expansion is a reflection of other elemental causes such as fiscal imbalances. This constitutes the public finance approach and is essentially a variant of the structuralist. Thus debate

about the causes of inflation in the literature is generally between the monetarist and the structuralist approaches (Ocran, 2007).

In Malawi, increases in food prices, particularly maize, have been blamed for inflation. Food costs account for 58.1% of the Consumer Price Index (CPI) whilst the remaining 41.9% is explained by non-food costs. As a result, the question of whether inflation in Malawi is a monetary phenomenon or not is not merely academic but has profound implications for economic policy. If inflation is a monetary phenomenon, it is the responsibility of the Reserve Bank of Malawi and the fiscal authorities to achieve price stability. If inflation is caused primarily by food prices, it would appear the Ministry of Agriculture should play a key role in containing inflation.

This study contributes to the on-going debate about inflation developments in Malawi and what monetary policy can do and cannot do.

The main objective of this study is to model and examine the relative importance of monetary factors for inflationary pressures in Malawi. Specifically, the study tries to answer the following questions: (1) Does money supply growth drive the domestic rate of inflation?; (2) Do exchange rate movements and world rate of inflation drive the domestic rate of inflation?; (3) What variables are relatively more important in driving the domestic rate of inflation?; (4) What is it that monetary policy can do and cannot do in Malawi?.

Some stylized facts about inflation in Malawi: Here, we give a brief on inflation trends and inflation control in Malawi. We use graphs to show the character of the data and give some intuition into whether cointegration holds. The data used are monthly and they span the period 1995-2011.

Reserve money programme in Malawi: Inflation sometimes is defined informally as "too much money chasing a few goods." This statement captures important aspects of why money growth is related to inflation. Still it is better to define inflation as increases in general level of prices rather than in terms of why increases in the general price level occur.

The monetary policy of the Reserve Bank of Malawi (RBM) aims to maintain low inflation. The reserve money programme in Malawi uses a money-based nominal anchor for inflation within a quantity theory of money framework which takes the form: $M_t\ v_t = p_t\ y_t$, where M denotes broad money supply, p the price level, v velocity of circulation, y real output and t is a time index.

Starting with the definition of the velocity of circulation, $v = p.\ y/\ M$, if the change in velocity and the level of economic activity can be predicted, these can be used to generate "an inflation-consistent" path for broad money. The proximate anchor is the broad money supply (M), whose path the monetary authorities seek to influence through balance sheet operations aimed at controlling the path of Reserve Money (RM) (Fig. A-1 in Appendix 1). The rationale for reserve money targeting as an anchoring mechanism is based on two assumptions both of which are verifiable. The first is that there is a predictable relationship between money and prices. If this relationship is stable, then a policy that targets the growth of nominal money has some prospect of stabilizing inflation at desired levels and at reasonable cost in terms of other objectives.

The second assumption is that there is a stable and exploitable relationship between the intermediate target, broad money and the operating target, the reserve money which consists of the currency in circulation in the economy plus the reserves of the banking systems lodged with the central bank. This relationship is defined by a multiplier, defined as $m = RM/\ M$, where m= money multiplier, RM = reserve money and M = broad money (Fig. A-2 in Appendix 1).

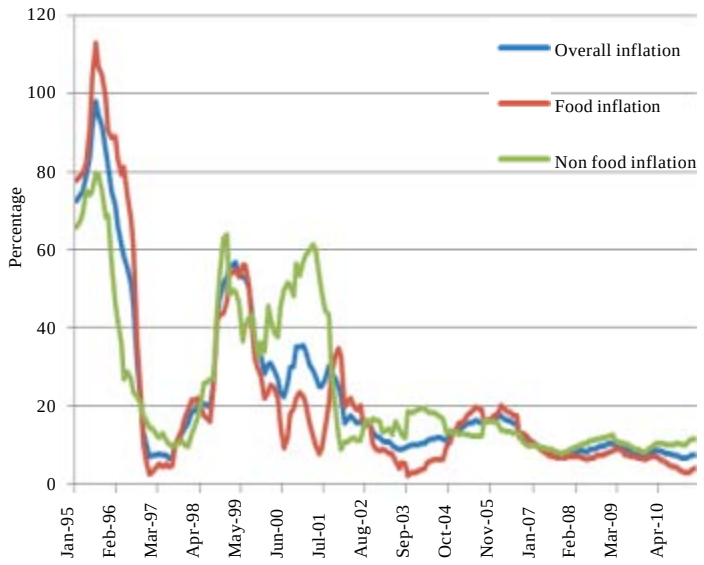

Fig. 1: Overall inflation, food inflation and non-food inflation. Source: Reserve Bank of Malawi

The Reserve Bank uses four main categories of financial instruments in its implementation of monetary policy: (1) open market type operations: RBM bill auctions; (2) outright transactions in repos and reverse repos in Treasury bills and RBM bills; (3) standing facilities window (discount window borrowing facility) and liquidity reserve requirement; (4) operations in the foreign exchange market.

The Malawi Government issues T-bills to cover its financing needs. The changes in the outstanding stock of T-bills, held outside the RBM, also affect the liquidity situation but the RBM does not regard primary issuance of T-bills as a liquidity management instrument.

The RBM Bank rate is seen as the benchmark interest rate indicator which signals to the market the expected movements in the market interest rates. The Bank rate is administratively set. The interbank money market rate, the yields on T-bills and RBM-bills and the banks' deposit and lending rates, normally move in tandem with the Bank rate.

Inflation trends in Malawi: Inflation, the variable of major interest, is plotted in Fig. 1. Inflation in Malawi has been quite volatile in the 1990s and early 2000s but the volatility has slowed down in recent years. Inflation rose sharply in 1995 to a peak of 98% in July 1995 due to a serious drought but declined abruptly to close year 1996 at 6.7%. The decline was attributed to a rebound from drought, assisted by favourable weather conditions and fiscal adjustment facilitated by the Reserve Bank of Malawi, including the curtailment of automatic access by the government to central bank credit. Inflation picked up again in 1999 and remained volatile in early 2000s, due to temporary loss of fiscal discipline and nominal exchange rate depreciation (Appendix 2).

Since 2005, Malawi has enjoyed price stability. Inflation declined from 16% in 2005 to 7.2% in March 2011. Overall inflation has remained moderate and in single digits since 2007. This impressive record on inflation has been anchored by a relentless adherence to a tight reserve money programme, heavily buttressed by the fiscal discipline and stable exchange rate.

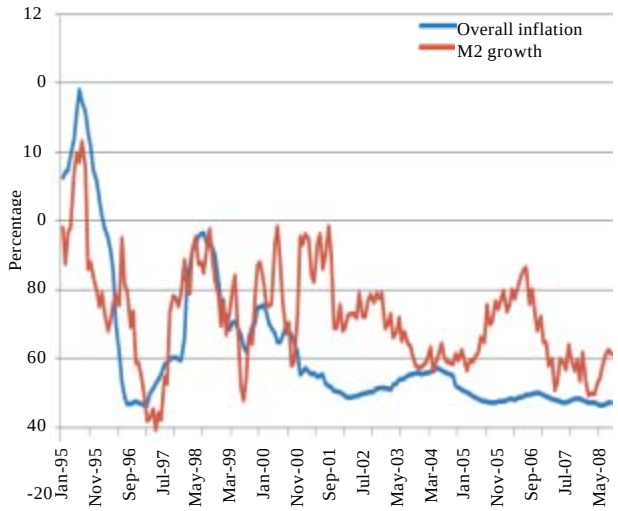

Fig. 2: Money supply growth and headline inflation. Source: Reserve Bank of Malawi

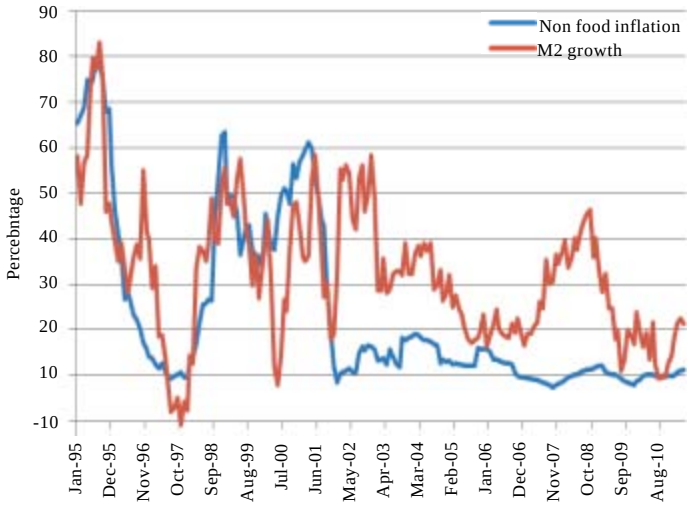

Fig. 3: Money supply growth and non-food inflation. Source: Reserve Bank of Malawi

Trends in inflation and monetary policy variables: Figure 2 shows graphical relationship between broad money supply and overall inflation. The graph shows that while overall inflation tracks money supply growth; the relationship breaks down after 2001. Figure 3 indicates the graphical relationship between money supply growth and non-food inflation. Similarly, while non-food inflation closely tracked money supply growth; the relationship breaks down after 2001. This raises the question of what is responsible for the breakdown in the relationship between money supply growth and inflation during the post-2001 period. A good starting point would be to examine the link between money supply and inflation i.e., the velocity of circulation.

It should be noted that reserve money targeting programme assumes that the link between money supply and inflation (the velocity of circulation) is relatively stable (around trend) and thus relatively predictable.

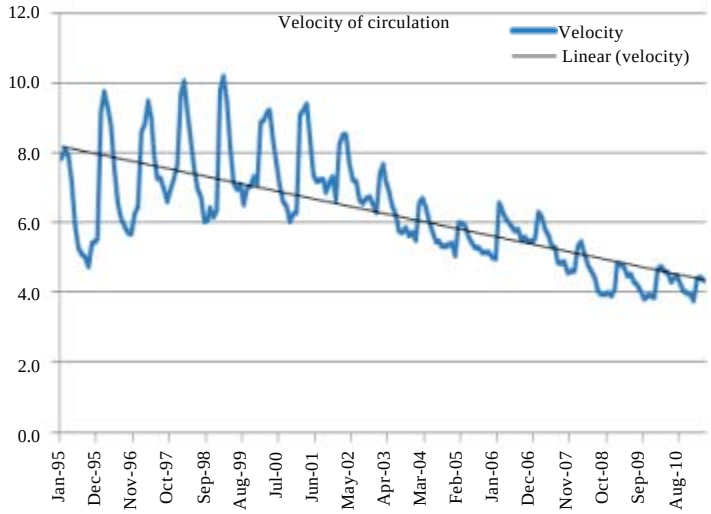

Fig. 4: Velocity of money (annual GDP divided by broad money). Source Reserve Bank of Malawi

Figure 4 shows the velocity of money circulation. It is clear that the velocity of circulation which was stable between 1995 and 2001, shifted downwards after 2001. This explains the weak link between broad money and headline inflation after 2001 observed in Fig. 2 and 3. The key point in terms of the shift in velocity is that the movement reflects a behavioural shift which is outside the control of monetary authorities. The shift in velocity of circulation is a structural issue. The velocity of circulation reflects the underlying structural demand for money. The downward shift in velocity could be a reflection of a shift in demand for money. How this can translate into price (and exchange rate dynamics) depends on the monetary response. It is clear from Fig. 4 that between 1995 and 2001, velocity hovered around 8.0 and then dropped afterwards towards 4.0 in 2010.

Exchange rate and non-food inflation: Generally, annualized exchange rate changes and non-food inflation have tended to move together, except after 2007 (Fig. 5). This is in line with theoretical expectations that depreciations result in inflation. In most instances, depreciation rate traced the trajectory or lagged the course of inflation, hence indicating the strong relationship between the two economic phenomena.

Econometric methodology: Here we discuss the theoretical framework and data issues underlying this study. The section also presents empirical estimations and diagnostics, among others. Johansen's cointegration test (Johansen, 1988) is used to examine the presence (or otherwise) of long-run relationships among variables that are thought to drive inflation in Malawi. The error correction terms obtained from the long run relationships are then used to account for long-run effects in the single equation short-run dynamic model for inflation.

Theoretical framework: Structuralist models of inflation emphasize supply-side factors as determinants of inflation. They emerged in 1950s as part of the structuralist theories of development promoted by Prebisch (Bernanke, 2005). In these models, inflation is driven by developments and bottlenecks on the real side of the economy. Food prices, wages and import prices

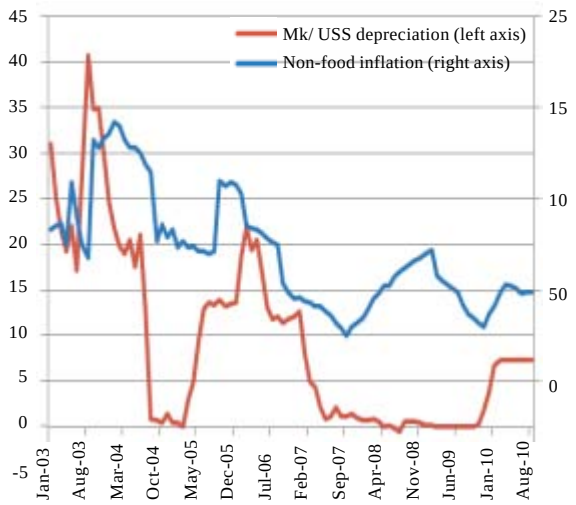

Fig. 5: Non-food inflation and annualized exchange rate changes (MK/US$). Source: Reserve Bank of Malawi

are considered sources of inflation. Structuralist models assume that such factors have to be accommodated by monetary policy makers because they are determined outside the monetary sphere. Monetary developments in themselves are given little importance as independent determinants of inflation.

Monetarist models on the other hand tend to emphasize the importance of monetary policy and the view that inflation is essentially a domestic phenomenon stemming from excessive money supply relative to the growth and supply of goods and services.

Following Harberger (1963) seminal work on price determination in Chile, the monetarist model formed the theoretical framework of many empirical analyses. However, Parkin (1977) affirmed that the monetary model was unworkable as a representation of small open economies with fixed exchange rate regimes. In order to render the monetarist model more realistic and workable, certain adjustments such as the incorporation of cost-push factors have been incorporated.

In this study we assume a general open economy monetary-structuralist model. In the short to medium term, inflation is posited to be affected by monetary factors, exchange rate changes, foreign inflation and supply shocks. Money supply shocks affect prices as they generate excess supply/demand conditions in the market. Similarly, domestic prices are impacted via pass-through effects from fluctuations in nominal exchange rate and imported goods prices.

The model used here is based on two things: (1) composition of the overall price index and (2) the quantity theory of money.

First, the overall price index consist of domestic price (P_d) and foreign price (P_f) components:

$$P = P^{a}_{d} (EP_f)^{1-\alpha} \tag{1}$$

where, α is a share of the domestic component and is assumed to be constant over time. Equation 1 suggests that overall inflation is a function of domestic inflation, nominal appreciation/depreciation and foreign inflation. Nominal depreciation would raise inflation (the pass-through effects), while an increase in foreign prices would result in higher overall prices index (imported inflation).

Second, the domestic prices component is assumed to follow the quantity theory of money:

$$MV = P_d Y \tag{2}$$

where, M is money supply, V is the velocity and Y is the real Gross Domestic Product (GDP). Equation 2 implies that increasing the money supply would lead to higher prices given the money demand as a function of the velocity and the real GDP. Because velocity has a negative time trend ($\theta<0$, as velocity typically declines with financial deepening) taking the natural logarithm of Eq. 2 gives:

$$P_d = m\text{-}y + \theta t + \eta \tag{3}$$

where, the small letters indicate natural logarithm values and η indicates any disturbances of the velocity other than the time trend component.

Taking the natural logarithm of Eq. 1 and combining it with Eq. 3 gives inflation as a function of money supply, real GDP, nominal exchange rate and foreign inflation (p_f). The general open economy monetary-structuralist model is then specified as:

$$p = f\,(ex, m, y, p_f; Z) = X\beta + Z\gamma + \varepsilon \tag{4}$$

where, $X = (e, m, y, P_f)$, Z is a set of control variables (if necessary) including time trend and ε is the error term. Coefficients for money supply (m) and nominal exchange rate (ex) should capture the effects of monetary policy and import prices, respectively, on inflation. The set up of the model suggests positive effects of money supply, nominal exchange rate and foreign prices (p_f).

To determine the relative importance of these variables in determining Malawian prices we develop a single equation Error Correction Model (ECM) for inflation that incorporates feedback from both relationships. The ECM is thus of the form:

$$\begin{aligned}\Delta p_t &= \pi_0 + \sum_{i=1}^{k-1}\pi_{1i}\Delta p_{t-i} + \sum_{i=0}^{k-1}\pi_{3i}\Delta ip_{t-i} + \sum_{i=0}^{k-1}\pi_{4i}\Delta ex_{t-i} + \sum_{i=0}^{k-1}\pi_{5i}\Delta p_{ft-i} \\ &+\alpha_1[p-(m-ip]+\alpha_2(lr-p)++\alpha_2(p-p_f-ex)_t + v_t\end{aligned} \tag{5}$$

where, Δ is inflation, ip is log of industrial production index, ex is the log of nominal exchange rate, p_f denotes log of foreign prices, m, denotes log of money supply and Ir denotes lending rates.

Data issues, unit root tests and cointegration analysis

Data issues and unit root tests: Our data base covers the period January 1995 to March 2011 on monthly basis. Reflecting our stylized model and data availability, the database includes inflation, monetary variables (broad money and lending rates), activity variables (industrial production index).

We first carry out unit root tests for the variables of interest. We then proceed to use Johansen (1988) procedure for non-stationary variables to determine the cointegrating rank and the associated cointegrating vectors. The purpose of the cointegrating analysis is to find out if the data supports the models outlined in Eq. 5.

In testing for unit roots with univariate methods, we use the Philips Perron test (PP) where the null hypothesis is that the variable tested is integrated of order one, denoted I(1). Later we do unit root tests in a multivariate framework with the Johansen procedure where the null is that the variable is stationary, i.e., I (0).

In Table 1, PP statistics and estimated roots are reported. The results show that all variables are integrated of order one and thus become stationary after first difference. These tests are complemented by the graphs of these variables (not shown) which show that the variables become stationary after the first difference. We thus ignore I (2) tests for these variables.

The Figures in brackets are McKinnon critical values for rejection of unit roots at the conventional 5% level of significance. * indicates that the variables are significant at 5% level of significance. The results show that all variables are non stationary (integrated of order one) and thus become stationary after first difference.

Cointegration analysis: The next stage is to determine the cointegrating vectors that span the variables in Eq. 5, that were found to be integrated of order one. That is, we test whether inflation, nominal exchange rate, money supply, lending rates and foreign prices are cointegrated. The purpose of the cointegration analysis is to find out if the data supports the models outlined in Eq. 5.

Table 1: Phillips Perron test

Variable	PP value (Intercept)	PP value (Intercept and trend)	Order of integration
P	-1.861369 (-2.885863)	-1.973832 (-3.448021)	
Δp	-7.341567* (-2.886074)	-7.377725* (-3.448348)	I(1)
ip	-2.216800 (-2.885863)	-14.59358* (-2.886074)	
Δip	-3.762551 (-3.448021)	-16.2059* (-3.448348)	I(1)
ex	-2.636605 (-2.885863)	-5.699602* (-2.886074)	
Δex	-2.550132 (-3.448021)	-5.904143* (-3.448348)	I(1)
Pf	-2.819463 (-2.885863)	-7.600013* (-2.886074)	
Δpf	-1.937619 (-3.448021)	-7.672794* (-3.448348)	I(1)
lr	-1.011034 (-2.885863)	12.11097* (-2.886074)	
Δlr	-3.089431 (-3.448021)	-12.0619* (-3.448348)	I(1)
M2	-1.43448 (-2.885863)	-9.046763* (-2.8858637)	
Δm2	-2.721841 (-3.448021)	-9.070868* (-3.448021)	I(1)

Table 2: The Johansen Cointegration test

Date: 05/24/11 Time: 15:51
Sample (adjusted): 2000M06 2009M12
Included observations: 115 after adjustments
Trend assumption: Linear deterministic trend
Series: OVERALL_INFL LEX LIPI LM2 LR
Lags interval (in first differences): 1 to 4
Unrestricted Cointegration Rank Test (Trace)
Hypothesized Trace 0.05

No. of CE(s)	Eigen value	Statistic	Critical value	Prob.**
None *	0.257439	77.68195	69.81889	0.0103
At most	10.225287	43.45215	47.85613	0.1219
At most	20.084044	14.09697	29.79707	0.8351
At most	30.030793	4.001481	15.49471	0.9035
At most	40.003512	0.404648	3.841466	0.5247

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis *et al*. (1999) p-values

In this investigation, we use the multivariate cointegration test, the Johansen procedure (Johansen, 1988). The test results are shown in Table 2.

Table 2 shows the eigen values, the likelihood ratio for the significant eigen values and the probability values. The hypothesis that we have no cointegrating vector (none) is rejected. The results show that we have one significant cointegrating vector. It should be noted that in a system of N variables, we should expect N-1 cointegrating vectors. The method used here helps us to get the significant vector(s). The cointegrating vector is formed as follows:

1 Cointegrating Equation (s):Log likelihood 293.0374
Normalized cointegrating coefficients (standard error in parentheses)
OVERALL_INFLLEXLIPILM2pf
1.0000006.007548-52.4481034.529491.461906
(13.5669)(14.1931)(6.98478)(0.35263)

Empirical results: This section reports on the correlation matrix, granger causality test results and estimation results from an error correction model.

Correlation matrix: We first start the correlation matrix by asking the question: Is inflation a monetary phenomenon? As shown in Table 3, money supply growth is correlated with inflation, although the relationship is relatively stronger with non-food inflation. The results also show that exchange rate changes have a relatively stronger relationship with inflation than money supply growth.

The next question: Is inflation driven by lending rates? Table 4 shows the correlation matrix of lending rates, money supply growth and inflation. It is clear that there is a close relationship between lending rates and inflation. Similarly, lending rates are correlated with money supply.

Granger causality tests: Having examined the correlation matrix of the variables under study, our next step is to determine how these variables drive each other. This is done through the Granger causality test. The results are shown in Table 5.

Table 3: Correlation matrix of money supply growth, exchange rate depreciation and Inflation (1995-2011)

	Overall inflation	Food inflation	Non-food inflation	M2 growth	Mk/US$ Depreciation
Overall inflation	1.0000				
Food inflation	0.7615	1.0000			
Non-food inflation	0.8699	0.3495	1.0000		
M2 growth	0.2493	0.0915	0.2739	1.0000	
Mk/US$ depreciation	0.5413	0.0265	0.7554	0.2666	1.0000

Table 4: Correlation matrix of money supply growth, lending rates and inflation

	Overall inflation	Food inflation	Non-food inflation	LR	M2 growth
Overall inflation	1.0000				
Food inflation	0.7615	1.0000			
Non-food inflation	0.8699	0.3495	1.0000		
LR	0.7506	0.5054	0.7048	1.0000	
Ms growth	0.2493	0.0915	0.2739	0.4861	1.0000

Table 5: Error correction model results

Dependent Variable: DOVERALL_INFL
Method: Least Squares
Date: 05/25/11 Time: 14:53
Sample (adjusted): 2000M12 2009M12
Included observations: 109 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Doverall_infl (-1)	0.433462	0.086965	4.984318	0.0000
Dlex (-1)	9.657173	3.967842	-2.433860	0.0167
DLIPI (-6)	-0.933724	0.996502	-0.937002	0.3510
DLM2 (-3)	0.775248	2.411602	2.104513	0.0378
DLM2 (-6)	0.195907	1.900597	2.733828	0.0475
Dpf (-2)	0.238243	0.054652	-5.234801	0.0012
C	-0.256780	0.105596	-2.431713	0.0168

R-squared	0.690352	Mean dependent var	0.250459
Adjusted R-squared	0.554490	S.D. dependent var	1.085393
S.E. of regression	0.872044	Akaike info criterion	2.626112
Sum squared resid	77.56705	Schwarz criterion	2.798951
Log likelihood	-136.1231	Hannan-Quinn crit.	2.696205
F-statistic	10.88494	Durbin-Watson stat	2.037031
Prob (F-statistic)	0.000000		

AR test = F (5,,119) = 0.27424 ARCH test: F (5,118) = 0.3152, Normality test: Chi-squared = 1120.2 Hetero test = F (20,1050), RESET test: F (1,120) = 1.1597

Money supply growth and overall inflation:

- M2 growth ⇒⇒ headline inflation F(2,113) = 2.50970[0.0625] M2 growth predicts inflation
- Headline inflation ⇒⇒ M2 growth F(2,113) = 1.47230[0.2261] No feedback effects

Three lags of each variable were used and we also tested reverse causation. The results of the F-test are shown and the figures in brackets are probability values. These results are interpreted as follows: Money supply growth predicts inflation with probability value of less than 10% while the reverse effects can only hold with a probability of 23% and so are not significant. Thus, overall inflation does not predict money supply growth; that is there are no reverse or feedback effects.

Money supply growth and non-food inflation:

- M2 growth ⇒⇒ non-food inflation F(2,119) = 1.89980[0.0776] M2 growth predicts non-food inflation
- Non-food inflation ⇒⇒ M2 growth F(2,119) = 1.67066[0.1251] No feedback effects

Money supply growth predicts non-food inflation with no feedback effects. Thus non-food inflation does not predict money supply growth.

MK/US$ exchange rate depreciation and non-food inflation:

- Depreciation ⇒⇒ Headline inflation F(8,119) = 3.45541[0.0656] depreciation predicts inflation
- Headline inflation ⇒⇒ Depreciation F(8,119) = 0.31916[0.5732] No feedback effects
- Depreciation is seen here to drive inflation but with no feedback effects

MK/US$ exchange rate depreciation and non-food inflation:

- Depreciation ⇒⇒ non-food inflation F(2,119) = 11.3957[0.0010] depreciation predicts non-inflation
- Non-food inflation ⇒⇒ Depreciation F(2,119) = 0.01648[0.89812] No feedback effects
- Depreciation is seen here to drive non-food inflation but with no feedback effects

Lending rates and private sector credit:

- Lending rates ⇒⇒ private sector credit F(2,119) = 1.64538[0.0948] lending rates predicts private sector credit
- Private sector credit ⇒⇒ lending rates F(2,119) = 2.31371[0.0133] feedback effects present
- Lending rates drive private sector credit with strong feedback effects

Lending rates and money supply growth:

- Lending rates ⇒⇒ money supply growth F(2,119) = 2.01871[0.0457] lending rates predicts money supply growth
- Money supply growth ⇒⇒ lending rates F(2,119) = 0.867541[0.5570] no feedback effects
- Lending rates predict money supply growth with no feedback effects

Overall inflation and industrial production index:

- Overall inflation ⇒⇒ industrial production F(2,119) = 1.78023[0.0649] headline inflation predicts industrial production
- Industrial production ⇒⇒ headline inflation F(2,119) = 0.53562[0.8855] no feedback effects
- Overall inflation drives industrial production index with no feedback effects

Lending rates and exchange rate depreciation:

- Lending rates ⇒⇒ depreciation F(2,119) = 3.79228[0.0255] lending rates predicts exchange rate changes
- Depreciation ⇒⇒ lending rates F(2,119) = 1.61363[0.2037] no feedback effects
- Lending rates influence exchange rate changes with no feedback effects

Exchange rate depreciation and industrial production index:

- Depreciations ⇒⇒ industrial production index F(2,119) = 0.62175[0.8181] depreciation does not drive industrial production index
- Industrial production ⇒⇒ depreciation F(2,119) = 0.80217[0.6472] industrial production index does not drive depreciations

Depreciations do not drive industrial production index. Similarly, industrial production index does not drive depreciations.

Error correction model of inflation: The final step is to estimate a single error correction model of domestic inflation. First a general model is estimated and the general-to-specific modelling strategy is used to obtain an empirically constant parsimonious model. The general model was estimated with nine lags of each variable in differences and an error correction term. The reduction of the general model was carried out by removing the longest lag of each variable with low t-statistics and then using the F-statistics and the Schwartz criteria to check the validity of the simplification. The coefficient of the ECM can be interpreted as the strength of adjustment or the amount of dis-equilibrium transmitted each period to the rate of inflation.

By following the general-to-specific approach, a parsimonious (preferred) short run model was obtained shown in Table 5.

The results indicate persistence of inflation, as past inflation is found to be a significant determinant of inflation in the short run. The coefficient of 0.43 for lagged inflation suggests high inflation inertia. The results also show a high exchange rate pass-through to domestic price. The nominal exchange rate appears to have a stronger impact on inflation than money supply growth. Exchange rate pass-through to domestic prices measures the extent to which fluctuations in nominal exchange rate affect consumer prices through changes in the prices of imported goods (in domestic currency). Consumer prices are affected directly by the change in the prices of imported finished and intermediate goods. The pass-through effects from both the exchange rate changes and foreign price level depend upon the structure of the economy. Loss of the nominal anchor could imply that shocks to the rate of inflation could have lasting impact, pushing the inflation rate to a higher level.

Foreign prices have a significant impact on inflation. One example of foreign price is oil price. The impact of oil price comes through first and second round effects. The first and second round effects of oil may be hard to distinguish in practice. The first round effect of increase in fuel price is taken to be its direct impact on the general price index. The second round effects are the persistent effects as they will feed through into firm's cost structure and hence into price setting in the wider economy. Second round effects unfold over a long period of time and may evolve in complex ways. For instance, a rise in the price of fuel will raise consumer price index directly and raise costs where fuel is used as an input but it will also reduce consumers' purchasing power, depressing demand for other goods at a later stage. Monetary policy cannot attempt to offset the unavoidable first round effects of the fuel price increase. However, it can be used to resist any flow-through to on-going prices and wages.

Money supply growth leads to higher inflation with lags of about 3 to 6 months. Money supply growth affects prices as they generate excess demand conditions in the money market. Finally, higher output and higher lending rates depresses inflation.

Statistical properties of the model were evaluated with a range of test statistics in order validate the results. The model appears to be statistically well specified. In addition to the relatively high R-squared, there seems to be no evidence of serial correlation (AR test) or autoregressive heteroskedasticity (ARCH test). The model can be said to have been well specified since the assumption that the model is well specified is not rejected.

CONCLUSION

This study examines the relative importance of monetary factors in driving inflation in Malawi. A stylized inflation model is specified that includes standard monetary variables, the exchange rate

and supply-side factors. The model is estimated for the period January 1995 to March 2011 on a monthly basis.

The results indicate that inflation in Malawi is a result of both monetary and supply-side factors. Monetary supply growth drives inflation with lags of about 3 to 6 months. On the other hand, exchange rate adjustments play a relatively more significant role in fuelling cost-push inflation. It is further observed that slumps in production generate inflationary pressures.

Thus the econometric study highlights the importance of closely coordinating monetary and exchange rate policies. The Reserve Bank should ensure that broad money supply expands in line with nominal gross domestic product. However, monetary policy alone might not address other exogenous structural shocks considered as additional causes of inflation. What monetary policy can do is to slowdown the rate of inflation expectations, by ensuring that prices in other categories of non-food items slow down. For example, it has been shown that exchange rate shocks have a strong effect on inflation. Given this finding exchange stability is key to anchoring inflation expectations, as the exchange rate pass-through in Malawi is relatively high. Finally, measures to control inflation must also emphasize enhancing production and supply, especially of food. Thus inflationary control should aim at policies directed at both monetary and supply factors.

Given the strong links between non-food inflation on one hand and nominal exchange rate and money supply growth on the other, the Reserve Bank should use non-food inflation as an operational guide in measuring the effectiveness of its monetary policy stance. In line with international best practices, however, the Bank should continue expressing its inflation targets in terms of headline inflation (the weighted average of food and non-food inflation).

APPENDIX 1

Appendix 1: Monetary policy variables, inflation and GDP

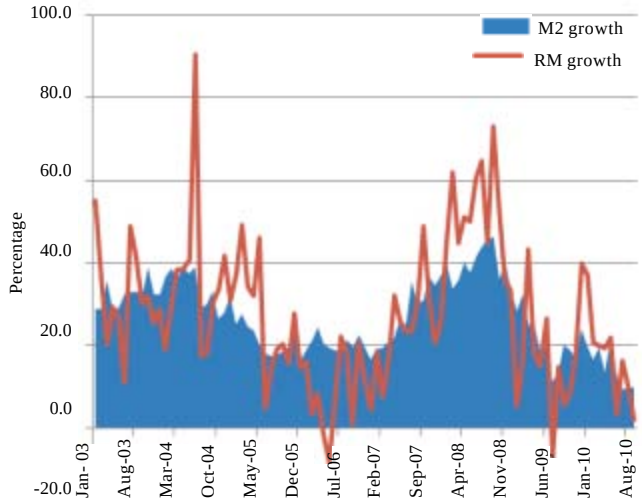

Fig. A-1: Reserve money growth (RM growth) and broad money growth (M2 growth)

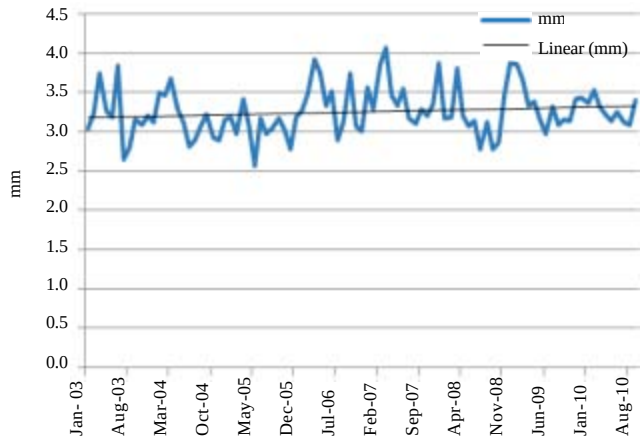

Fig. A-2: Broad money multiplier (mm)

APPENDIX 2

Appendix 2a: Overall inflation

Dependent Variable: OVERALL_INFL Method: Least Squares
Date: 05/27/11 Time: 22:19
Sample (adjusted): 2000M08 2009M12
Included observations: 113 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Overall_infl (-1)	0.959413	0.019795	48.46757	0.0000
DLM2 (-3)	11.87444	2.907750	4.083721	0.0001
DLEX (-4)	6.991454	3.861786	1.810420	0.0731
DLPF (-6)	19.40579	9.927080	1.954834	0.0532
DLIPI (-2)	2.492191	1.354066	1.840525	0.0685
ECM_ovrall 2 (-1)	-0.008797	0.031898	-0.275787	0.7832
C	-0.186095	0.296198	-0.628278	0.5312
R-squared	0.976512	Mean dependent var		13.94690
Adjusted R-squared	0.975182	S.D. dependent var		7.159735
S.E. of regression	1.127916	Akaike info criterion		3.138566
Sum squared resid	134.8527	Schwarz criterion		3.307520
Log likelihood	-170.3290	Hannan-Quinn criter.		3.207126
F-statistic	734.4872	Durbin-Watson stat		1.670296
Prob(F-statistic)	0.000000			

Appendix 2b: Non-food inflation

Dependent Variable: NON_FOOD_INFL
Method: Least Squares
Date: 05/27/11 Time: 23:40
Sample (adjusted): 2000M11 2009M12
Included observations: 110 after adjustments

Variable	Coefficient	Std. Error	T-statistic	Prob.
Non_food_infl (-1)	0.921509	0.015929	57.85159	0.0000

Appendix 2b: Continue

Variable	Coefficient	Std. Error	T-statistic	Prob.
DLEX (-1)	25.17811	7.169295	3.511937	0.0007
DLEX (-3)	33.41611	6.486678	5.151499	0.0000
DLM 2 (-9)	7.832091	4.563366	1.716297	0.0891
DLIP I (-9)	-2.481066	2.048031	-1.211440	0.2285
DLPF (-5)	30.48277	15.45794	1.971982	0.0513
ECM_NONF 2 (-1)	-0.014382	0.027261	-0.527565	0.5989
C	-0.090603	0.344844	-0.262735	0.7933
R-squared	0.981174	Mean dependent var		16.34455
Adjusted R-squared	0.979882	S.D. dependent var		12.53984
S.E. of regression	1.778641	Akaike info criterion		4.059523
Sum squared resid	322.6835	Schwarz criterion		4.255922
Log likelihood	-215.2738	Hannan-Quinn criter.		4.139184
F-statistic	759.4196	Durbin-Watson stat		1.789464
Prob(F-statistic)	0.000000			

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