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Reserve Bank of Malawi

Abstract

This study sought to assess the role of the interbank market as a conduit for transmission of monetary policy in Malawi. In particular, the study sought to understand the transmission of changes in monetary policy changes to the interbank market rates, lending and deposit rates. The paper used bank specific monthly data spanning the period 2016-2020 and panel cointegration and panel DOLS estimation methods. The results show a strong pass-through from monetary policy rate to the interbank market rate. However, the study finds a somewhat weak pass-through from the interbank market rate to the savings interest rates of commercial banks. Therefore, the interbank market is efficient and effective in facilitating monetary policy transmission albeit with a bias on the lending side. Additionally, the study confirms that liquidity on the interbank market is structural in nature and policies to improve its management would be useful.

The author would like to thank participants at the validation workshop on the above topic at the COMESA Monetary Institute (CMI) in Nairobi, Kenya for valuable insights and comments, CMI and anonymous reviewers. The usual disclaimer applies.

I. Introduction

Interbank markets are essential to liquidity management for banks. They are a source of liquidity to banks that are short of liquidity and an avenue to off-load excess liquidity by banks that are running surpluses. Hence, the interbank market provides a liquidity leveraging mechanism for banks. Banks need liquidity in order to settle maturing obligations and to comply with statutory liquidity reserve requirements set by central banks. A functioning interbank market facilitates and enhances the flow of funds within the system and central banks encourage the use of the interbank market as an overnight liquidity management platform. In doing so, there is limited or rather moderated traffic in terms of accessing discount window facilities.

The transactions conducted on Malawi's interbank market are based on defined rules that were set and agreed upon by the participating banks and the Reserve Bank of Malawi (RBM). In 2016, the Reserve Bank initiated the process of migration towards inflation targeting (IT) by adopting forward looking monetary policy frameworks. One key element of the IT is efficiency of the interest rates in signaling the stance of monetary policy. In this regard, from May 2016, the interbank market rate was designed to be within a corridor around the policy rate. Thus, policy makers Endeavor to align the interest rate operational target mostly an interbank rate to the policy rate (Tiriongo and Kanyumbu, 2019). This operational alignment entails that the interbank market rate operates within an efficient and effective money and capital markets.

The interest rate pass-through from the central bank policy rate to money market rates and from the money market rates to retail market rates has received significant attention from both the policy perspective and academic research. The interest stems from the realization that effective monetary policy requires that a change in the official interest rate is transmitted quickly to other interest rates and that the magnitude of the change that is passed on to other rates is great enough to influence aggregate demand in some way (Lim, 2001; Fourie et al., 1999). At the center of the transmission mechanism is the interbank market which plays two crucial functions, namely; (i) enabling smooth functioning of the financial system by providing a short-term borrowing window to banks with liquidity challenges from banks with excess reserves; (ii) transmitting monetary policy action to the real economy to achieve price stability and promote economic growth.

The Reserve Bank of Malawi adopted interest rate targeting framework in 2016. The effectiveness of this framework depends on the efficiency of the interbank market in responding to monetary policy signals and also in transmitting the signals to the market. Thus, the speed and magnitude of adjustments in the interbank market relative to policy adjustments is critical in monetary policy. This study therefore seeks to understand the linkages between the interbank market and monetary policy effectiveness. To the best of the authors' knowledge, there is no study in Malawi on the interbank market and effectiveness of monetary policy that focuses on interest rate pass through. The previous studies in Malawi focused on the pass through from the policy rate to market rates (lending and deposit rates) as well as market discipline (Tiriongo and Kanyumbu, 2019: Chiumia and Palamuleni, 2019).

This study contributes to literature in two ways: firstly, by investigating how the relationship between interbank market rates and the monetary policy rate. Secondly, by determining how strongly and quickly are changes in interbank market rates transmitted to other relevant interest rates. Specifically, the study

will examine the speed and size of response of the interbank market rate to monetary policy rate adjustments and the speed and size of pass-through of the interbank rate to banks' deposit and lending rates

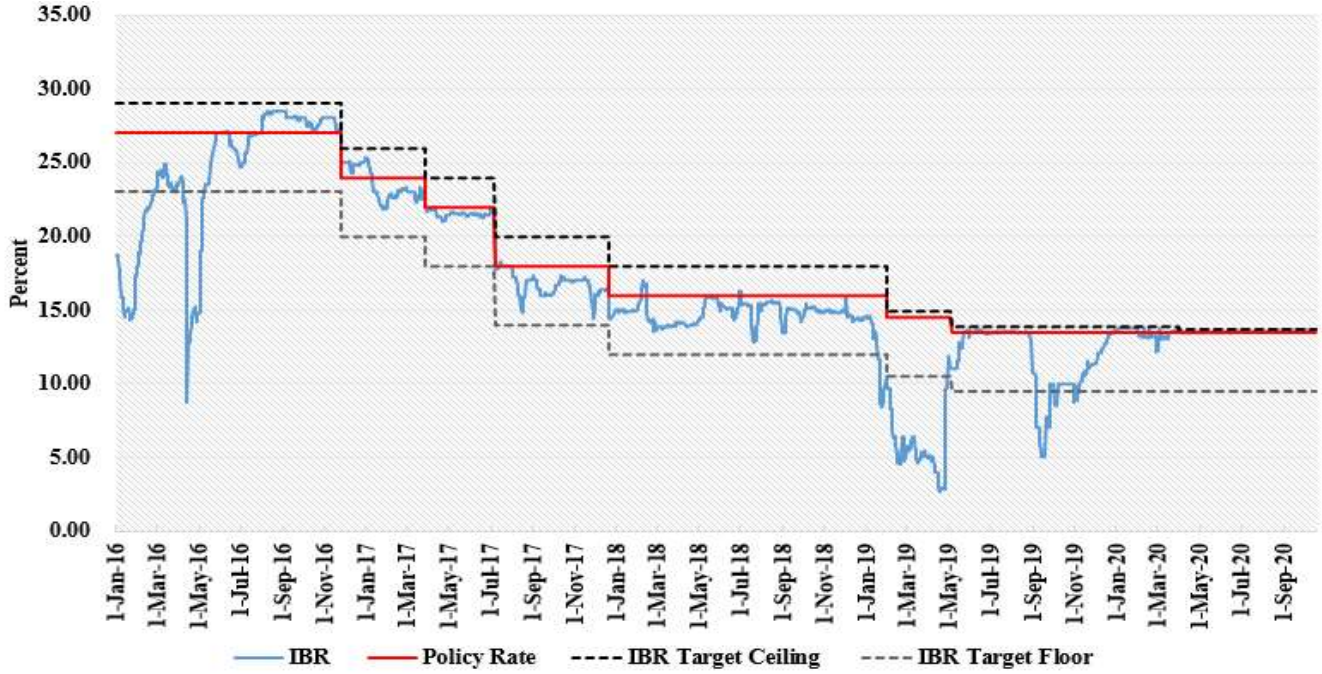
The rest of the paper is organized as follows: section 2 provides stylized facts on Malawi's financial structure and interbank liquidity management. Section 3 reviews theoretical and empirical literature while section 4 provides the analytical framework, econometric model and the methodology. Section 5 discusses the results and Section 6 provides summary of the findings, policy implications and conclusions.

II. Stylized Facts on Malawi's Financial Structure and Liquidity Management

The financial landscape in Malawi has changed tremendously since the deregulation of interest rates in 1989. There has been a number of reforms and entrance of new market players since then. More recently, the banking sector has experienced consolidation with some banks purchasing others[1]. Further, continental discount house evolved into an investment bank with discount house operations maintained but diversified into investment banking.

Participants in the interbank market comprises of eight authorized dealer banks[2] and one discount house. Transactions in the market are made up of different maturity profiles. Transactions are done in Malawi Kwacha and the traded funds are either collateralized or uncollateralized. The interbank window opens between 8.00am and 4.00pm daily, as transactions are initiated by lenders or borrowers. Collateralized transactions are recorded in the Central Securities Depository which is a securities register. Deals are concluded bilaterally between participating banks.

Figure 1: Evolution of Interbank Rate (2016 – 2020)



[1] INDEBANK was bought by National Bank of Malawi, Malawi Savings Bank was bought by FDH Bank, Opportunity Bank and NEDBANK were bought and later consolidated by MyBacks Corporation

[2] Most banks practice universal banking model despite each having economies of scale in a particular banking segment.

The interbank market operations are set in such a way that the interbank market rate is in line with the monetary policy rate developments. This is implemented through a Lombard corridor which is currently set at a targeted ceiling and floor of 20 and 400 basis points above and below the monetary policy rate, respectively effective April 1, 2020. The other changes were implemented on January 31, 2019 and only the IBR target ceiling which was revised to a premium of 40 basis point over the policy rate from a ceiling of 200 basis points. In this set up, in times of tight liquidity conditions the IBR rises above the policy rate and during loose monetary conditions or when the market is awash with liquidity, the IBR is observed below the policy rate. Therefore, the Reserve Bank conducts open market operations in such a way that the IBR remains within this target range.

As depicted in figure 1, there have been only three episodes when the IBR collapsed outside the targeted corridor since 2016. The first episode was largely attributed to transitioning period following of the setting up of the corridor and not necessarily driven by liquidity developments. Whereas there were market induced intervention in the previous two episodes, the collapse of the IBR in September 2019 resulted from the introduction of the reference rate to set the basis of setting interest rates in the money market. The reference rate was set as a composite of the Lombard rate, Treasury bills rate, IBR and savings deposit rate. This was an administrative measure which resulted in normalization of the IBR rate and liquidity conditions in the market. One key observation is that the interbank market rate has since become relatively less responsive to liquidity levels since the introduction of the reference rate in September 2019.

Figure 2: Inter-Bank Market Daily Trading Volumes.

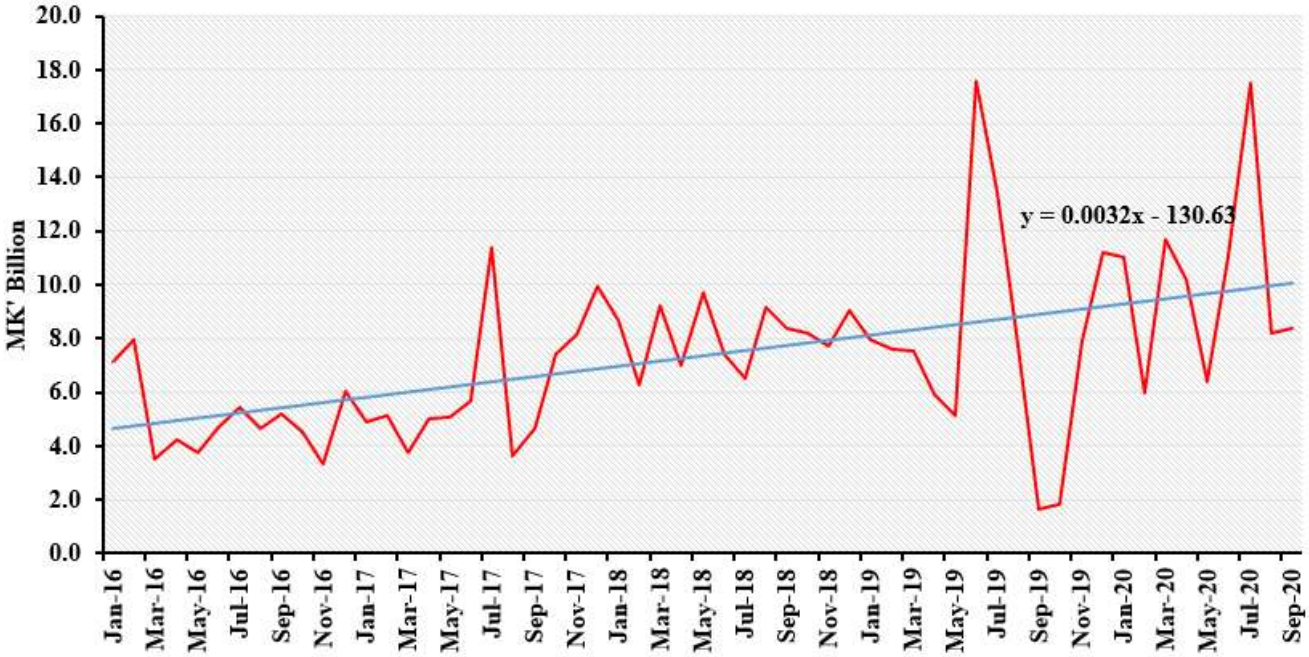


Figure 2 depicts average daily interbank market volumes traded on the money market in the study period. There has been a steady increase in the average daily transactions with a positive trend. Currently, an average of K10 billion is traded daily on the market up from an average of K4.5 billion traded in early 2016. The volatility has also increased since May 2019. Notable periods are when there was a liquidity crunch in the money market beginning September 2019.

Figure 3: Access to Interbank Market by Banks

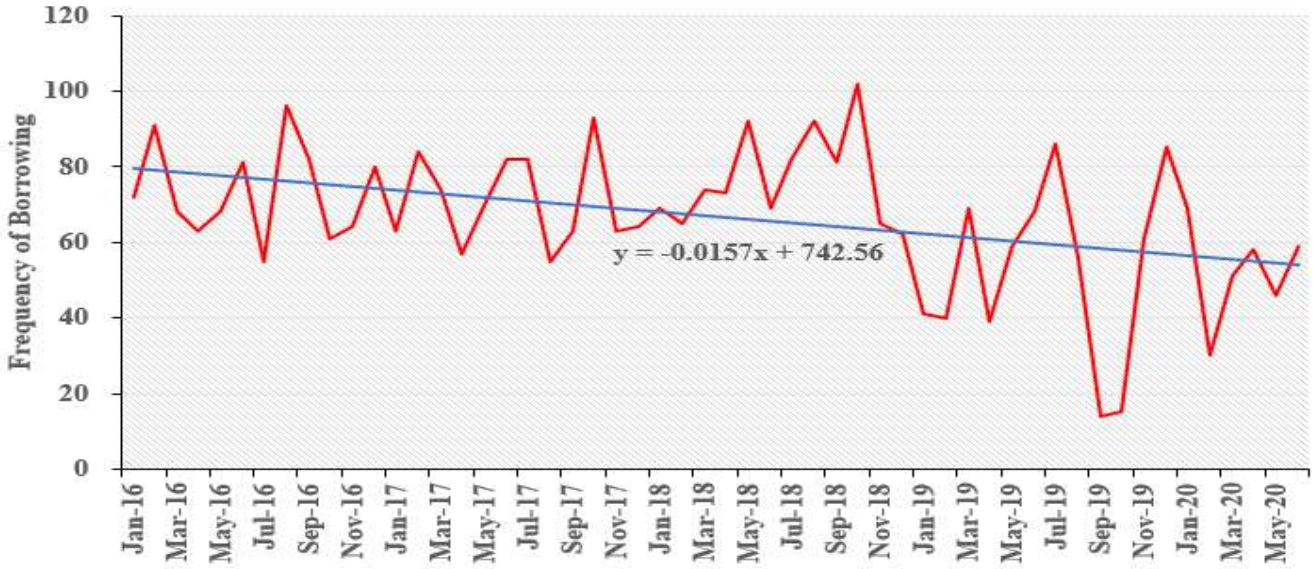


Figure 3 shows that overtime, there is less participation on the interbank market despite the increase in transacted volumes. This may be attributable to the change of the structure of the market following the 2018 review of the RBM Act. In particular, following the enactment of the RBM Act of 2018, the central bank no longer participates in the government securities primary market, forcing government to raise finances from the commercial banks. This has resulted into predominantly tight liquidity conditions in the banking system and hence reduced frequency of borrowing in the interbank market. Correspondingly, access on the Lombard facility increased during the period.

III. Literature Review

Mishkin (1996) categorizes monetary policy transmission mechanisms into three channels, namely; interest rate channel, asset pricing channel and credit channel. The focus of this paper is on the interest rate channel, a process through which a change in the policy rate affects other money market rates.

The interest rate pass-through can be separated into two stages. The first stage measures how changes in the monetary policy rate are transmitted to short term market rates, while the second stage describes how changes in the market rates influence bank deposit and lending rates. The first stage is to a large extent influenced by the stability of the yield curve: If the term structure, whatever its form may be (negative or positive sloping), remains stable over time, the pass-through from policy rates to market rates is said to be proportionate. However, any twist in the yield curve can change the size of the pass-through.

There are two broad strands of theories which explain the yield curve. The first is the expectations hypothesis and the second is the market segmentation theory. Market segmentation theory posits that the yield curve is a function of demand and supply of debt instruments of different maturities (Taylor, 1992). Therefore, there is no connection between short run and long run interest rates because these are different markets which are solely affected by demand and supply conditions in their respective markets. On the other hand, the expectations theory contends that the term structure of interest rates is a function of economic agents' expectations about the future interest rates (Shiller, 1973; Taylor, 1992). The economic

agents charge a premium for each time period. Therefore, debt markets are linked in a unique but traceable way, otherwise referred to as pass-through. Hence, the expectations theory will be followed to examined interlinkages which exists between short term interest rates and long terms interest rates.

From a theoretical perspective, the Monti-Klein model is a prototype model for analyzing the role of the banking system in monetary policy transmission process (Monti, 1971; Klein, 1971). The model assumes perfect competition in the banking industry, resulting in a swift and symmetric response to changes in the monetary policy rate. Deviations from long-run equilibrium will only appear in the short term and be corrected in the long- run. Full pass-through is a long run phenomenon while deviations from long run equilibrium occurs only in the short run.

Empirical studies on the subject have mainly focused on three areas: (i) investigating the existence of a relationship between central bank policy rate and market rates; (ii) analyzing the speed of transmission of changes in central bank policy rate to money market rates and (iii) investigating the degree/magnitude of pass-through from the central bank policy rate to retail market rates. Generally, studies have found a quick and complete pass through from central bank policy rate to money market rate (Jovanovski et al. 2005; Velickovski 2006). However, empirical literature is inconclusive on the pass-through from money market rate to bank retail rates. On one hand, some studies have found a complete pass-through of changes in money market rate to retail bank rates (Dube and Zhou, 2014; Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Altunbas et al., 2002). On the other hand, there is significant evidence of a very slow and incomplete interest rate pass-through from money market interest rate to bank retail rates, in which case a one percentage point change in money market rate is accompanied by a less than one percentage point change in bank retail interest rates (Cottarelli and Kourelis, 1994; Mojon, 2000; Angeloni and Ehrmann, 2003; De Bondt et al., 2005; Hofmann and Mizen, 2004; Pasley, 1994; Heffernan, 1997). In Malawi, a study by Chiumia and Palamuleni, (2019) investigated the interest rate pass-through for the period 2009-2015 and found evidence of near-complete interest rate pass-through. The study also found bank-level heterogeneity in the interest rate pass-through, with smaller banks exhibiting higher magnitude of the pass-through.

Further, studies have established heterogeneity in the degrees of interest pass-throughs across countries. Mojon, (2000) and De Bondt, (2005) found cross-country differences in pass-through multipliers across the Euro area. Cross-country heterogeneity was also observed for African countries where countries with well-developed financial systems tend to have complete or near complete interest rate pass through compared to those with underdeveloped financial system.

A number of reasons have been cited for the differences in the response of market rates to changes in central bank policy rate, the completeness of interest rate pass-through and the heterogeneity in the pass-through across countries. These include, monetary policy orientation, that is, whether liberal or a controlled monetary policy regime and whether the monetary policy process has formal accountability and transparency measures; the stage of financial market development; the degree of financial market openness; the concentration within the banking sector and asymmetric information (Aziakpono and Wilson, 2013).

IV. Methodology

4.1 Analytical Framework

The paper follows a micro-founded model developed by Monti (1971) and Klein (1971). The model assumes N banks, indexed n=1,…,N, using the same technology to hold deposits, D_n, for the households and supply loans, L_n, to borrowers, who are homogenous from the perspective of the bank. The model assumes one type of deposit and loan product. Further, the bank faces a downward sloping demand function for loans and an upward sloping supply function for loans. Without loss of generality, it is also assumed that the bank use deposits to fund loans, and generate profits by creating a differential between the loan and deposit rates. However, the bank could also borrow or lend on an interbank market. Considering interbank loans, M_n, then each bank attempts to match the volume of interbank loans and loans with its deposit holdings. This can be expressed as:

$$D_n = L_n + M_n \qquad (1)$$

Taking the deposit rate as i_d, the lending rate i_l and interbank rate as *ibr*, then the profit of the n^{th} bank is defined as

$$\pi_n = \left\{i_l\left(L_n + \sum_{i \neq n} L_i^*\right)L_n + ibrM_n - i_d\left(D_n + \sum_{i \neq n} D_i^*\right)D_n - C(D_n, L_n)\right\} \qquad (2)$$

Where L_n^* is the optimal loan volume for all other banks, D_n^* is the optimal deposits of all other banks and $C(D_n, L_n)$ is the cost of administration of banking services.

From the equation above, the Cournot equilibrium for optimal bank loans and deposits for each bank takes place when $L^* = \frac{L_i^*}{n}$ and $D^* = \frac{D_L^*}{n}$. The first order conditions of equation 2, assuming the primary objective of the bank is to maximise profits, are given as

$$i_L^* = -i_L'(L^*)\frac{L^*}{n} + ibr + C_L'(D, L) \qquad (3)$$

$$i_D^* = -i_D'(D^*)\frac{L^*}{n} + ibr - C_D'(D, L) \qquad (4)$$

Where $i_L'(L^*)$ and $i_D'(D^*)$ represent the slopes of the loan and deposit functions, $C_L'(D, L)$ and $C_D'(D, L)$ represent the marginal administrative costs for an incremental loan and deposit. Therefore if we assume that the costs are linear such that $C(D_n, L_n) = \mu_D D_n + \mu_L L_n$ then the *nth* bank has a markup of μ_L on the first order condition of the bank's profits with respect to loans and a markdown of μ_D on the first order condition of the bank's profits with respect to deposits.

In terms of perfect competition, the equilibrium slope will be defined under the condition that n is large enough such that it approaches infinity, $n \to \infty$, in which case the first order condition on profits for n^{th} bank yields the slope of $i_L^* = ibr + \mu_L$ on the loan supply function and $i_D^* = ibr - \mu_D$ on the deposit demand function. This slope implies that the bank has no market powers such that the markup on interest rate on loans only reflects marginal administrative costs. Similarly, the markdown on deposit rate only reflects the marginal costs.

Under monopolistic competition especially where the number of banks is relatively small, it is noted that the markup on retail lending interest rates is larger than the marginal administrative costs since $i_L^*(L^*) < 0$. Similarly, the markdown on deposit rates is larger than the marginal administrative costs because $i_D^*(D^*) > 0$. This approach was later popularised by (De Bondt, 2005).

From the foregoing discussion, it is apparent that the number of banks and the degree of competition influences the interest rate pass-through deviation from unity[3]. Theoretically, there are additional factors that affect the pass-through. Amongst these are: monetary policy framework; the level of financial market segmentation, bank size, the degree of financial market openness; degree of information asymmetry; and menu costs, amongst other things (Sorensen and Werner, 2006).

Direct monetary policies lead to rigidities and changes in interest rates are only observed when the policy rates changes. In contrast, in a liberalized framework, market forces are allowed to determine market rates movement. Aziakpono and Wilson, (2013) found a high speed of adjustment of market interest rate to monetary policy action during periods of market-oriented reforms in South Africa. Furthermore, Liu et al et al., (2008) found that as monetary policy transparency increases, future short term rate changes become less uncertain. This enhances the degree of pass through of official rates to retail rates.

The orientation of the financial system can as well have an impact on the nature of interest rates adjustments. In a competitive market, profit-maximizing behaviour will require banks to adjust their rates promptly as market conditions change, but if market forces are weak (owing, for instance, to barriers to entry or absence of competition from non-bank intermediaries) inefficiency will not be penalized and bank interest rates may be more rigid, (Cottarelli and Kourelis, 1994).

Also, in a highly concentrated banking market, oligopolistic behaviour of banks may cause interest rates to adjust asymmetrically to an increase or a decrease in the policy rate. The asymmetric adjustment of interest rates can be explained using two competing hypotheses; the collusive behaviour of banks and adverse customer reaction hypotheses (De Bondt, 2005). The collusive behaviour hypothesis suggests that deposit rates will be rigid upward when the policy rate is increased, while the lending rates will be rigid downward in the case of decrease in the policy rate. On the other hand, the adverse customer reaction hypothesis implies that deposit rates will be rigid downward when the policy rate is decreased, while the lending rates will be rigid upward in the case of an increase in the policy rate.

The ownership structure of banks (that is whether state-owned, private sector or foreign owned) is another factor that could influence the speed of adjustment of interest rates. A state dominated banking system results in banking concentration or some form of monopoly, which may cause rigidity in the interest rates as noted above. In addition, due to political pressures or simple inefficiency, bank interest rates will be more rigid in a banking system dominated by state-owned banks, (Cottarelli and Kourelis, 1994).

The response of banks also depends on the extent to which banks rely on the accommodation facilities provided by the central bank for their liquidity needs. If the financial system is sufficiently open and banks can easily access external source of finance, this may reduce reliance on the accommodation facilities from the central bank (Fourie, et al., 1999). Consequently, in an open financial system the response of bank interest rates to changes in the policy rate may be slower than when the market is not open. If banks perceive the risk of default to be very high, they will maintain a large spread between lending and deposit rates. If this cushion is very large, then market lending rate may be relatively insensitive to small changes in policy rate.

[3]It should be noted that this formulation does not take into account adjustment costs such that the level of administration costs or the degree of competition in the market are immediately reflected in the retail interest rates.

The level of development of the financial system can also affect the degree of interest rate adjustment. A well-developed financial system will offer alternative financial instruments and intermediaries for investors and savers thereby providing alternative investment or financing sources to bank loans and deposits.

4.2 Econometric Procedure

Consistent previous work and the analytical framework, in equation 5, the study specified a model to facilitate analysis of the response of the interbank market rate to changes in the monetary policy rate.

$$IBR_{i,t} = \alpha_1 + \alpha_2 PR_{i,t} + \mu_{it} \quad (5)$$

Where IBR_t is the interbank interest rate for a particular month; PR_t is the monetary policy rate, μ_t is a white noise error process; while α_1 and α_2 are the parameters to be estimated.

The model in equation 6 shows the response of retail market interest rates to changes in the interbank market rate.

$$I_{i,t} = \beta_1 + \beta_2 IBR_{i,t} + \varepsilon_{it} \quad (6)$$

where $I_{mi,t}$ represents the endogenously determined market interest rates (deposit rate and base lending rate) and IBR_t is the interbank interest rate for a particular month; ε_t is a white noise error process; while β_1 and β_2 are the parameters to be estimated. Based on the cost-of-funds approach, the constant term denotes the fixed markup and markdown on the lending interest rates and deposit interest rates, respectively. As in Marotta (2009), the constant term is treated as a credit risk premium under the lending rates. The apriori expectation is that $0 \leq \beta_2 \leq 1$, which is the pass-through coefficient. The closer to zero the parameter is the lower the pass-through and vice versa with complete pass-through implied by a value of one on the coefficient whilst a coefficient value of zero implies no pass-through at all. Due to, *inter alia*, Calvo pricing, imperfect market conditions, asymmetric information, menu costs, it is unlikely that the parameter can assume the value of unity. However, overreaction of particular interest rates to changes in the policy rate can be observed with the coefficient yielding a value of more than one. This could result from commercial banks' inability to correctly process market information.

The study carried out unit root tests as well as cointegration tests, (Levin, et al., 2002; Pedroni (2001) using the null of stationarity with the following test equations and null hypothesis:

$$\Delta x_{it} = \phi_{1t} + \delta x_{it} + \sum_{i+1}^{p} \lambda \Delta x_{it} + \upsilon_{it} \quad (7)$$
$$H_0: \delta = 0$$

The study adopted an autoregressive distributed lag (ARDL) bound testing approach to cointegration relationship popularized by Pesaran and Pesaran (1997); and Pesaran et al., (2001) in order to assess the degree of pass-through of interest rates in Malawi. The ARDL framework is preferred because of its better asymptotic properties. The approach has some econometric advantages over the Engle and Granger, (1987) and maximum likelihood-based approach as proposed by Johansen and Juselius, (1990) and Johansen, (1991). Firstly, the bounds test does not require pre-testing of the series to determine their order of integration. Secondly, the test can be conducted regardless of whether the variables to be modelled as

I(1), I(0) or mixed or mutually integrated. Thirdly, the ARDL modelling incorporates sufficient number of lags to capture the data generating process. In addition, serial correlation endogeneity problems are addressed in this technique by selecting only best fitting lags (Pesaran and Shin, 1999). In this approach, all the variables are assumed to be endogenous and the long run and short run parameters of the model are estimated simultaneously. In this case, it is considered as an unconstrained error correction model unlike the Johansen and Juselius procedure as well as the Engle and Granger procedure. The issue of endogeneity is particularly relevant since the causal relationship between market interest rates and the policy rates cannot be ascertained beforehand as literature suggests that a bidirectional relationship could exist between the two. Finally, the ARDL has superior small sample properties as compared to the Johansen and Juselius (1990) cointegration test (Pesaran and Shin, 1999).
An ARDL(p,q) representation of the interest rate pass-through model can be specified as an unrestricted error correction model as follows:

$$IBR_{i,t} = \delta_0 + \sum_{t=1}^{p} \delta_t \, IBR_{i,t} + \sum_{t=0}^{q} \psi_t \, \mathrm{PR} + \epsilon_{it} \qquad (8)$$

$$I_{i,t} = \delta_0 + \sum_{t=1}^{p} \delta_t \, I_{i,t} + \sum_{t=0}^{q} \psi_t \, IBR_{it} + \epsilon_{it} \qquad (9)$$

Where equation 8 relates to the model in equation 5 of the interbank rate as a function of the monetary policy rate; and equation 9 corresponds to the model in equation 6 of market rates as a function of interbank rates. The ARDL estimates $(p+1)^k$ number of regressions in order to obtain the optimal lags for each variable, where p is the maximum number of lags on the endogenous variable and k is the number of variables in the model. The SBC is used to choose the parsimonious model. The first procedure in implementing the ARDL approach is to test the null hypothesis of $H_o: \psi_1 = \psi_2 = \cdots = \psi_q = 0$ against the alternative hypothesis of $H_1: \psi_1 \neq \psi_2 \neq \cdots \neq \psi_q \neq 0$ from equation 7. This tests the existence of the long-run relationship. The ω's represent long-run parameters while the φ's capture short-run dynamics.
The cointegration test is based on the Wald test. The Wald test can be carried out by imposing restrictions on the estimated long-run coefficients in the equation. Since the Wald test has non-standard distribution, Pesaran and Pesaran (1997) and Pesaran, et al. (2001) provided two sets of critical values for the cointegration test. According to these authors, the lower bound critical values assumed that the explanatory variables x_t are I(0), while the upper bound critical values assumed that x_t are I(1). The computed F-statistic from the Wald test is evaluated with the critical values obtained from (Pesaran, et al., 2001). If the computed F-statistic is smaller than the lower bound value, then the null hypothesis is not rejected and we conclude that there is no long-run relationship between economic growth and the said explanatory variables. If the computed F-statistic is greater than the upper bound value, the converse holds. On the other hand, if the computed F-statistic falls between the lower and upper bound values, then the results are inconclusive.

While the bounds test for cointegration analysis does not require pretesting of the variables for unit root, it is imperative that the unit root test be carried out to ensure that the series are not integrated of an order higher than one. The use of the ARDL model practically breaks down in the presence of series integrated of orders higher than one. The Swartz Bayesian Criterion (SBC) and the Akaike Information Criteria are used to determine optimal lag length for the tests. The preferred model is the parsimonious case.

Once cointegrating relationship has been ascertained, the long run and error correction estimates of the ARDL model are obtained. The error correction representation of the series can be specified as follows:

$$\Delta I_{it} = \delta_0 + \delta_1 I_{i,t-1} + \delta_{t-2} \sum_{t-2}^{p} \Delta I_{i,t} + \alpha_1 IBR_{i,t-1} + \alpha_{t-2} \sum_{t-2}^{q} \Delta IBR_{i,r} + \varepsilon_{it} \qquad (10)$$

Where δ_1 is the speed of adjustment parameter, with a restriction $-1 < \delta_1 < 0$. Further, α_1 is the implied cointegrating coefficient whose significance is also materially important.

The study also considered market specific attributes like frequency of participation on the interbank money market, turn-over and excess reserves or reserve requirement position for each bank. Further, we use the actual bilateral interbank market rates offered by each bank and not market averages.[4]

4.3 Data Sources

The study used bank specific monthly data on savings or deposit rate, base lending rate, interbank rate and bank liquidity. A total of nine commercial banks have been enumerated in the study. The sample period spans from January 2016 to June 2020. Therefore, the data characteristics allow us to set out a macro-panel analysis. All the interest rate series were drawn from the Reserve Bank of Malawi's repository while data on commercial banks' characteristics are drawn from call reports. Times series for number of times an individual bank got into the market to borrow funds or obtain liquidity (countb), number of times an individual bank got into the market to lend funds or supply liquidity (countl), interbank market borrowing rate (ibrb), interbank market lending rate (ibrl), savings rate (svr), lending rate (blr) and monetary policy rate (pr) were compiled for each bank. Bank specific liquidity position, as defined by excess reserves, is available on a daily basis but using averaging and end of period data to convert it to monthly frequency would render the variable non-representative of the developments in the month. As such, the frequency and mode of participation in the interbank market has been used to proxy bank liquidity position following Furfine, (1999).

V. Empirical Results

5.1 Cointegration Tests

All the conducted cointegration tests confirmed cointegration among the variables at conventional levels of significance (Annex 3). Unit root tests were also conducted and the results are reported in Annex 2.

5.2 Discussion of the Results

The results of the pass through of the monetary policy rate to the interbank borrowing and lending rates are reported in table 1. The results of the long run relationship suggests that there is a complete pass-through of the policy rate to the interbank borrowing rate with an estimated coefficient is 1.15. implying that a one percent increase in the policy rate results in a 1.15 percent increase in the interbank borrowing. The results also suggest an error correction coefficient of 0.74 suggesting that 74 percent of the deviations in the interbank borrowing rate are corrected in the next period. Furthermore, the policy rate is found to

[4] The study conducted panel dynamic ordinary least squares (DOLS) as a robustness check

be significant in the short run. However, liquidity is found to be insignificant in influencing the movements in the interbank borrowing rate both in the short and long run.

Table 1: Pass-through of Monetary Policy Rate to (IBRB) and IBRL

	(1) Interbank Borrowing rate (IBRB)	(2) Interbank Lending rate (IBRL)
PR	1.1509*** (0.0254)	0.6671*** (0.2015)
COUNT	0.0246 (0.0267)	0.1274** (0.0545)
ECT	-0.7435*** (0.000)	-0.5151*** (0.0429)
D(IBR(-1))	0.1686*** (0.0147)	0.3781*** (0.0500)
D(IBR(-2))	0.2334*** (0.0428)	
D(IBR(-3))	0.1342*** (0.0252)	
D(PR)	-0.2528* (0.1377)	1.3519** (0.6638)
D(COUNT)	-0.0112 (0.0166)	-0.0014 (0.0190)
Constant	-2.9848*** (0.2082)	1.0309*** (0.1199)
Sample(N,T)	9, 54	9, 54
S.E of regression	1.8651	4.9482
S.D dependent var	2.7278	2.8399
Hannan-Quinn Criteria	4.1839	4.7006

Standard Errors in parenthesis. *, ** and *** imply significance at 10%, 5% and 1%, respectively.

The last column of table 1 presents results of the reaction of interbank lending rate to changes in the monetary policy rate. In the short run, there is a strong pass through of changes in the monetary policy rate to the interbank lending rate and coefficient is statistically significant. The results also indicate an error correction coefficient of 0.52 implying a relatively strong correction of 52 percent, of the

misalignment in the next period. In the long run, the coefficient of the policy rate is estimated at 0.66 implying that a one percent change in the policy rate results to an increase of 0.66 percent in the interbank lending rate, ceteris paribus. The liquidity coefficient is also insignificant in this case.

Table 2 presents results of the pass through of the interbank rate to commercial banks' savings rate and base lending rate. The results in column 2 of table 2 indicate that in the short run, neither changes in the interbank market rate nor level of liquidity in the interbank market influences changes in the commercial banks' savings. However, the result indicates existence of a long run relationship between the savings rate and the interbank market rate with an estimated coefficient of 0.25 suggesting that a one percent change in the interbank rate changes the savings interest rate by 25 basis points. These results corroborate the results in Chiumia and Palamuleni, (2019). The coefficient for the error correction term is 0.15 and it is statistically significant at all conventional confidence levels. This means that 15 percent of that short run deviations in the savings rate are corrected in the next month. However, the liquidity measure is not statistically significant both in the short run and the long run.

Table 2: Pass Through of Interbank Rate to Savings Rate and Base Lending Rate

	(1)	(2)
Dependent Variable	Savings Rate (SVR)	Base Lending Rate (BLR)
IBR	0.2524***	1.5326***
	(0.0229)	(0.1070)
COUNT	0.0359	0.2846**
	(0.0297)	(0.1342)
ECT	-0.1505***	-0.1026***
	(0.0166)	(0.0082)
D(IBR)	0.0044	0.0719
	(0.0042)	(0.0485)
D(COUNT)	-0.0027	-0.0474***
	(0.0039)	(0.0134)
Constant	0.1519	-0.6755***
	(0.1103)	(0.0595)
Sample (N,T)	9, 54	9, 54
S.E of regression	0.4953	1.3971
S.D dependent var	0.5202	1.5689
Hannan-Quinn Criteria	1.4857	3.6399

Standard errors in parenthesis; *, **, *** imply significant at 10%, 5% and 1%, respectively

The results in last column of table 2 show that in the short run, the interbank market lending rate plays an insignificant role in explaining movements in commercial banks' base lending rate but the relationship is significant in the long run. This result implies that a one percent increase in the interbank rate leads to a 1.5 percent increase in the base lending rate in the long run. The results further suggest that the liquidity condition of a bank plays an important role in explaining changes in commercial banks' base lending rate both in the short run as well as the long run. While the relationship is inverse in the short run as expected, implying the higher the liquidity the lower the base lending rate, the long run relationship has a perverse sign. The coefficient of the error correction term suggests that 10 percent short term deviations from equilibrium are corrected in the next time period.

VI. Conclusion and Policy Implications

This study sought to assess the role of the interbank market as a conduit for the transmission of monetary policy in Malawi. The study is important as Reserve bank of Malawi adopted the interest rate targeting framework in 2016 as a stepping-stone to transitioning to inflation targeting policy strategy. The effectiveness of this framework relies on a well-functioning interbank market in transmitting policy signals from the central bank to the commercial banks. As such, the study firstly assessed how changes to monetary policy induce changes in the interbank market rates and secondly, how commercial banks' savings rate and base lending rates react to changes in interbank market rates. The study also assessed the role of liquidity in the transmission of monetary policy through the interbank market.

The results on the responsiveness of interbank rates to policy rate show that interbank market rates respond to changes in the policy rate. In the long run there is a complete pass-through of changes in monetary policy rate to the interbank borrowing rates and a strong pass at 67 percent to interbank lending rate. This shows that monetary policy is important in influencing interbank market rates. This is very important for interest rate targeting framework of monetary policy transmission. Further, the study finds that level of liquidity has a significant impact on the interbank lending rate. However, the relationship is contrary to apriori expectations as increases in liquidity are found to result in increases in interbank lending rates. This result is attributable to an imperfect structure of the banking system in Malawi.

On the analysis between the retail interest rates and interbank rates, the results indicate that interbank market rates have an impact on commercial banks' savings and base lending rates. However, in the case of the savings rate, the results are only significant in the long run meaning that in the short run there are other factors apart from movements in interbank market rates that significantly explain changes in commercial banks' savings rates. In regard to the commercial banks' base lending rate, the study finds that there is an overshooting of long run pass through of changes in interbank lending rate to commercial banks' base lending rates. The coefficient for the long run pass through is 1.53. In terms of magnitude, comparison between the impact of the interbank rate on the savings and lending rates indicate a weaker impact on commercial banks' savings rates with the long run pass through coefficient at 0.25. The differences in the size of the pass through between the lending and savings rates partly explain the wide spreads in Malawi's interest rates. This notwithstanding, the results show that the Malawi's interbank market is efficient and effective in facilitating monetary policy transmission although with a bias towards lending side. Overall, the study finds that Malawi's interbank market supports monetary policy transmission mechanism as expected in an interest targeting framework. However, its effectiveness can

be improved by adopting deliberate policy actions that improve liquidity management in the banking system.

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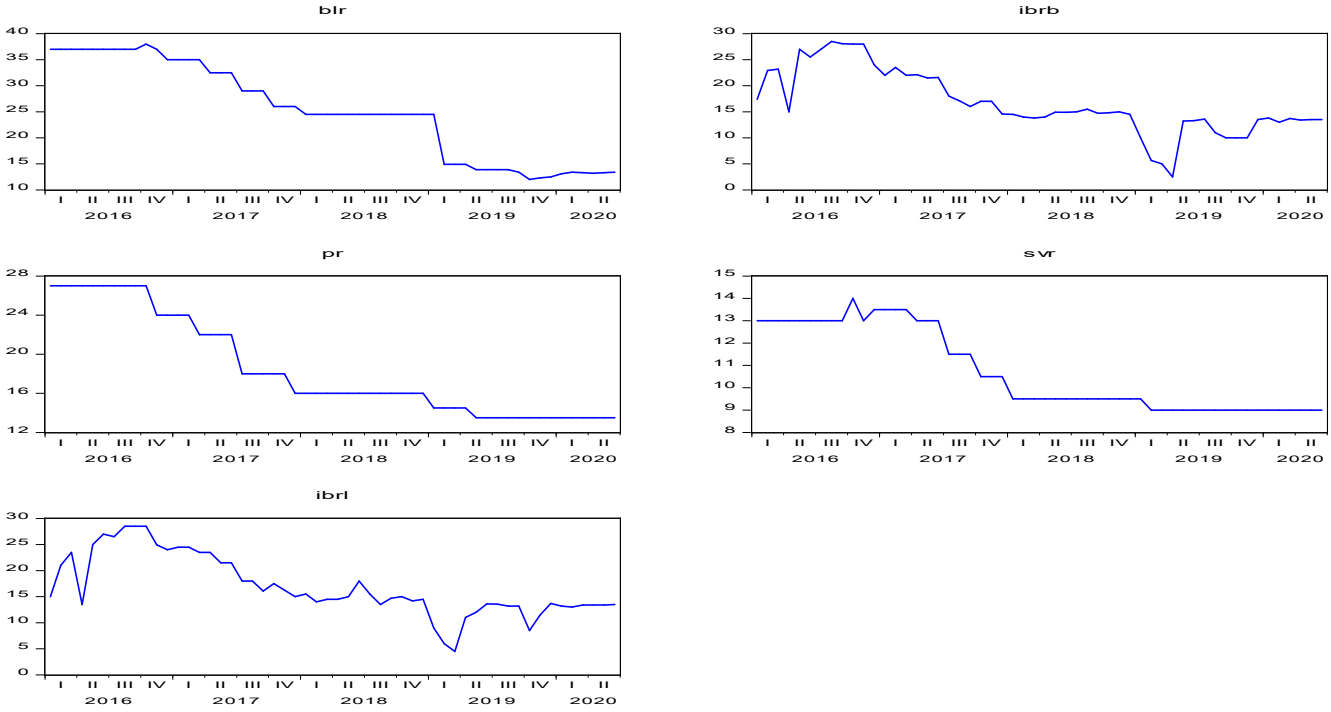
Annexes

Annex 1 Trends in Interest Rates



Annex 2: Results for Unit Root Tests

	LLC			IPS		
	t-statistic	p-value	Inference	t-statistic	p-value	Inference
svr	-2.579	0.005	I(0)			I(0)
d.svr				-7.943	0.000	
blr	-4.807	0.000	I(0)			I(0)
d.blr				-5.532	0.000	
Countl	-7.621	0.000	I(0)	-6.409	0.000	I(0)
Countb	-8.218	0.000	I(0)	-7.500	0.000	I(0)
Ibrl	-3.935	0.000	I(0)	-3.569	0.000	I(1)
Ibrb	-5.684	0.000	I(0)	-4.380	0.000	I(1)
pr	-0.247	0.403	I(1)			I(1)
d.pr	-4.348	0.000		-7.943	0.000	

Critical values for the IPS test are -2.837, -2.630 and -2.530 for the 1%, 5% and 10% significance level, respectively.

Annex 3 Cointegration Results

A. Policy rate, Interbank Lending Rate, Liquidity

I. Kao Test

Ho: No cointegration

Ha: All panels are cointegrated

	Statistic	p-value
Modified Dickey-Fuller t	-4.7101	0.0000
Dickey-Fuller t	-4.5913	0.0000

Augmented Dickey-Fuller t	-4.0041	0.0002
Unadjusted modified Dickey-Fuller t	-13.1240	0.0000
Unadjusted Dickey-Fuller t	-7.0139	0.0000

II. Pedroni Test

Ho: No cointegration

Ha: All panels are cointegrated

	Statistic	**p-value**
Modified Phillips-Perron t	-3.5218	0.0002
Phillips-Perron t	-6.5101	0.0000
Augmented Dickey-Fuller t	-4.2641	0.0000

III. Westerlund Test

Ho: No cointegration

Ha: Some Panels are Cointegrated

	Statistic	**p-value**
Variance ratio	1.6997	0.0446

B. Policy rate, Interbank Borrowing Rate, Liquidity

I. Kao Test

Ho: No cointegration

Ha: All panels are cointegrated

	Statistic	**p-value**
Modified Dickey-Fuller t	-6.1671	0.0000
Dickey-Fuller t	-6.0458	0.0000
Augmented Dickey-Fuller t	-4.5507	0.0000
Unadjusted modified Dickey-Fuller t	-16.5163	0.0000
Unadjusted Dickey-Fuller t	-8.6874	0.0000

II. Pedroni Test

Ho: No cointegration

Ha: All panels are cointegrated

	Statistic	**p-value**
Modified Phillips-Perron t	-4.8138	0.0002
Phillips-Perron t	-8.3501	0.0000
Augmented Dickey-Fuller t	-6.9524	0.0000

III. Westerlund Test

Ho: No cointegration
Ha: Some Panels are Cointegrated

	Statistic	p-value
Variance ratio	1.3382	0.0904

C. Base Lending Rate, Interbank Lending Rate, Liquidity

I. Kao Test

Ho: No cointegration
Ha: All panels are cointegrated

	Statistic	p-value
Modified Dickey-Fuller t	-3.0885	0.0010
Dickey-Fuller t	-2.5589	0.0052
Augmented Dickey-Fuller t	-0.8629	0.1941
Unadjusted modified Dickey-Fuller t	-8.6749	0.0000
Unadjusted Dickey-Fuller t	-4.4702	0.0000

II. Pedroni Test

Ho: No cointegration
Ha: All panels are cointegrated

	Statistic	p-value
Modified Phillips-Perron t	-0.8682	0.1927
Phillips-Perron t	-2.7271	0.0032
Augmented Dickey-Fuller t	-1.0137	0.1554

III. Westerlund Test

Ho: No cointegration
Ha: Some Panels are Cointegrated

	Statistic	p-value
Variance ratio	3.0340	0.0012

D. Saving Deposit Rate, Interbank Borrowing Rate, Liquidity

I. Kao Test

Ho: No cointegration
Ha: All panels are cointegrated

	Statistic	p-value
Modified Dickey-Fuller t	-6.9833	0.0000
Dickey-Fuller t	-5.4245	0.0000
Augmented Dickey-Fuller t	-3.8278	0.0001
Unadjusted modified Dickey-Fuller t	-13.1534	0.0000
Unadjusted Dickey-Fuller t	-6.8103	0.0000

II. Pedroni Test

Ho: No cointegration

Ha: All panels are cointegrated

	Statistic	p-value
Modified Phillips-Perron t	-4.2335	0.0000
Phillips-Perron t	-6.4786	0.0000
Augmented Dickey-Fuller t	-5.1739	0.0000

III. Westerlund Test

Ho: No cointegration

Ha: Some Panels are Cointegrated

	Statistic	p-value
Variance ratio	0.2111	0.4164