

Interbank Market and Effectiveness of Monetary Policy in Malawi

Esmie Koriheya Kanyumbu

Research Paper 464

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Interbank Market and Effectiveness of Monetary Policy in Malawi

By

*Esmie Koriheya Kanyumbu
Reserve Bank of Malawi*

AERC Research Paper 464
African Economic Research Consortium, Nairobi
September 2021

This research study was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

ISBN 978-9966-61-162-8

© 2021, African Economic Research Consortium.

Contents

List of tables

List of figures

Abstract

List of abbreviations and acronyms

1.	Introduction	1
2.	Stylized facts about liquidity management, interbank market and monetary policy in Malawi	6
3.	Literature review	13
4.	Methodology and data	18
5.	Results	22
6.	Conclusions, policy implications and recommendations	28
	Notes	29
	References	30
	Appendixes	32

List of tables

1.	Malawi's interbank market participants as at 31 December 2017	10
2.	Descriptive statistics of variables used in the study	21
3.	Results of unit root tests on the variables using ADF test	22
4.	Estimation results of the long-run IBR and lending rate equations	23
5a.	Results of interbank market rate residual equation	23
5b.	Results of lending rate residual equation	24
6a.	Estimation results of the interbank market rate error correction model	25
6b.	Estimation results for the lending rate error correction model	26

List of figures

1.	Movements in money market rates (2001-2018)	4
2.	Withdrawals via repos and tap sales (MK billion)	7
3.	Daily average interbank traded volume (MK billion)	8
4.	Banking system liquidity 2010-2017 (MK billion)	9

List of abbreviations and acronyms

CEPA	Centre for Policy Analysis
FPAS	Forecasting and Policy Analysis System
IBR	Interbank Market Rate
LRR	Liquidity Reserve Requirements
MPC	Monetary Policy Committee
MPR	Monetary Policy Rate
OMO	Open Market Operation
RBM	Reserve Bank of Malawi
SDF	Standing Deposit Facility

Abstract

The study aimed at investigating how the interbank market affects the monetary policy transmission mechanism in Malawi. To achieve that, the study analysed the nature of the relationship between excess reserves and the interbank market rate and tried to discuss other possible factors that affect the interbank market rates in Malawi and limit the effectiveness of the central bank's efforts that aim at influencing important interest rates in the economy. The study further analysed the strength and speed at which the interbank market rate affects other money market rates, specifically the lending rate. Using financial markets monthly data for the period 2010:1 to 2018:6, the study applied Ordinary Least Square methods for estimation using Error Correction Model. From the results of the study, it is concluded that the interbank market is the right platform through which the central bank can influence money market rates in the process of monetary policy implementation. Interbank market rates respond to levels of banking system liquidity at a speed that makes sense for monetary policy and they are able to send significant signals to other relevant market rates like lending rates. Drawing from these outcomes, the study recommends continued forecasting and controlling of banking system liquidity by the central bank and establishment of additional factors that affect the interbank market rate and hence limit the central bank's efforts. For further improvement in the monetary policy transmission mechanism, the study recommends increased knowledge on interbank pricing models for individual commercial banks and research on the informal sector's reaction to central bank's policy actions.

1. Introduction

Background to the study

Interbank markets are markets where banks lend and borrow funds from each other in order to meet their daily liquidity needs. Discussions on interbank markets have attracted a lot of attention following the US subprime mortgage crisis of 2007 and the default of Lehman Brothers in 2008. The world macro-economic scenario has been dominated by the effects of these two events on global financial markets. Behaviour of interbank market rates after the global financial crisis has attracted attention of different economies, and interbank market has quickly become one of the key gauges of market tensions and expectation. This is so because interbank market rates underlie many derivative markets that are used quite often by financial intermediaries and policy makers to infer market expectations. Although most developing countries like Malawi did not have serious problems emanating from the results of the recent financial crisis, research on interbank markets in such countries remains important for a number of reasons. From a macro-economic point of view, interbank market rates do matter since they are a key part of the monetary policy transmission mechanism. In addition, since interbank market rates are somehow determined by the policy rates, interbank market rates give a good picture of the stance of a central bank's monetary policy. In a normal functioning market, variations in interbank market rates are rapidly transmitted to the entire interest rate structure and result into affecting borrowing conditions for economic agents. This is why interbank market rate spreads have been at the centre of debate, bringing out suggestions that such spreads should be incorporated into the formal macro-economic models (Angelini et al, 2011).

In recent years, the interest rate channel of monetary policy has become more important in many countries and has replaced the monetary aggregates route. In the case of Malawi, the central bank, the Reserve Bank of Malawi (RBM), aims at formulating and implementing monetary sound and macro-prudential policies that are consistent with the agreed national strategies and the transition from monetary aggregate targeting in favour of interest rate targeting, has been treated with much attention since 2014. Generally, interest rate targeting involves choosing a short-term market interest rate as an operating target for monetary policy. In the case of Malawi, the overnight interbank market rate is being used for this purpose. The choice of the interbank market rate as an operating target for monetary policy is

based on the trust that changes in this short-term rate are able to send monetary policy signals and to significantly affect other money market rates at a speed that makes sense for monetary policy. It is further assumed that changes in the money market rates are consequently reflected in the overall economic performance of the economy since they reflect cost of funding. Generally, the effectiveness of monetary policy, regardless of what policy is in place, rests on its ability to affect the rate of inflation (De Angelis, 2005).

Monetary transmission mechanism refers to the process by which monetary policy decisions affect the real economy and inflation (CEPA, 2012). Although the transmission mechanism operates through several channels, from central banks' point of view, the onset of monetary policy dwells on banking system liquidity management. This is based on the fact that the interbank market rate is quickly and directly influenced by liquidity levels in the banking system of which the central bank can easily influence through banking system liquidity injections and withdrawals.

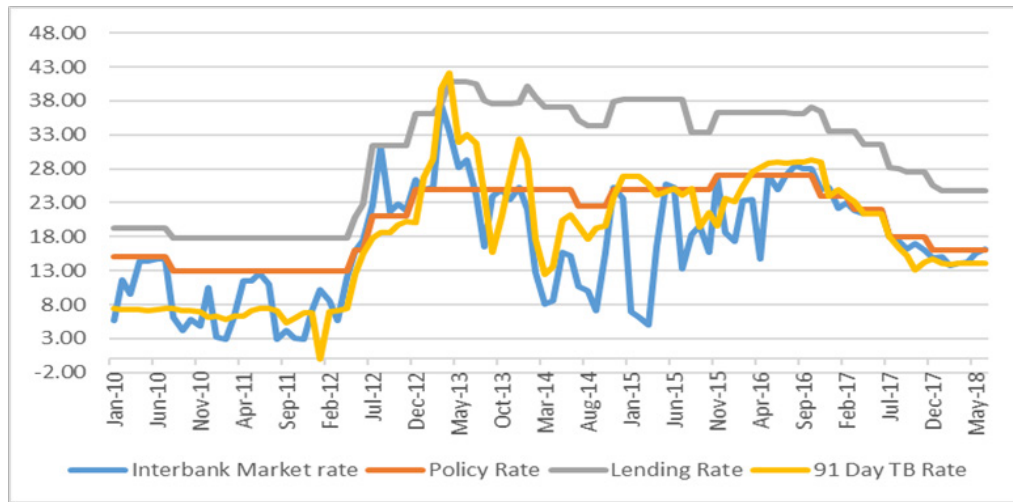
From time to time, the RBM through its Monetary Policy Committee (MPC) sets the Monetary Policy Rate (MPR), an interest rate that is used to determine the levels of the rest of the interest rates in the economy. In the case of Malawi, the Lombard Rate is the rate at which banks borrow money from the central bank and is set at specified percentage points above the monetary policy rate. Thus, to a certain extent, banks offer financial products to their clients at an interest rate that is based on the ruling monetary policy rate. Following that, the choice of the interbank market rate as an operating target for monetary policy is based on the understanding that changes to the MPR, to which the central bank has control, directly and quickly affect the interbank market rate. It is further assumed that changes to the interbank market rate affect all other relevant interest rates in the market. Although there are other relevant market and demand factors that affect the determination of bank rates such as banking competition, size of banks, level of development of financial markets, aspects affecting each single customer or credit transaction, interbank interest rates remain the main drivers of the rates charged by banks on loans (Aristei and Gallo, 2014). Importantly, the MPR affects the interbank market rates, which are the basis of the process of defining the cost of money lent by banks to their customers, and hence have effects on the behaviour of borrowers and consequently on the real economy. As pointed out by Kovanen (2011), the transmission of interest rate changes through the interest rate channel should ideally take place over a relatively short period of time since a faster transmission would strengthen the impact of monetary policy on the real economy. Practically, however, due to different factors, the short-run interest rate pass-through may be less than complete in reality and interest rates may not adjust in tandem with the rising and falling of policy interest rates. Consequently, the speed of interest rate adjustment differs across countries, financial institutions and financial products. This is true even in countries with deep and well developed financial markets like the U.S. and the Euro region.

The research issue

The Reserve Bank of Malawi is mandated by the country's constitution to maintain price stability in the economy. The mandate is achieved through implementation of monetary policy. In order to carry out that role, RBM has in place a Monetary Policy Committee which extensively deliberates on macroeconomic developments and projections in order to decide on the monetary policy stance. In order to do this, the RBM sets a medium-term inflation rate objective¹, such that all efforts are geared towards attaining the prescribed specific target. Subject to meeting the inflation objective, the MPC is also required to support government's economic policy, particularly its objectives for economic growth and employment. Monetary policy decisions are currently based on a Forecasting and Policy Analysis System (FPAS) which is an information-intensive forward-looking framework for structured and evidence-based monetary policy decision making.

In trying to improve the framework for conduct of monetary policy, one of the RBM's efforts, in the transition from monetary aggregate targeting to interest rate targeting, has been to influence banking system liquidity levels (the supply/demand side) as a way of influencing the interbank market rate (the price side). This implies that, effective monetary policy, the ability of the RBM to influence the overall demand conditions in the economy, rests on the central bank's ability to influence the interbank market rate. It further entails that the central bank should manage liquidity in such a way that the interbank market rate stays near the level of the MPR. However, until recently, the interbank market rate in Malawi has not been moving close to the policy rate (Figure 1), giving doubts as to whether the monetary policy stance of the central bank is indeed reflected in the interbank market rate and hence questioning the effectiveness on monetary policy. It has also been the case that some money market interest rates like the Treasury Bill rate have not been giving a clear picture of the stance of monetary policy, again leaving doubts as to whether market rates reflect the stance of monetary policy. On the other hand, for quite a long time, average posted bank lending rates in Malawi have, to a large extent, generally been mimicking the monetary policy rate although adjustments of lending rates by commercial banks following revisions to the policy rate have not always been a uniform action.

As can be observed from the chart in Figure 1, given the trends of money market rates in Malawi, it is not conclusive if changes in banking system liquidity automatically affect the IBR, and consequently affect the other market interest rates that are relevant for monetary policy. While the shallowness of financial markets in Malawi could be one of the factors affecting the strength of the transmission channel of monetary policy, just like any interbank market, the pricing of liquidity is also influenced by the perceived riskiness of the borrowers as well as the relationships between the interbank market participants. There is hence a need to empirically establish this strength of the transmission mechanisms given that interbank market prices both liquidity and risk. This is because the difference between the impact of liquidity and the impact of risk on the aggregate cost of interbank loan is difficult to differentiate by mere observation since there is just a single rate for each loan.

Figure 1: Movements in money market rates (2001-2018)

Source: Author's computation from RBM data.

Despite the theoretical knowledge that excess reserves affect the interbank market rates, there is still a need to test this relationship for different specific data sets and using different methodologies. In addition, there is a need to test the strength of the transmission mechanism from the interbank market rate to other market rates for specific economies. This study provides empirical discussion on whether central bank's liquidity forecasting and liquidity management efforts are adequate and establish whether there are shortcomings in the central bank's efforts that contribute to the interbank market rate's deviations from the desired levels. The approach has been twofold; first, the study has attempted to establish the strength of the relationship between excess reserves and the interbank market rate and further tried to explain other possible factors that can affect the interbank market rates. Secondly, the study attempted to establish the strength of the relationship between the interbank market rate and other money market rates.

The results of the study are very relevant in establishing the effectiveness of the interest rate targeting strategy in the conduct of monetary policy in Malawi and other economies of similar characteristics. The results are further useful in coming up with ways through which the effectiveness of monetary policy can be improved in countries like Malawi. Specifically, the findings of the study inform the RBM and other central banks whether the commonly used liquidity management efforts are enough for attainment of the desired monetary policy stance. The results further indicate whether there is a need for extra tools in order to align interbank market rate with excess reserves. The results, therefore, guide monetary policy makers on the need for additional efforts in aligning the interbank market rate with other market rates and hence influence the real sector of the economy as much as desired. The findings of the study contribute to literature on the interest rate targeting way of implementing monetary policy in economies with shallow markets, especially in establishing the

determinants of the strength of the transmission mechanism in such economies. The study indirectly recommends to policy makers on what needs to be put in place when switching to the interest targeting way of monetary policy.

Objectives of the study

The main objective of the study was to investigate the relationship between the interbank market and the monetary policy transmission mechanism in Malawi. This motivation is built on the understanding that the more reliable the central bank's model of overnight interest rates, the greater its ability to set interest rates that makes sense for monetary transmission. The study therefore analysed the relationship between excess reserves and the interbank market rates and the relationship between the interbank rates and lending rates in Malawi.

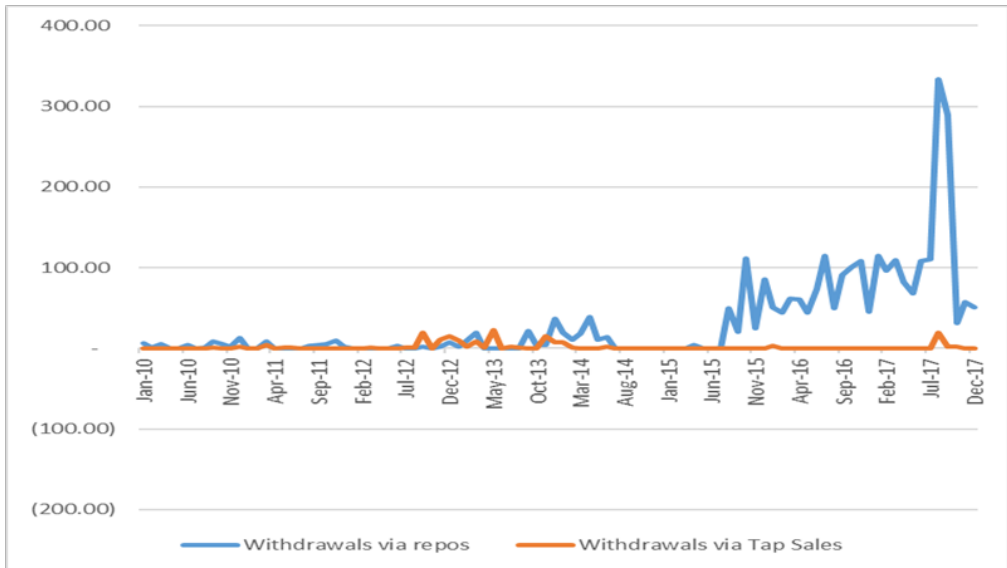
2. Stylized facts about liquidity management, interbank market and monetary policy in Malawi

Central bank activities and liquidity management

As defined by authors such as Saxegaard (2006) and Agénor et al (2004) in general terms, liquidity refers to the quantity of reserves deposited with the central bank by commercial banks in excess of the statutory liquidity requirements in relation to time and demand liabilities of the banks. The specific calculation of excess reserves varies from time to time and from country to country depending on the monetary policy objectives of a country at a given time. Other authors like Mohanty et al (2006) argue that, if commercial banks hold substantial government securities, bank reserves with the central bank only capture a part of the total holdings of liquid asset and therefore are less reliable as a measure of liquidity holdings. Since the definition of liquidity varies, in this study, we take liquidity to be specifically associated with high-powered securities owned by banks that are eligible for statutory liquidity requirements. Thus, the description of excess reserves in this study is the quantity of bank reserves deposited with the central bank in excess of the statutory liquidity requirements specified at a given period in time. The RBM, like most central banks, influences excess reserves, as defined above, in a number of ways in trying to implement monetary policy goals.

Open market operations

Monetary policy in Malawi is formulated and implemented by the RBM and is generally directed at achieving and maintaining stability in the general level of prices. The MPC is responsible for formulating monetary policy which is implemented through various Open Market Operation (OMO) tools. The main OMO instruments frequently used by the RBM to withdraw liquidity from the banking system include Repurchase Agreements (repos) and tap sales of Treasury Bills. However, repos are used more than tap sales (Figure 2), probably due to their flexibility in maturity.

Figure 2: Withdrawals via repos and tap sales (MK billion)

[Source: Author's computation from RBM data]

The use of these instruments, and hence the success of monetary policy implementation, is dependent on a well-functioning interbank market. The daily operations of the central bank aim at influencing the liquidity levels in the banking system and consequently affect the rate at which commercial banks trade liquidity on daily basis. In order to achieve that, the RBM has put in place a liquidity forecasting framework that guides on the daily operations in terms of whether to inject or withdraw liquidity from the banking system.

Standing facilities

The Reserve Bank of Malawi has two main standing facilities that are utilized in relation to liquidity management. In line with section 4 (g) and section 46² of the Reserve Bank of Malawi (RBM) Act 1989, the central bank provides a uniform set of rules to financial institutions registered under the Banking Act 1989 in accessing Standing Facilities for the purposes of addressing very short-term liquidity shortages. One of the facilities is called the Lombard Facility and is intended to primarily cover banks' temporary liquidity deficits that arise as a result of the daily settlement of payments. The facility provides collateralized overnight loans at a predetermined interest rate³. The interest rate charged on these overnight loans acts as a penalty rate to discourage banks' over-reliance on the central bank. Because the rate charged by the central bank is punitive, in an ideal situation, banks are supposed to borrow overnight from the Reserve Bank if and only if funding possibilities are not available in the interbank

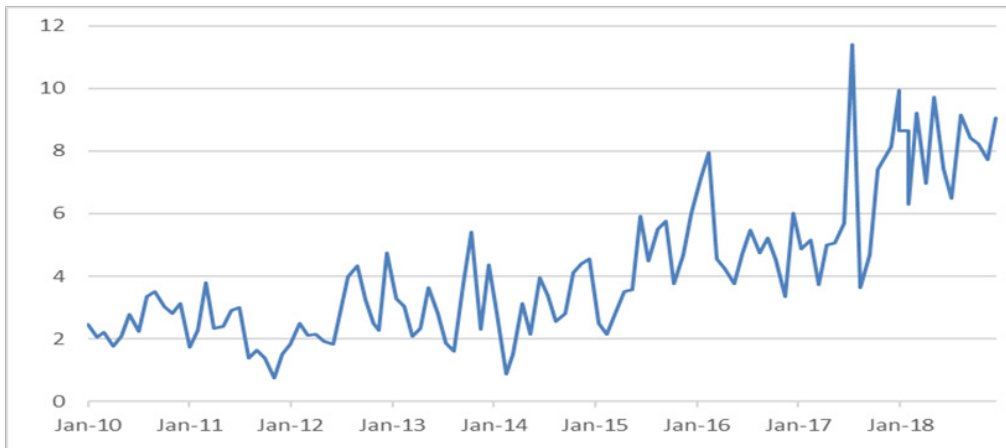
market so as to meet their payment obligations at end-of-day settlement and avoid being penalized for not meeting their respective Liquidity Reserve Requirements (LRR). However, experience has shown that this has not always been the case in Malawi. The Lombard Facility, in some cases, is still accessed even when there are un-borrowed funds in the interbank market (Figure 2). This may be a reflection of how banks treat each other on this type of market. This violates the central bank’s role of being the lender of last resort and hence interferes with the pricing of liquidity. The current framework is different from the old one where banks could be accommodated on the Discount Window only after the central bank’s approval. With the introduction of the Central Security Depository, banks can always access the Lombard Facility as long as they have the required collateral. This, to a certain extent, limits the ability of the interbank market to communicate real liquidity situations through pricing of liquidity.

The other standing facility is called the Standing Deposit Facility (SDF)⁴ and allows banks to place excess reserves for remuneration. The interest rate on the facility reflects the monetary policy stance of the RBM. Unlike the Lombard Facility which is readily available, the deposit facility is revoked whenever RBM feels the need to withdraw liquidity from the banking system in addition to using other instruments, for monetary policy purposes. Since its introduction, the SDF has not been used much as RBM favours use of OMO repos for liquidity withdrawal due to their diversified maturity periods.

The interbank market

The interbank market in Malawi opened its doors in 2001. Since its inception, trading (in terms of volumes) has generally been increasing (Figure 3).

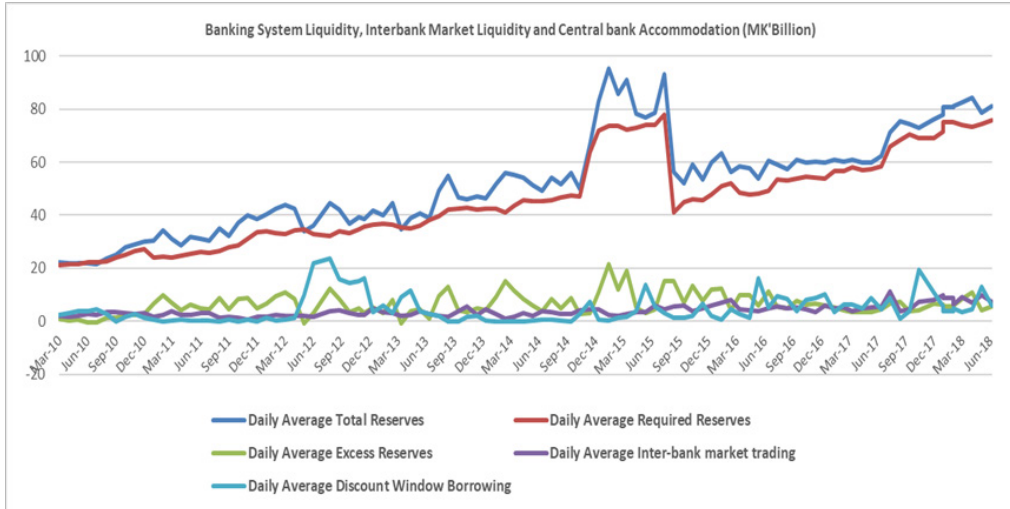
Figure 3: Daily average interbank traded volume (MK billion)



Source: RBM data.

Trading in the Malawi interbank market has, to a large extent, been depicting the liquidity conditions in the country’s banking system and the monetary policy stance (Figure 4).

Figure 4: Banking system liquidity 2010-2017 (MK billion)



Source: Author’s computation from RBM data.

As at 31 August 2018, there were nine commercial banks and one discount house participating on the interbank market in Malawi. The institutions participate in the interbank market mainly for LRR complying purposes. The list of interbank market participating institutions is shown in Table 1.

These 10 LRR complying institutions use the interbank market mainly for the purpose of meeting their LRR. RBM recognizes the central role that the interbank market plays with regard to monetary policy implementation, especially in the transmission of its monetary policy actions. Developments in overnight interest rates are, therefore, expected to influence short-term interest rates, which are the operating target of monetary policy in Malawi. The RBM recognizes the need to have a clear understanding of the interbank operations, especially on the factors that drive interbank rates for effective monetary policy implementation. To a certain extent, the three critical roles of the interbank market (liquidity redistribution, conduit of monetary policy transmission, and facilitation of price discovery) are evident in Malawi. However, the RBM intervenes in the interbank market mainly for liquidity management (market based) and monetary policy purposes. Although the interbank market in Malawi is characterized by different maturity profiles, over 95% of trading (in terms of both volumes and number of trades) mature overnight and funds are on both collateralized and uncollateralized bases. The tracked transactions in the interbank market are those carried in local currency (Malawi kwacha) since foreign exchange interbank lending and borrowing have not been common.

Table 1: Malawi's interbank market participants as at 31st December 2017

Name of institution	Number of branches	Number of agencies, kiosks and mobile vans	Largest shareholders and percentage of shares held
CDH Investment Bank Limited	3	1	Continental Holdings Limited (74.45)
Ecobank Malawi Limited	8	0	Ecobank Transnational Incorporated Company (96.00)
FDH Bank Malawi Limited	19	34	FDH Financial Holdings Limited (93.68)
First Discount House Limited	1	0	FDH Financial Holdings Limited (100)
FMB Limited	10	26	FMB Capital Holdings Plc (100)
National Bank of Malawi	15	16	Press Corporation Limited (51.49)
NBS Bank Limited	13	39	Nico Holdings Limited (50.10)
Nedbank Malawi Limited	9	2	NedGroup Investments Africa (99.29)
New Finance Bank Limited	6	0	1. MyBucks (50.00) 2. Finsbury Investments Limited (50.00)
Standard Bank Malawi Limited	7	22	Stanbic Africa Holdings Limited (60.18)

Source: Reserve Bank of Malawi.

As earlier noted, the interbank market in Malawi is important for three main reasons. Firstly, this type of market facilitates a smooth functioning of the financial system by acting as a channel for redistributing liquidity in the event of intertemporal shocks/ imbalances. Where efficiency is attained in this kind of market, the market should restore equilibrium and close undesirable liquidity gaps without the intervention of the central bank. Secondly, the interbank market acts as a conduit for the transmission of monetary policy signals, mainly through the interest rate and credit channels. A well-functioning interbank market, therefore, provides an effective price discovery mechanism in the money market as a whole hence acts as an important guide for pricing loans, mortgages, futures, options and swaps in the financial system. Thirdly, through its market disciplining role, the interbank market can potentially offer support to macro-prudential regulation, which continues to face challenges in the wake of growing sophistication in the banking industry, information asymmetry and weak legal frameworks (Andreivskaya and Semenova, 2013). The above important functions of the interbank market call for examination of this market with a specific view to ascertaining the extent to which such a market can be relied upon in the monetary policy transmission process.

As pointed out by Tiriongo and Kanyumbu (2019), the interbank market in Malawi depicts some characteristics of segmented markets; lending and borrowing agreements in the interbank market are not open to all banks, but rather there are established lines of credit (created through a credit profiling process that banks

conduct on each other). The credit profiling is mostly done on the basis of, among other factors, bank size in terms of assets and ownership structure (considering parent company if it is a subsidiary). Among other things, the credit lines would guide prices charged on this type of market. These features are therefore important in the determination of the interbank market rate and hence the extent to which the interbank market portrays the monetary policy stance of central bank. A quick observation of the interbank market data for Malawi reveals evidence of some form of market segmentation where large banks access funds at relatively lower interest rates when compared to what small banks are charged. The differentiated interest rates applied are based on some credit assessment that banks are urged to conduct on themselves. Due to this, some banks are compelled to seek funds from the central bank at much higher cost than the existing interbank rate, even when some banks in the market are known to be holding excess funds. Although there is understanding that the interbank market also prices risk, at times, the interbank market rate diverts a lot from the rate commensurate with liquidity levels. This could be a policy concern as it could limit the central bank's efforts that aim at influencing money market rates. Moreover, until recently, dealers in the interbank market could not have access to information on all the trades that have taken place in the market. Through the introduction of Reuters platform (market tracker), it is now mandatory that banks should disclose all trades done in the interbank market immediately a deal is concluded and all market participants now have access to that information. The introduction of the platform is expected to assist market participants to improve their pricing of liquidity and is expected to improve the way the interbank market rate reflects liquidity conditions.

Monetary policy in Malawi

As highlighted by Ngalawa and Viegli (2011), the monetary framework in Malawi can be categorized under three broad regimes: the repression period (1964-1986), the financial reform period (1987-1994) and post period of financial reform (1995-to date). Malawi's financial reform packages have brought about new financial innovation with growing banking system, removal of interest rate and credit controls, removal of some controls on current and capital account and adoption of a managed and floating exchange rate regime, among other things. All these policy changes and implementations have been happening at different time periods. The role of interest rate and credit channels in transmitting monetary policy impulses has become more important in the post period of financial reforms. Importantly, beginning mid 2000s, the monetary policy transmission performed consistently with predictions of economic theory and there is no evidence of a price puzzle as found in the previous literature on Malawi. However, the statistical significance of the private credit supply remains weak and this calls for more financial reforms targeting the credit market which can contribute to monetary transmission and promote further economic growth in Malawi.

The Reserve Bank of Malawi has been going through the process of modernizing its monetary policy framework, aiming at moving from a framework that is based primarily on controlling monetary aggregates to an interest rate targeting framework with plans for eventual transition to an inflation targeting framework. Currently, the RBM uses an interest rate-based monetary policy framework. Under this framework, a change in the central bank's policy stance is communicated by changing the policy rate. The idea in implementing the monetary policy stance in an interest targeting framework is to bring short-term interest rates close to the policy rate that is announced by the central bank. In this framework, the interbank market rate (IBR) is of much importance since it is used as an operating target. RBM uses a corridor system and the current rule is that IBR should not be allowed to deviate by more than 400 basis points below the policy rate, and not more than 200 basis points above the policy rate. To achieve that, RBM controls banking system liquidity conditions using its open market operations. RBM aims to keep excess reserves at very low positive⁵ levels because high excess reserves are associated with downward pressure on interbank market rates.

Successful implementation of monetary policy in the current framework is based on the assumption that a change in central bank interest rates is transmitted through interbank liquidity to lending and deposit rates. It is further assumed that changes in lending and deposit rates influence spending decisions of firms and households. The spending decisions of economic agents affect demand and supply of goods and services in an economy resulting into changes in the general price levels (inflation). The Reserve Bank of Malawi aims to achieve a single-digit inflation figure at all times.

3. Literature review

Monetary policy transmission mechanism refers to the process by which monetary policy affects key macroeconomic variables such as aggregate spending, prices, investment and output. The theoretical reasoning behind this follows the conventional Keynesian interest rate channel, where an increase in short-term interest rate, mainly resulting from manipulation of a policy instrument (such as policy rate) increases the cost of capital, lowers the demand for credit and consequently depresses spending on durable goods. Hence the general literature on the topic dwells on the liquidity management processes of central banks and how that affects market interest rates and consequently the real sector of the economy.

Theoretical literature

The role of interbank market in monetary transmission has, in most cases, been examined theoretically. The empirical literature has mainly assessed the transmission mechanism following Bernanke and Gertler's (1995) 'black box' approach, ignoring the role of interbank liquidity. Therefore, the role played by interbank liquidity is still not well understood, even though there is some evidence that central bank's adjustments of the policy rate affects other rates in the market. However, referring to a growing body of theoretical literature by authors like Allen and Gale (cited in Angelini et al, 2011), it is established that interbank crises stem from liquidity shocks. According to such theories, central bank's liquidity management efforts should be linked to interbank market rates.

Liquidity management by central banks can have short- and long-term implications, depending on the nature of operations (Reserve Bank of India, 2002). While short-term effects of the central bank's actions are felt in financial markets, the long-term implications are relevant for the real sector since this sector is influenced by long variable lags. Although the short-term liquidity operations conducted by a central bank may not have immediate implication for the real sector, injections or absorptions made over extended periods (as an intended part of monetary policy) have crucial implications on output and prices. Ideally, the impact of liquidity operations of the central bank on the real sector is felt via changes in interest rates and aggregate demand. Under the conventional Keynesian interest rate channel, an increase in short-term interest rates (done by either the manipulation of a policy instrument or mopping

of liquidity from the banking system) increases the cost of capital and lowers demand for credit and depresses spending on durable goods. In general, monetary policy changes affect the supply of credit, particularly by commercial banks (CEPA, 2012). Because banks rely on demand deposits as an important source of funds, monetary policy tightening, by reducing the aggregate volume of bank reserves, reduces the availability of bank loans and hence affects the economic growth of the country.

The interest rate channel mainly involves operations of the central bank that directly influence the interbank market rate. For example, cutting the policy rate would reduce the rate at which the central bank provides liquidity to commercial banks at their demand. With the liquidity available at lower cost from the central bank, banks will be induced to reduce the rates on the interbank market at which they trade liquidity with each other. The overall lower cost of funds would allow banks to reduce their lending rates and this could result in increase in inflation. Opposite results are yielded when the central banks raise the policy rate. On daily basis, central banks' manipulation of the banking system liquidity through their OMO activities affects the interbank market rate, which in turn affects other rates in the market.

Empirical literature

Studies done on the topic include the one by Kovanen (2011) who analysed this interest rate pass-through for Ghana. In the study, prolonged deviation in the interbank market rate from the monetary policy rate was pointed out as one of the main challenges the Bank of Ghana faces when targeting a short-term money market interest rate in its conduct of monetary policy. The study used time series and bank-specific data in order to highlight linkages between policies, wholesale market, and retail market interest rates. The study analysis showed that responses to changes in the policy interest rate are gradual in the wholesale market. The study concluded that asymmetries in the wholesale market adjustment may have resulted from weak monetary policy signalling, weak policy credibility and poor liquidity management. The findings of the study imply that central banks' level of communication plays a crucial role in the effectiveness of the interest rate transmission mechanism. On the other hand, the results of the study indicated that in the retail market, pass-through to deposit and lending interest rates is protracted and incomplete. This poses a number of questions as what should be done for the transmission mechanism to be effective enough for a specific economy.

Jacimovic (2012) examined an extension of the theoretical model by Freixas and Jorge (2008) on the interbank market lending under perfect and asymmetric information. By allowing for the cross-border interbank market operations between the headquarters and the affiliates of bank holding companies, the findings of the study showed that the foreign ownership of a considerable fraction of the financial system limits the effectiveness of the monetary policy in the host country. Variy (2015) used a different approach and drew a model from Bech and Keister (2013) which is in the tradition of models of Poole (1968). In general, these models show that banks that

are subjected to minimum reserve requirements maximize their expected profits by choosing the amount of interbank loans they make depending on how much liquidity is created by the central bank. The study further concluded that interbank market fragmentation disrupts the transmission of monetary policy.

Using a Markov-switching Vector Autoregressive model, Aristei and Gallo (2014) analysed the interest rate pass-through between interbank and retail bank interest rates in the Euro area during the financial crisis. Based on monthly data for the period 2003:1–2011:9, the empirical results showed that, during periods of financial turmoil, all interest rates used in the study showed a reduction of their degree of pass-through from the interbank market rate. Moreover, interest rates on loans to non-financial firms were found to be more affected by changes in the interbank rate than loans to households, both in times of high volatility and in normal market conditions. This implies that the nature and size of borrowers affect the transmission mechanism of monetary policy.

One of the uniqueness of interbank markets is the fact that lending can sometimes be uncollateralized. Dwelling on the work by Green et al (2016), banks utilize lines of credit with other banks for lending and borrowing and lenders determine the credit worthiness of borrowers to whom they lend. This affects the volume as well as the price at which individual banks can borrow liquidity in the same market. Moreover, relationship and networking are important in this type of market. This implies that institutions with lesser reputation tend to transact regularly and consistently with limited number of counterparties while those that are looked at as “too good to fail” have the flexibility of borrowing from most of the institutions within the market. As empirically established by Tiriongo and Kanyumbu (2019), banks with improved asset quality (lower asset quality ration) face lower borrowing costs compared to their counterparts with poor quality of asset (higher ratios of non-performing loans to total loans). This was established to be true for both Malawi and Kenya. Additionally, large banks enjoy lower costs of borrowing compared to smaller banks. Moreover, banks with increased capital buffers enjoy lower costs of borrowing in the interbank market since highly-capitalized banks are perceived as less risky for both Malawi and Kenya. Given that commercial banks have their own screening efforts when it comes to lending in the interbank market, the liquidity management efforts of the central bank may be limited in as far as monetary policy is concerned. This implies that apart from looking at the liquidity levels that are prevailing in the market at a given period of time, it also matters who has the liquidity for that period.

The transmission of monetary policy to credit aggregates and the real economy can also be impaired by weaknesses in the contracting environment, shallow financial markets, and a concentrated banking system. Abuka et al (2015) empirically assessed the bank lending channel in Uganda during 2010–2014 using a supervisory data set of loan applications and granted loans. Focusing on a short period during which the policy rate rose by 1,000 basis points and then came down by 1,200 basis points, the five authors found that increase in interest rates reduces the supply of bank credit both on the extensive and intensive margins and established a significant pass-through to

retail lending rates. They further highlighted a strong bank balance sheet channel and established that lending behaviour of banks with high capital and liquidity is different from that of banks with low capital and liquidity. The results of the study pointed towards significant real effects of the bank lending channel in developing countries.

In trying to validate the significance of monetary policy in Malawi, Mangani (2008) investigated the nature and strength of the relationships among monetary policy instruments, intermediate targets, and prices using monthly data from January 1994 to March 2009. The study concluded that an increase in the monetary policy rate instantaneously increased the lending rate although the effects reached their peaks in about five months, after which they died off almost immediately. At the peaks of these effects, a 1% positive shock to the bank rate could induce an increase in the lending rate of about 1.5%. The study further established that both the policy rate and the lending rate had no significant forecasting power for prices, leaving the evidence regarding the ineffectiveness of the interest rate channel to be unambiguous.

Effectiveness of monetary policy may also be affected by the size of the informal sector and how the informal sector responds to central bank information and actions. Practically, results of policy actions may go beyond the formal financial sector of the economy in Malawi, of which data is readily available and can be analysed. As Chipeta and Mkandawire (1991) pointed out, the informal financial sector was larger than the formal financial sector in 1989 when measured in terms of credit extended to private sector. They also arrived at the same result by comparing savings mobilized by the formal and informal financial sectors. The informal sector remains relatively large to this date and the nature of interaction between the formal and informal sectors varies and is of importance in as far as monetary policy implementation is concerned. While some studies show that interest rates in the two sectors do not necessarily change together, Ngalawa and Viegi (2013) have demonstrated that in quasi-emerging economies, formal and informal sector loans are complementary in aggregate. This complementary link also exists in Malawi where growth in demand for credit in the formal sector is accompanied by an increase in demand for credit in the informal sector (Chipeta and Mkandawire, 1991). This simply implies that central bank actions go beyond the formal financial sector and their final impact on inflation may be under-predicted since data on the informal financial sector is difficult to get. There is therefore need to do much research to establish the reaction of the informal financial sector to interest rate shocks and how that can affect monetary policy.

From the pieces of literature reviewed above, three main observations can be made. Firstly, it is noted that the existing literature has mainly assessed the monetary policy transmission mechanism following the 'black box' approach by Bernanke and Gertler (1995), among others, which ignore the role of interbank liquidity. In general, the role played by interbank liquidity in the transmission mechanism of monetary policy is still not well understood, notwithstanding the scanty evidence that changes in the interbank market rate may affect other interest rates in the market. Secondly, studies by Kovanen (2011), Jacimovic (2012), Bech and Keister (2013), and Variy (2015) suggest that banks that are subjected to minimum reserve

requirements maximize their expected profits by choosing the amount of interbank loans they make depending on how much liquidity is created by the central bank. It is also observed from such studies that interbank market fragmentation tends to disrupt the transmission of monetary policy. Thirdly, a unique feature of interbank markets is the fact that lending can sometimes be uncollateralized. Previous papers by Green et al (2016) and Tiriongo and Kanyumbu (2019) seem to suggest that banks with increased capital buffers enjoy lower costs of borrowing in the interbank market since highly-capitalized banks are perceived as less risky. Given that banks have their own screening efforts with respect to lending in the interbank market, the liquidity management efforts of the central bank may be limited. Overall, therefore, there exists a gap in knowledge in how precisely specific interbank markets influence monetary policy transmission mechanism, either in terms of interest rates (prices) or liquidity (quantity). This paper attempted to fill this gap. Learning from the reviewed literature, it is noted that market liquidity conditions remain the starting point in discussing important factors that influence interbank market behaviour. This is specifically with regard to pricing of interbank loans. The study was, therefore, interested in discussing how excess reserves affect interbank market rate and how lending rates are affected by the interbank market rate.

4. Methodology and data

Methodology

In order to achieve the highlighted objectives, we demonstrated how monetary policy and Open Market Operations influence market interest rates. We first examine the impact of central bank's liquidity injection and withdraw operations on the interbank rate by looking at the relationship between the market liquidity position and the interbank market rate. Apart from setting the monetary policy rate at a particular level, the central bank manages excess reserves in the banking system through its Open Market Operations. This implies that if the operations are really effective, the interbank market rate, to a certain extent, should reflect the general liquidity environment in the market, in addition to reflecting the central bank's monetary policy rate. In a well-functioning financial system, banks' liquidity shortfalls and excesses at the end of each business day are covered in the interbank market. This implies that if the central bank leaves the money market short of liquidity at the end of the day, there will be increased demand for liquidity in the interbank market and the interbank market rate will go up until it reaches the rate at which banks borrow funds from the central bank. In the Malawi context, the rate at which banks borrow funds from the central banks is called the Lombard Rate. The study was guided by a model by Kovanen (2011) in which the link between interbank rate, the monetary policy rate and market liquidity condition is shown as in Equation 1.

$$i_t^{IB} = i_t^{CB} + R_t^d + \mu_t \quad (1)$$

Where, i_t^{IB} is the interbank market rate prevailing in period t , i_t^{CB} is the rate at which banks borrow from the central bank (the Lombard Rate, in our case and reflects the monetary policy rate) in period t , R_t^d is the liquidity effect and its impact on the interbank market rate in period t , and μ_t is the error term. Practically, the level of the policy rate would be reflected in the interbank market rate already because it is not common for banks to borrow in the interbank market at a rate that is above the rate at which they borrow funds from the central bank. The central bank's lending rate, therefore, acts as the upper bound benchmark rate at which banks lend and borrow

from each other in the interbank market. In equilibrium, the supply and demand for reserves in the interbank markets must be equal. By lowering available reserves in the interbank market, and hence increasing the demand for liquidity, the central bank can push the interbank market rate higher. By increasing available reserves in the interbank market, the central bank, on the other hand, can pull down the interbank market rate.

In order to shed light on the interest rate transmission process, the lending channel of monetary policy is tested. This is done by analysing how interbank market rate affects the rate at which banks extend loans to the general public. As highlighted by Kovanen (2011), the effectiveness of the interest rate transmission channel has important implications for monetary policy effectiveness. Specifically, if the transmission from the monetary policy interest rates to the interbank market rate and eventually to banks' lending interest rates works adequately, monetary policy would have a desirable effect on the real economy and prices after a short period of time.

To achieve this, the study was guided by an error correction model by Kovanen (2011) as shown in Equation 2.

$$\Delta i_t = \sum_{j=1}^K \beta_j \Delta i_{t-j} + \sum_{l=0}^N \lambda_l \Delta r_{t-l} - \mu(i_{t-1} - \alpha - \delta r_{t-1}) + \varepsilon_t \quad (2)$$

In this case, a one period change in a variable is denoted as

$$\Delta x = x_t - x_{t-1} \quad (3)$$

Equation 2 is a general presentation of the relationships that can be tested among different money market rates. For example, the change in the dependent interest rate, Δi_t in Equation 2 could be the change in the interbank market rate, the Treasury Bill rate, the exchange rate or banks' lending rate. Likewise, the change in the independent interest rate variable, Δr_t , could be the change in the monetary policy rate, the interbank market rate or Treasury Bill rate or any other rate, depending on the specific model specification. In our case, interest lies in the relationship between lending rates and interbank market rate as specified in Equation 5. However, we will first test the relationship between excess reserves and interbank market rate (Equation 4) before moving on to test how the lending rate is affected by the interbank market rate.

The specific interest in this study was to shed light on the effectiveness of the interest rate transmission channel of monetary policy. This is done by, first, investigating how the central bank influences the interbank market rate by examining the relationship between excess reserves and the interbank market. This is captured by estimating the empirical model 4 as shown in Equation 4.

$$IBR_t = \beta_1 + \beta_2 ER_t + \beta_3 Inf_t + \varepsilon_t \quad (4)$$

In Equation 4, IBR_t stands for interbank market rate in period t . This is the overnight weighted average rate at which all commercial banks lend and borrow funds from each other in the interbank market in a particular month. ER_t stands for the excess reserves in period t , defined as the quantity of reserves, in billion Malawi kwacha, deposited with the central bank by commercial banks in excess of the statutory liquidity requirement. The relationship between excess reserves and interbank market rate is a reflection of cost of funds on the interbank market given the demand and supply of such funds. Inf_t is inflation rate in period t . For the sake of this study, we used non-food inflation. It is assumed that the monetary policy rate is already reflected in the interbank market rate. Since banks that have collateral can always be accommodated by the RBM in times of liquidity shortages, it is not common for banks to pay a higher rate to borrow from another bank than the rate at which they borrow from the central bank. This phenomenon ensures that the interbank market rate remains close to the policy rate.

In the second step, we examined how interbank market rate affects the commercial banks' lending interest rates. Theoretically, in addition to other factors, banks consider their cost of borrowing when setting the rates at which they lend to their customers (commonly known as lending rates). Following that point of view, the interbank market rate, the rate at which banks lend or borrow funds from each other, is likely to be one of the most important variables that is included in commercial banks' loan pricing model. Following that, we captured the relationship between the interbank market rate and the lending rate as specified in Equation 5.

$$LR_t = \phi_1 + \phi_2 IBR_t + \phi_3 Inf_t + \varepsilon_t \quad (5)$$

Where, LR_t is the average rate at which commercial banks lend funds to their customers. Equation 5 specifies the lending rate as a function of the interbank market rate and inflation. If the objective of the central bank is achieved, it is expected that interbank market rate will move in the same direction with the lending rate. Where this is achieved, monetary policy, to a certain extent, is deemed to be effective. Inflation is included in both models to reflect how the lenders consider inflation in the pricing of loans. Ideally, lenders are aware that inflation will erode the value of their money over the period of a loan, so they increase interest rates to compensate for the loss. Inflation is, therefore, expected to have a positive sign in both models since lenders increase lending rates when inflation is expected to go up in order to make sure that inflation does not erode the value of their money.

Data and data sources

In order to achieve the econometric procedures highlighted above, we used monthly data for our variables of interest for the period 2010:1 to 2018:6 and the data was collected from the Reserve Bank of Malawi website. Table 2 provides the descriptive statistics of the variables employed.

Table 2: Descriptive statistics of variables used in the study

Variable	Excess Reserves (MK Billion)	Interbank Market Rate (%)	Lending Rate (%)	Inflation (%)
No. of Observations	102	102	102	102
Mean	6.275313	19.53005	32.59603	17.31578
Media	5.325000	19.79500	33.00000	13.65000
Maximum	21.36000	40.82000	65.00000	61.20000
Minimum	-0.810000	2.850000	17.75000	7.500000
Std. Dev.	4.259014	9.678714	11.75356	10.07318

In estimating the above mentioned relationships, Ordinary Least Squares (OLS) methods have been applied. The tests and the estimations reported in this paper are conducted using E-Views 10 software.

Anticipated results

We expected a negative relationship between excess reserves and interbank market rate. We further expected lending rate and interbank market rate to move in the same direction reflecting a positive relationship between the two variables. Following earlier arguments, inflation was expected to move in the same direction with both the interbank market rate and the lending rate.

5. Results

Stationarity and unit root tests

Estimation and hypothesis testing using a least square technique is based on the assumption that mean variances and auto-covariances of a time series are constant and independent of time. If this assumption holds, we have a stationary stochastic process. If a series is stationary, the mean, variance and other statistics based on a small realization are relevant for larger realization and may actually be considered good approximations of statistics of the entire stochastic process. On the other hand, if the stochastic process is non-stationary, the mean and variance based on a small realization cannot be used to characterize large or the entire stochastic process. If the variables are non-stationary, the relationship between the variables is termed spurious regression and we no longer use such elements as t, R-Squared or F statistic.

To deal with the issue of stationarity, the study employed the Augmented Dickey Fuller (ADF) test to establish whether the variables are stationary or not before conducting a regression analysis. As pointed out in Davidson and MacKinnon (2004), the ADF is superior to Phillips-Perron (PP) test in limited samples as is the case for this study. Table 3 provides the results of the unit root tests. We added one to the optimal lag length based on the Akaike information criterion and ended up with a maximum lag length of 14 for the tests. Guided by a graphical inspection of the time series, both intercept and trend terms were included in the tests. The results are presented in Table 3.

Table 3: Results of unit root tests on the variables using ADF test

Variable	ADF Test Statistic in Levels	ADF Test Statistic in First Differences	Order of Integration
Excess Reserves	-2.38	-8.46	I(1)
Interbank Rate	-1.92	-6.17	I(1)
Lending Rate	-1.86	-13.85	I(1)
Inflation	-2.67	-5.20	I(1)

Note: We used a 5% critical value of -3.43

As can be observed from Table 3, the ADF tests confirm that all the variables of interest are integrated of the first order.

Cointegration and error correction model

Although a linear combination of unit root processes will itself contain a unit root in many cases, that is if $X \sim I(1)$ and $Y \sim I(1)$, then $Z = Y - \beta X$ will also be $I(1)$, in some cases, it is possible to find a β such that $Z = Y - \beta X \sim I(0)$. In such cases, we say that there is a cointegrating relationship between X and Y and that β is the cointegrating parameter. This means that even though both X and Y contain unit roots, they are linked in such a way that they do not move too far from each other. The results of the unit root tests suggest that the series could be cointegrated, hence there may exist separate short-run and long-run effects. To establish cointegration of the $I(1)$ variables, we used the Engle and Granger 2-Step Procedure. We first estimated long-run equations whose results are presented in Table 4.

Table 4: Estimation results of the long-run IBR and lending rate equations

Variable	Coefficient [Standard Error]	Variable	Coefficient [Standard Error]
<i>(Dependent variable is IBR)</i>		<i>(Dependent variable is LR)</i>	
Constant	9.6811*** [1.8462]	Constant	12.9828*** [1.3821]
ER	-0.5085*** [0.1601]	IBR	0.4334*** [0.0732]
INF	0.5549*** [0.0834]	INF	0.5069*** [0.0736]
R-squared	0.3323	R-squared	0.630753
Adjusted R-squared	0.3188	Adjusted R-squared	0.623294
Prob(F-statistic)	0.0000	Prob(F-statistic)	0.0000

***, **, * denote significance at 1%, 5% and 10%, respectively. Figures in brackets are standard errors.

We then subjected the residuals obtained from estimation of the long-run equations to stationarity test by estimating auxiliary regressions whose results are shown in tables 5a and 5b. Residuals obtained from the long-run interbank market rate and the long-run lending rate equations are denoted as “RESID01” and “RESID02”, respectively.

Table 5a: Results of interbank market rate residual equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: DRESID01				
C	0.092694	0.401544	0.230844	0.8179
RESID01(-1)	-0.199871	0.064617	-3.093173	0.0026
DRESID01(-1)	-0.014706	0.100736	-0.145982	0.8842

Table 5b: Results of lending rate residual equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dependent Variable: DRESID02				
C	-0.278075	0.398199	-0.698331	0.4866
RESID02(-1)	-0.256388	0.072180	-3.552073	0.0006
DRESID02(-1)	-0.008793	0.100454	-0.087529	0.9304

The test statistic here is the t-ratio for the residual equations, and as can be observed in table 5a and 5b, takes the value of -3.093173 in the interbank market rate residual equation and -3.552073 in the lending rate residual equation. Both values would be statistically significant if we used the standard t-distribution. However, the standard t-distribution is not appropriate in this case because the statistic does not follow the t-distribution under the null hypothesis. We instead used the χ^2 -distribution and used the MacKinnon critical values as a basis for comparison. We calculated these critical values from tables based on computer simulations. We obtained such tables from MacKinnon (2010) where the following formula is used to calculate the critical values:

$$\beta_{\infty} + \beta_1/T + \beta_2/T^2 \text{ where } T \text{ is the sample size.}$$

Based on the formula above, using $T=100$ for the interbank market residual equation and $T=102$ for the lending rate residual equation, the 5% critical values were calculated to be -2.89032 and -2.88975, respectively, implying rejection of the null hypothesis of no cointegrating vector linking the variables in both cases. This implies that there is a long-run structural relationship between the non-stationary variables in both models. In other words, the non-stationary variables are cointegrated. Given that the variables in both models are non-stationary, in order to avoid obtaining spurious results, Error Correction Model (ECM) is employed in both cases. We, therefore, estimated the interbank market rate and the lending rate models as in Equations 6 and 7, respectively.

$$\Delta IBR_t = \beta_1 + \beta_2 \Delta IBR_{t-1} + \beta_3 \Delta ER_t + \beta_4 \Delta ER_{t-1} + \beta_5 \Delta INF_t + \beta_6 \Delta INF_{t-1} + RESID01_{t-1} \quad (6)$$

$$\Delta LR_t = \phi_1 + \phi_2 \Delta LR_{t-1} + \phi_3 \Delta IBR_t + \phi_4 \Delta IBR_{t-1} + \phi_5 \Delta INF_t + \phi_6 \Delta INF_{t-1} + RESID02_{t-1} \quad (7)$$

The results of the two ECMs are shown in Table 6a and Table 6b.

Table 6a: Estimation results of the interbank market rate error-correction model

Variable	Coefficient [Std. Error]
Dependent Variable: DIBR	
C	0.0947 [0.3866]
DIBR(-1)	0.0390 [0.1039]
DER	-0.7380*** [0.0980]
DER(-1)	-0.2004* [0.1136]
DINF	-0.1534 [0.2930]
DINF(-1)	0.2753 [0.2841]
RESID01(-1)	-0.1944*** [0.0631]
R-squared	0.4474
Adjusted R-squared	0.4117
F-statistic	12.5471
Prob(F-statistic)	0.0000

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Figures in brackets are standard errors.

The two models were also subjected to diagnostic tests and they all passed the test and hence the results can be used with confidence. The Breusch-Godfrey Serial Correlation test for high order serial correlation was conducted and the results indicate that the null hypotheses of no serial correlation could not be rejected for both models. The White's Heteroscedasticity test was performed on the residuals to establish the presence or absence of heteroscedasticity. The results showed that the null hypothesis of no heteroscedasticity could not be rejected in both cases. In addition, the null hypothesis of no ARCH could not be rejected. To test whether the models were correctly specified, the Ramsey RESET test was conducted on the residuals and the null hypothesis of no misspecification could not be rejected for both models.

Table 6b: Estimation results for the lending rate error-correction model

Variable	Coefficient [Std.Error]
Dependent Variable: DLR	
C	-0.0401 [0.1338]
DLR(-1)	-0.0099 [0.0951]
DIBR	0.1078*** [0.0276]
DIBR(-1)	0.0452 [0.0298]
DINF	0.0568 [0.0973]
DINF(-1)	0.0539 [0.0984]
RESID02(-1)	-0.0853** [0.0277]
R-squared	0.2764
Adjusted R-squared	0.2297
F-statistic	5.9203
Prob(F-statistic)	0.0000

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Figures in brackets are standard errors.

Discussion of results

As expected, the coefficient of excess reserves in the interbank market rate model is negative and significant at 1% confidence level. Previous period's changes in excess reserves are also observed to have a negative impact on interbank rate. Precisely, a unit positive change to excess reserves leads to a decrease in the interbank market rate by about 0.74 percentage point. These results suggest that an increase in excess liquidity has a decreasing effect on the interbank market rate. The results confirm the role of liquidity as suggested by Allen and Gale (cited in Angelini et al, 2011), while at the same time refuting the conclusions by McAndrews et al (2008) that central bank liquidity injection and withdraw efforts do not affect the interbank market rates. However, both present and previous period's changes in inflation have no impact on the changes to the interbank market rate. We, therefore, conclude that the interbank market rate does not respond to changes in inflation. The adjusted R-squared of 0.411704 implies that about 41% of the changes in the interbank market rate are explained in the model, taking the number of variables into consideration. This implies that the model used may not be very adequate in explaining changes in the interbank market rate. The coefficient of the lagged value of the residual obtained from the long-run interbank

market rate equation is negative and significant at 1% confidence level, indicating that about 19% of disequilibrium gets corrected each month.

The coefficient of IBR is positive and significant at 1% in the lending rate model, confirming that the interbank market rate affects the lending rate. This clearly shows that commercial banks in Malawi take into account the interbank market rate in pricing of loans. Precisely, and holding all things constant, a unit positive change in interbank market rate results into about 0.11 percentage point positive change in lending rates. However, lagged values of IBR have no impact on the lending rate. Like the interbank market rate model, both current and previous period's changes to inflation do not affect lending rates. The adjusted R-squared of about 0.23 indicates that only about 23 percentage changes in the lending rate is explained by the model, taking the number of variables into consideration, again implying that the model may not be very adequate in explaining change to the lending rate. The results therefore confirm that, although with small magnitudes, the liquidity management efforts of the Reserve Bank of Malawi have the potential of influencing the lending rates through the interbank market rate. The coefficient of the lagged value of the residual obtained from the long-run lending rate equation is negative and significant at 5% confidence level, indicating that about 9% of disequilibrium gets corrected each month.

6 Conclusion, policy implications and recommendations

From the results of the study, we conclude that the central bank's activity in influencing liquidity levels in the banking system works, and that the interbank market is a strong platform through which actions aimed at monetary policy implementation can be fulfilled. The study concludes, therefore, that the interbank market rate, being the operating target for monetary policy in Malawi, responds well to banking system liquidity. The central bank can, therefore, effectively affect the interbank market rate through its open market operations. We further conclude that the interbank market rate is well linked to other money market interest rates, specifically the lending rate, since its movements affect the pricing of commercial banks' loans. From that point of view, we conclude that monetary policy transmission mechanism in Malawi is effective in as far as influencing the pricing of bank loans is concerned. We further conclude that the central bank's model of controlling interbank market rates could be reliable. Since the interbank market rate moves with the monetary policy rate that is set by the RBM from time to time, these results imply that the central bank has the ability to set interest rates that make sense for monetary policy transmission. The interest rate targeting framework of monetary policy is, therefore, the right way for the Malawi economy.

From these findings, it is recommended that the RBM should continue controlling the level of liquidity as a way of achieving a desired level of interbank market rate. However, there is a need to, empirically, establish other factors beyond banking system liquidity levels that affect pricing of liquidity in the interbank market in Malawi. Such knowledge is helpful to the central bank in deciding the magnitude of its operations in order to achieve desired levels of interest rates and hence inflation levels. Such may involve engagement of interbank market players and try to understand how each player prices liquidity on the interbank market. By so doing, the central bank can establish the limiting factors to movements in interbank market in some cases. Future research should also attempt to study how the informal sector of the economy responds to central bank actions. Such research would review how the monetary policy transmission mechanism can be strengthened, given the significant size of the informal financial sector in countries like Malawi. Moreover, given that the central bank is able to influence interest rates in the financial market through its operations, for monetary policy to be strengthened, there is a need to consider coming up with incentives that would encourage economic agents to move from the informal financial sector into the formal financial sector. That calls for financial literacy initiatives that encourage people to take part in the formal financial sector.

Notes

1. The target was 5% at the time this paper was written.
2. As updated and revised.
3. The Lombard rate is currently set at two percentage points above the monetary policy rate.
4. A chart for this facility is not produced because RBM has used this for just a few times.
5. Excess reserves is calculated as the amount a bank has deposited with RBM minus the statutory required amount and can be positive or negative. Positive excess reserves imply that, in total, banks have deposited with RBM more than what is required for them to meet the Liquidity Reserve Requirement (LRR) while negative excess reserves imply that banks have deposited with RBM less than what is required for them to meet the LRR. Negative excess reserves imply that at least one bank has violated LRR and is penalized by the RBM.
6. In some cases, the liquidity reserve requirement (LRR) figures include vault cash. RBM varies the way LRR is computed based on monetary policy stance of a particular period. While LRR figures include vault cash in some cases, vault cash is not part of LRR in some instances.
7. Most of the trades are overnight and hence data on the overnight rate is the one that is sufficient.
8. Non-food inflation (and not overall inflation) will be used in the study since monetary policy mainly has impact on this type of inflation.

References

- Abuka, C., R.K. Alinda, C. Minoiu, J. Peydró and A.F. Presbitero. 2015. “Monetary policy in a developing country: Loan applications and real effects”. IMF Working Paper No. WP/15/270. International Monetary Fund, Washington, D.C.
- Agénor, P., J. Aizenman and W.H. Alexander. 2004. “The credit crunch in East Asia: what can bank excess liquid assets tell us?” *Journal of International Money and Finance*, 23: 27–49.
- Andreivskaya I. and M. Semenova. 2013, “Market discipline and the Russian interbank market”. BOFIT Discussion Paper. 29. Bank of Finland: Institute of Economics in Transition
- Angelini, P., A. Nobili and C. Picillo. 2011. “The interbank market after August 2007: what has changed, and why?”, *Journal of Money, Credit and Banking*, 43(5): 923–58.
- Aristei, D. and M. Gallo. 2014. “Interest rate pass-through in the Euro area during the financial crisis: A multivariate regime-switching approach”. *Journal of Policy Modelling*, 36(2): 273–95.
- Bech, M. and T. Keister. 2013. “Liquidity regulation and the implementation of monetary policy”. BIS Working Paper. 432
- Bernanke, B. and M. Gertler. 1995. “Inside the black box: The credit channel of monetary transmission”. *Journal of Economic Perspectives*, 9: 27–48.
- Centre for Policy Analysis (CEPA). 2012. *The Relevance of the Monetary Policy Rate in the Monetary Transmission Mechanism*.
- Chipeta, C. and M. Mkandawire. 1991. *The Informal Financial Sector and Macroeconomic Adjustment in Malawi*. AERC Research Paper No. 4. African Economic Research Consortium, Nairobi.
- Davidson, R. and J.G. MacKinnon. 2004. *Econometric Theory and Methods*. New York: Oxford University Press.
- De Angelis, C. 2005. “The functioning of the interbank market and its significance in the transmission of monetary policy”. Rhodes University.
- Freixas, X. and J. Jorge. 2008. “The role of interbank markets in monetary policy: A model with rationing”. *Journal of Money, Credit and Banking*, 40(6): 1151–76.
- Green, C., Y. Bai, V. Murinde, K. Ngoka, J. Maana and S. Tiriongo. 2016. “Overnight interbank markets and the determination of the interbank rate: A selective survey”. *International Review of Financial Analysis*, 44: 149–61.
- Jacimovic, A. 2012. “Interbank market structure and the bank lending channel of monetary policy transmission”. Erasmus Mundus, Master in Complex Systems Studies, University of Warwick.
- Kovanen, A. 2011. “Monetary policy transmission in Ghana: Does the interest rate channel work?” IMF Working Paper No. WP/11/275. International Monetary Fund, Washington, D.C.

- MacKinnon, J.G. 2010. "Critical values for cointegration tests". Queen's Economics Department Working Paper No. 1227. Queen's University, Department of Economics, Kingston (Ontario).
- Mangani, R. 2008. *The Effects of Monetary Policy in Malawi*. AERC Research Paper No. 252. African Economic Research Consortium, Nairobi.
- McAndrews, J., A. Sarkar and Z. Wang. (2008). "The effect of the term auction facility on the London Inter-Bank Offered Rate." Federal Reserve Bank of New York Staff Report. No. 335.
- Mohanty, M. S., G. Schnabel, and P. Garcia-Lima. 2006. "Banks and aggregate credit: what is new?" In: *The Banking System in Emerging Economies: How much Progress has been Made?* BIS Papers No. 28.
- Ngalawa, H. and N. Vieg. 2011. "Dynamic effects of monetary policy shocks in Malawi". *South African Journal of Economics*, 79(3): 224–50.
- Ngalawa, H. and N. Vieg. 2013. "Interaction of formal and informal financial markets in quasi-emerging market economies". *Economic Modelling*, 31: 614–24.
- Poole, W. (1968) "Commercial bank reserves management in stochastic model: implications for monetary policy". *Journal of Finance*, 23(5): 769–791.
- Reserve Bank of India. 2002. *A Short Term Liquidity Forecasting Model for India*. Reserve Bank of India Report.
- Saxegaard, M. 2006. "Excess liquidity and effectiveness of monetary policy: Evidence from sub-Saharan Africa". IMF Working Paper No. WP/06/115. International Monetary Fund, Washington, D.C.
- Tiriongo, S. and E. Kanyumbu. 2019. *Interbank Market Discipline and its Effectiveness: Case Study of Kenya and Malawi*. AERC Research Paper No. 367. African Economic Research Consortium, Nairobi.
- Variy, M. 2015. "Implementing monetary policy in a fragmented monetary union". *CEPREMAP, Document de Travail (Docweb) No. 1516*.

Appendixes

Appendix 1: Definitions of variables and how they are measured

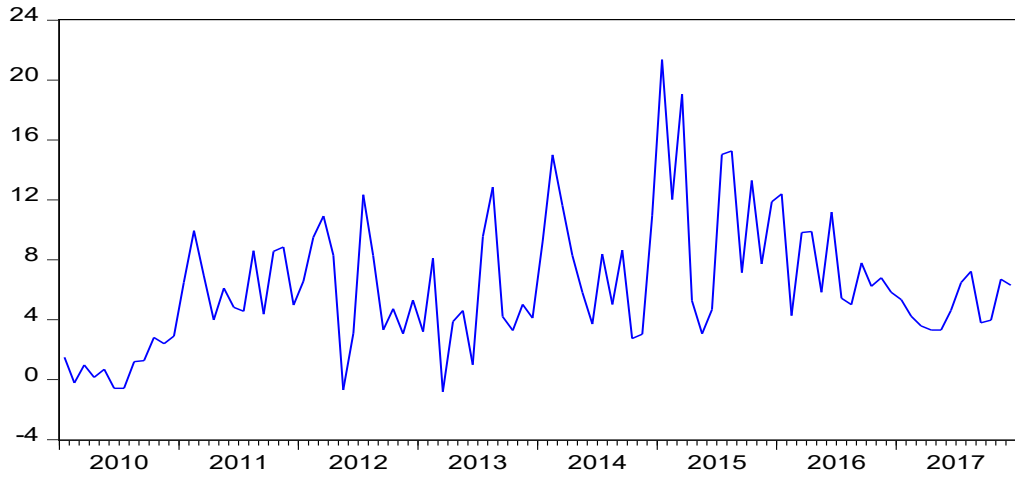
Variable	Definition	How it is measured measure
Excess reserves	Quantity of reserves deposited with the central bank by commercial banks ⁶ in excess of the statutory liquidity requirement	Monthly average in MK billions
Interbank market	The overnight ⁷ weighted average rate at which all commercial banks borrow/lend each other funds on the interbank market	End of period rate
Lending rate	The average market rate at which commercial banks lend funds to their customers	End of period rate has been used
Inflation	The general increase in prices of all goods and services in Malawi	Non-food end of period inflation rate has been used ⁸

Appendix 2: Some of the main changes in the monetary policy instrument used by RBM (2001–2018)

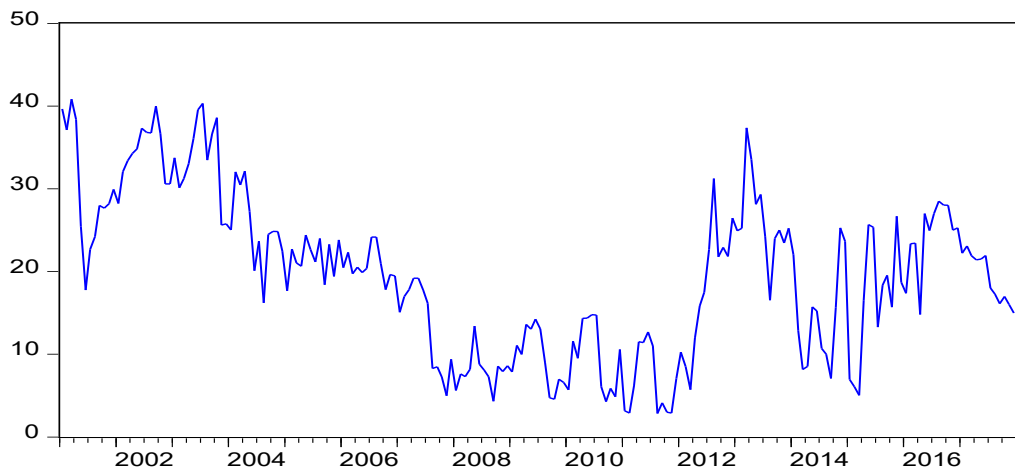
Date	Main Reform
June 2001	RBM set the Minimum Liquidity Reserve Requirements at 30% and each depository institution (commercial banks and discount houses) were supposed to maintain minimum cash balances in relation to the preceding month's total deposit liabilities (including government deposits). The Liquidity Reserve Requirement consisted of balances in the main account with the Reserve Bank, call deposit account balances with licensed discount houses and vault cash. However, balances with discount houses to be considered as part of the LRR was not to exceed 25% of the LRR. The minimum LRR specified above was to be maintained as a simple one-week (Monday - Sunday) average.
February 2006	The RBM set the Minimum Liquidity Reserve Requirements at 25% and each depository institution was to maintain minimum cash balances in relation to the preceding week's total local currency deposit liabilities, including government deposits. In the case of discount houses, the LRR was to apply to non-collateralized deposits from the corporate sector. Non-collateralized deposits with discount houses to be considered as part of LRR was not to exceed 10.0% of the LRR. The minimum LRR specified above was to be maintained as a simple one-week (Monday - Sunday) average. Monitoring of compliance was to be effective from the first business day of the week.
February 2008	The LRR ratio was set at 15.5% and had to be observed as a simple one-week (Monday - Sunday) average.
June 2010	Each depository institution was supposed to maintain required reserves in relation to the preceding fortnight's total deposit liabilities, including government deposits, repurchase agreements, foreign currency deposits, and any other liabilities, as the Reserve Bank of Malawi was to define from time to time. LRR observance on foreign currency deposits was set at a minimum of US\$200,000.00 equivalent in Malawi kwacha and the LRR ratio was set at 15.5%. The LRR was set to be observed as a simple two-week (Monday of the first week – Sunday of the second week of the observance period) average.
January 2014	The RBM introduced a Lombard Facility at its discount window. The Lombard Rate was set at two percentage points above the monetary policy rate. In addition, the RBM revised the guidelines on the Rediscount Facility and introduced a Foreign Exchange Swap Facility to provide banks with alternative avenues (other than the Lombard Facility) for managing their Malawi kwacha liquidity. The LRR ratio was set twofold: at 15.5% to be observed fortnightly and 12.0% to be observed daily.
November 2015	The RBM set the LRR at 7.5%. Each depository institution is now supposed to maintain required reserves in relation to the preceding fortnight's total deposit liabilities, including government deposits, repurchase agreements, foreign currency deposits, and any other liabilities as the RBM may define from time to time. The LRR observance for foreign currency was set at a minimum of US\$200,000.00 equivalent in Malawi kwacha. The 7.5% LRR is to be maintained as a minimum on daily basis during a two-week period which is from Monday of the first week to Sunday of the second week of the observance period.

Appendix 3: Series used in the analysis

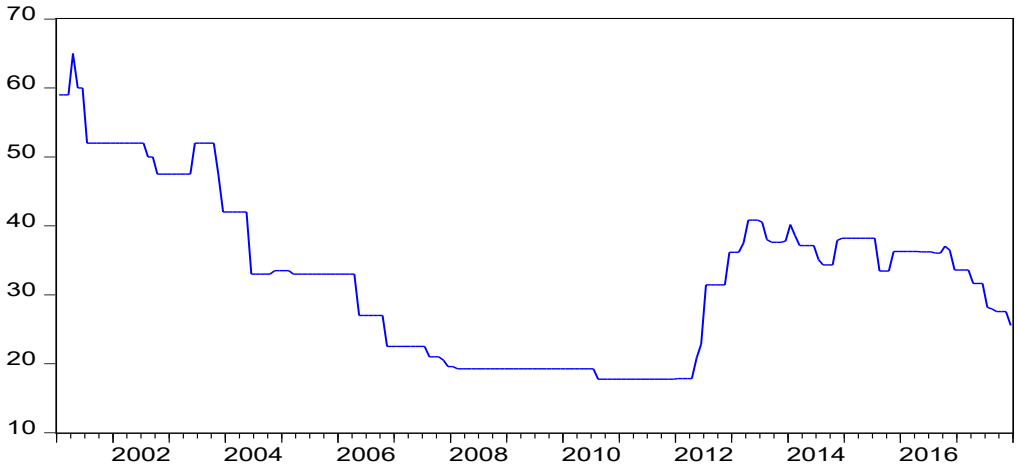
Excess Reserves (MK billion)



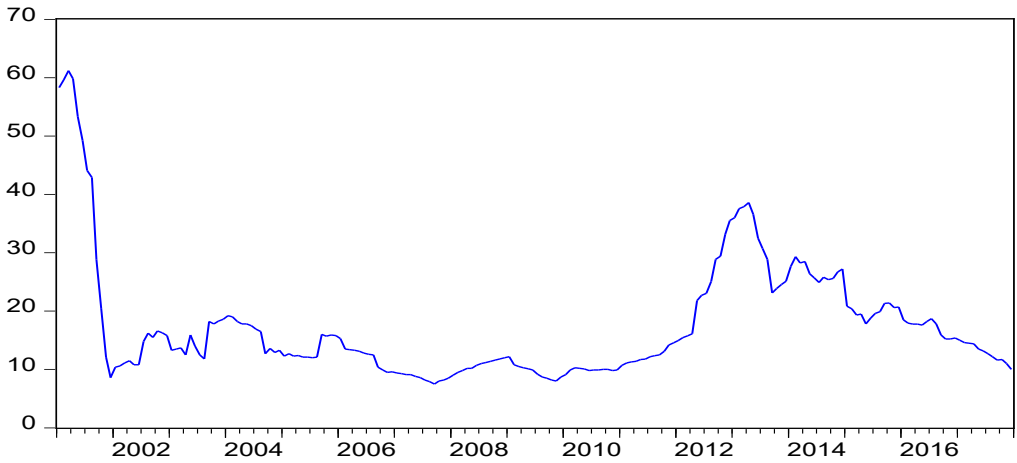
Interbank Market rate



Lending Rate



Non-food inflation





Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

www.aercafrica.org

Learn More



www.facebook.com/aercafrica



www.instagram.com/aercafrica_official/



twitter.com/aercafrica



www.linkedin.com/school/aercafrica/

Contact Us

African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@ercafrica.org