Interest Rate Pass-Through in Malawi: Implications for Effectiveness of Monetary Policy

Austin Chiumia
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Arnold Palamuleni

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By

Austin Chiumia
and
Arnold Palamuleni
Reserve Bank of Malawi

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Abstract

This study investigated the interest rate pass-through and its implications for monetary policy effectiveness in Malawi. Using the cost-of-funds approach and monthly data from 2009 to 2015, an autoregressive distributed lag model was estimated. Results suggest that the structure of the banking industry (banking environment) matters. Also, market power is important in understanding the resulting variation in the savings and lending rates across banks in the market as well as the transmission of monetary policy impulses. Overall, our findings suggest that short-term rates as operating target are consistent with inflation targeting as a monetary policy objective.

Keywords: Interest rate pass-through, Autoregressive Distributed Lag model, Mark-up, Mark-down

JEL Classification: C51, C52, G21

1. Introduction

The objective of this study is to assess the interest rate pass-through and draw lessons for the effectiveness of monetary policy in Malawi. According to Karagiannis *et al.* (2010), interest rate pass-through measures the adjustment of retail bank interest rates (lending and deposit rates) in response to changes in wholesale rates (Central Bank policy rate and interbank market rates). The success of monetary policy largely relies on proper understanding of how the Central Bank policy actions steer the economy in the desired direction. This is known as the monetary policy transmission mechanism. One of the channels of transmission is the interest rate channel. This channel has attracted growing attention, especially under inflation targeting frameworks.

O'Connell (2011) observes that several African countries have made substantial macroeconomic progress. This progress places them on the right path to rely on the interest rate as a policy instrument. This suggests moving away from the long history of monetary aggregate targeting. According to Liu *et al.* (2008), monetary aggregate targeting is deficient in signalling the stance of monetary policy. They argue that policy transparency and effectiveness can be enhanced by shifting to active use of interest rate instruments. Other studies, such as Gali (2008) also show that the monetary policy rate, which is defined as the rate at which commercial banks rediscount securities at the Central Bank, has more influence on short-term interest rates than the monetary aggregates. Understanding the transmission of the policy rate impulses to retail rates (interest rate pass-through) is therefore key in ensuring the effectiveness of monetary policy. The need to examine the interest rate pass-through is more pronounced for low income countries such as Malawi due to the nature of their macroeconomic landscape.

The significance of this study is that it will assist authorities to improve effectiveness of monetary policy by determining policy rate changes which are necessary to bring about desired movements in retail interest rates. The effectiveness of monetary policy depends on the existence, degree and speed of the interest rate pass-through. For the interest rate policy to have impact on aggregate demand and inflation, policy signals should be transmitted to the retail rates with speed. This should also be done in relatively large magnitudes (Lim, 2001; Karagiannis *et al.*, 2010). Without the knowledge of the speed and magnitudes of transmission, the policy rate changes tend to be ad hoc. When this happens, monetary policy may contribute to financial market instability and not deliver the intended objectives. This study further highlights the oligopolistic behaviour in banks which may require appropriate supervision approach.

Furthermore, as argued by Zulkhibri (2012), understanding the interest rate pass-through in the financial market provides insight into the transmission mechanism.

The gap that is filled by this paper is that studies on Malawi, such as Chirwa and Mlachila (2006), have only concentrated on assessing the impact of financial market liberalization on interest rate spreads. Another class of studies, such as Mangani (2012) and Simwaka et al. (2012), mainly assess the impact of monetary policy on prices. These studies do not analyse interest rate pass-through as a first step of monetary policy transmission. The available evidence which is more on developed countries has divergent results. For example, complete pass-through is documented by De Graeve *et al.* (2007), overreaction is documented by Bogoev and Petrevcki (2012), and Karagiannis *et al*. (2010) found mixed results. The differences in findings in literature suggest that the pass-through might be dependent on country and bank characteristics.

In this study, we built on the results of Grigoli and Mota (2017) and estimate an Autoregressive Distributed Lag (ARDL) model which is conditioned on several financial sector variables. We estimated two models, namely the lending and savings models, for each of the nine banks in our sample. Although Malawi has 13 banks, the study was conducted on 9 banks because 2 of the banks were in the process of being acquired by other banks and the other 2 were relatively short-lived and therefore had too few data points to provide meaningful inference. We also estimated aggregate models for the lending and savings rates. We used these models to:

i) examine the short-run and long-run pass-through of the short-rates to lending and savings rates;
ii) estimate the mark-ups over lending and savings rates for each bank; and
iii) estimate the speed of adjustment of the lending and savings rates.

By estimating individual equations, we expose the heterogeneity in each bank's pricing behaviour. We also compared the interest rate pass-through under the cost of funds and the monetary policy approach.

The rest of the paper is organized as follows:

Section 2	reviews macroeconomic developments, monetary policy conduct and the interbank market in Malawi.
Section 3	is literature review.
Section 4	details the estimation technique.
Section 5	discusses estimated results and Section 6 concludes.

2. Macroeconomic landscape

Malawi is a small, open land-locked economy. Real gross domestic product (GDP) and per capita income were estimated at US$6.9 billion and US$393.2 respectively in 2015. Agriculture is the lead sector and is mostly driven by rainfall. The sector generates over 80% of the country's foreign exchange. The main exports are raw produce with tobacco alone generating over 60% of the export proceeds. Other exports include tea, coffee and sugar. About 72% of the agricultural output is produced by the smallholder sector. The manufacturing sector is mostly in agro-processing. Malawi mostly imports fertilizer, fuel and pharmaceuticals. The current production pattern and the international trading system have remained relatively unchanged since the colonial period. Historically, up to 40% of the country's total expenditure has been financed by donors. This macroeconomic landscape leaves the country susceptible to weather, terms of trade shocks and changing approaches to budget support by donors.

Table 1 shows that there has been a general rise in inflation while the GDP growth rate patterns are rather mixed. The lowest inflation and highest GDP growth rates were recorded between 2008 and 2012, owing to a fixed exchange rate system and expansion in agriculture and infrastructure projects. However, the policy frameworks during this period emphasized production that generated little foreign exchange inflows in an economic system where consumption and production mostly rely on imports. Consequently, in May 2012 the fixed exchange rate system became unsustainable and was abandoned.

Table 1: Selected economic indicators (%, unless otherwise stated)

	Policy rate	T-bill rate	M2**	MK/USD*	Inflation rate	GDP
1980-1986	10.3	11.9	17.6	1.3	14.1	1.6
1987-1993	15.4	16.6	22.3	3.0	19.7	3.3
1994-2007	34.8	32.8	34.9	67.0	26.6	3.4
2008-2012	16.2	10.9	29.9	167.6	10.7	6.0
2012	17.8	14.3	27.8	235.5	21.4	2.1
2013	25.0	21.2	31.3	369.2	28.6	6.3
2014	25.0	22.6	20.7	421.4	23.8	6.2
2015	27.0	24.4	23.7	636.5	21.9	2.9

* Malawi Kwacha per US dollar, ** broad money supply.
Source: Reserve Bank of Malawi 2016 Annual Economic Report.

The banking system

The banking sector in Malawi is relatively small. Helped by lower integration and prudent regulations, it remained relatively stable after the 2008 global financial crisis. The country has 13 commercial banks with over 70 branches across the country. In January 2014 the banks migrated to the Basel II Accord. Table 2 shows the skewed distribution of bank assets. The two large banks have a combined asset size of over 50% of the total banking sector assets. These two banks also have combined capital of about 56% of the total banking sector capital. They also control around 50% of the loan and deposit markets. The top 4 banks have about 70% stake in loan and deposit markets. Five of the banks are foreign owned. The government holds majority shares in two banks.[1]

Table 2: Banking sector market share (%) and ownership in 2014

Name of bank	Assets	Loans	Deposits	Capital	Ownership
A	26.3	25.7	25.1	29.4	Domestic
B	24.4	18.3	25.8	26.1	Foreign
C	10.4	10.1	8.5	16.0	Foreign
D	9.6	13.1	9.0	8.3	Domestic
E	6.4	7.3	6.3	4.0	Foreign
F	6.3	8.4	7.5	3.4	Government
G	3.0	4.2	3.2	1.2	Government
H	2.7	2.1	2.2	2.5	Foreign
I	2.1	1.5	2.4	1.7	Foreign
Other banks					
J	6.3	6.7	7.2	5.2	Domestic
K	2.4	2.5	2.7	2.1	Domestic

Table 3 shows that commercial banks' deposits account for over 70% of the sources of funds. Tables 2 and 3, therefore, reveal that the bulk of the deposits arise from the two largest banks which contribute about 51% of total banking sector deposits. In terms of assets, the banking system's main assets comprise loans and advances followed by cash holdings and assets due from banks. Similarly, Tables 2 and 4 reveal that out of the total loan assets of the banking system, over 50% are held by the three largest banks. This structure of asset composition and sources of funds shows that larger banks may exert significant influence on the behaviour of lending and savings rates, a feature which may directly reflect financial market fragmentation.

Table 3: Banking system sources of funds (%)

	Dec 2010	Dec 2011	Dec 2012	Dec 2013	Dec 2014
Deposits	73.1	75.2	71.1	72.8	69.1
Liabilities to other banks	4.5	3.2	6.0	2.5	4.1
Other liabilities	6.3	6.9	8.4	8.9	8.5
Total capital	16.0	14.7	14.5	15.7	18.3

Source: Reserve Bank of Malawi Annual Bank Supervision Report (2015)

Over 40% of the loans are extended to the wholesale, retail and agriculture sectors. An additional 15% is extended to the manufacturing sector. These three main sectors account for over 50% of the total loan value.

Table 4: Banking system assets composition (%)

	Dec 2010	Dec 2011	Dec 2012	Dec 2013	Dec 2014
Cash and due from banks	14.1	15.4	24.6	29.4	30.2
Securities and investment	18.6	19.3	12.2	18.6	18.1
Net loans and advances	52.4	52.2	50.1	39.3	38.3
Other assets	14.9	13.1	13.1	12.8	13.5

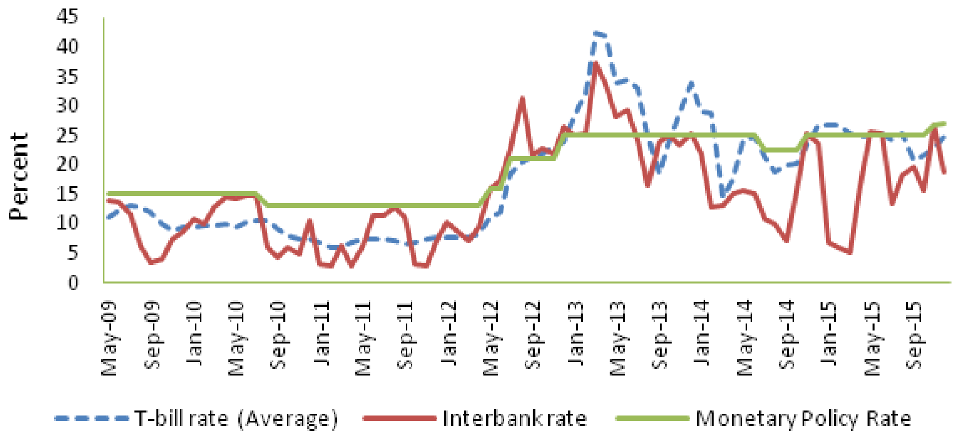
Source: Reserve Bank of Malawi Annual Bank Supervision Report (2015)

Monetary policy and the interbank market

The objective of monetary policy is to achieve price and financial stability. For a relatively long period (1990–2012), monetary policy was implemented using the Monetary Aggregate Targeting (MAT) framework. Although MAT remains a *de jure* monetary policy framework, de facto, monetary policy conduct since 2012 has shifted towards influencing interbank market rates (IBR). Under the current framework, the monetary policy stance is signalled by the policy rate which is decided upon six times in a year. There are implicit considerations of inflation and output developments in setting the monetary policy rate. In between monetary policy committee meetings, the Reserve Bank of Malawi uses Open Market Operations (OMOs) to influence liquidity condition to ensure that IBR is in line with the monetary policy stance.

When the Central Bank wishes, for example, to lower rates it purchases Treasury securities from the banking system which then increases the price of the securities and lowers their yields. Since Treasury yields are the bellwether, returns on alternative assets start adjusting as well. Evidence suggests that the IBR tends to mimic the policy stance when excess reserves are almost zero. This highlights the critical role of OMOs in transmitting the policy stance to short and long-term rates. This transmission is expected to lead to convergence of actual inflation towards the target. The resulting distribution of rates in the financial markets is, however, a function of the structural characteristics of the economy. Figure 1 shows that the policy rate (pr) has mostly been above the interbank and the Treasury bill (T-bill) rates. Exceptionally, in 2012/13 the policy rate was below the T-bill rate and IBR due to severe liquidity shortages in the banking system.

Figure 1: Policy rate and money market rates

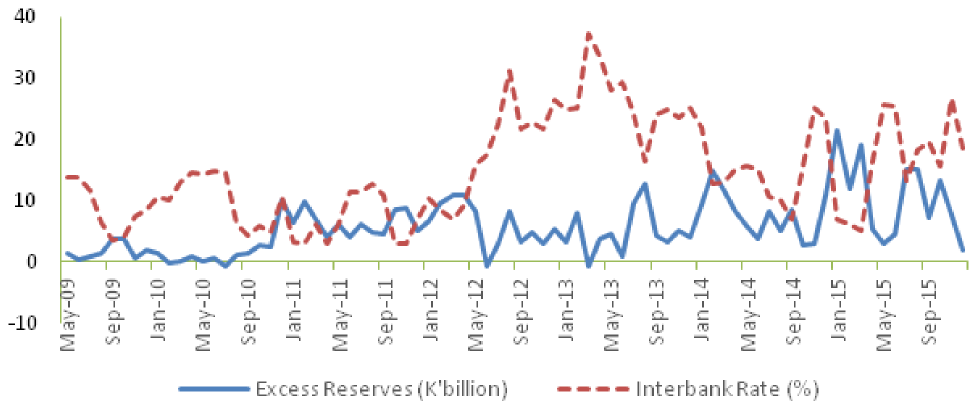


Source: Various Reserve Bank of Malawi's Monthly Economic Reviews

One of the features of Malawi's interbank market is that traded values are agreed upon bilaterally between the borrower and the lender. The borrower and the lender transact mostly based on their liquidity positions and on the borrower's risk profile. The borrower, however, seeks quotations from several banks before making a decision. Some caveats exist. First, this process may enhance price discrimination following the lender's uncompetitive assessment of the borrower's risk profile. For example, bigger banks are perceived to have low risk profiles and therefore borrow at lower rates. Not surprisingly, the smaller banks still seek recourse from the Central Bank at relatively higher interest rates despite the presence of the interbank market. This is a major caveat in the transmission of monetary policy in most low income countries (LICs) as the IBR may not completely reflect demand and supply dynamics on the interbank market.

The banking system in Malawi is also characterized by volatile and excess liquidity (Figure 2). The main sources of this are two. First, the persistent fiscal deficits which inject liquidity in the banking system. Second, the donor inflows which are often not sterilized. As observed by Baldini et al. (2015), excess liquidity does not always reflect monetary policy stance but some systemic risks associated with banking in African economies. High risk premium leads to an increase in commercial banks holding excess reserves and may impede the transmission of monetary policy impulses to lending and deposit rates. This implies that in low income countries like Malawi, high liquidity levels may affect the effectiveness of monetary policy. More so, the excess liquidity is skewed towards larger banks which eventually distorts the overall pattern of the interbank trades.

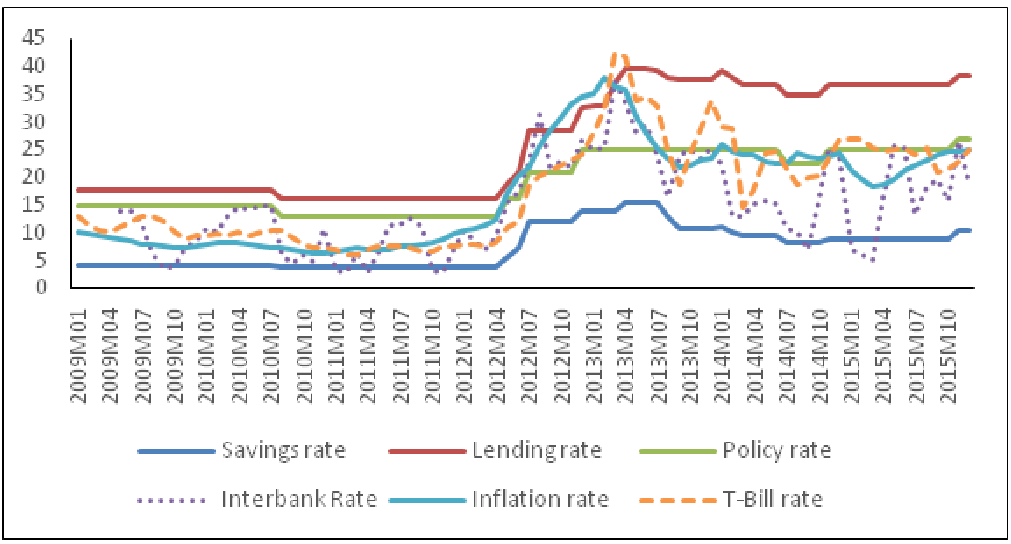
Figure 2: Excess reserves and the Interbank rate



Source: Various Reserve Bank of Malawi's Monthly Economic Reviews

Figure 3 shows that between mid-2012 and mid-2013 there was a narrow gap between the policy and savings rate. During this period, the country moved from a fixed to a floating exchange rate system. A liquidity crunch ensued as the private sector moved deposits around the banks in search for foreign exchange to clear the huge import backlog. Due to this process, deposit rates kept rising as banks competed to protect their customer base. During this time, the Central Bank unconventionally accorded non-collateralized lending to the banks to manage the liquidity problems that ensued. Before and after this period, the interest rate pattern shows that the gap between the deposit rate and the lending rates is widening.

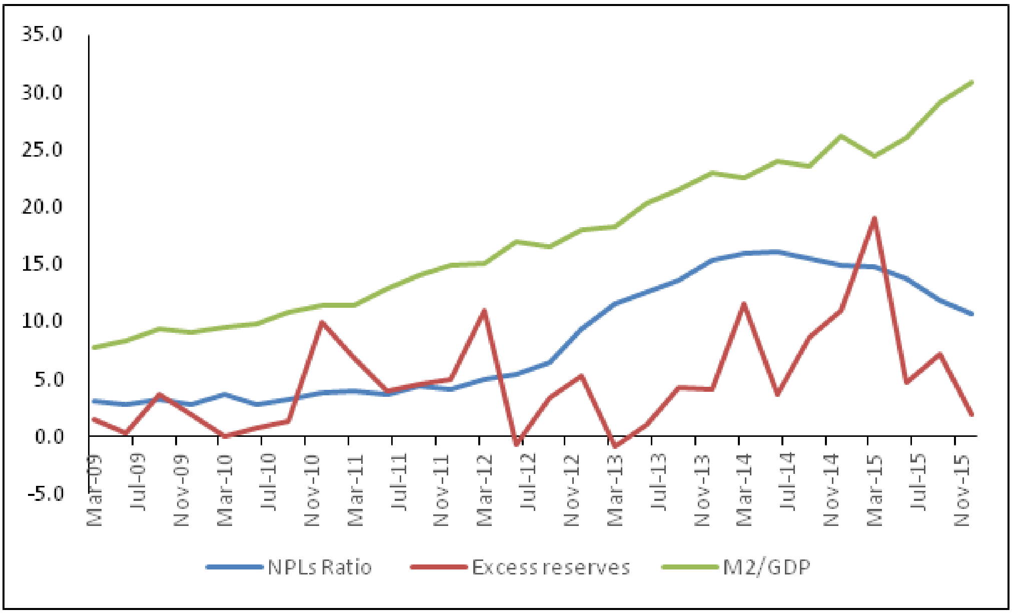
Figure 3: Interest rates and Inflation



Source: Various Reserve Bank of Malawi's Monthly Economic Reviews?

Due to high levels of interest rates and declining real GDP growth rates, non-performing loans measured as volume of non-performing loans as a ratio of total loans steadily rose between 2012 and 2013 and remained elevated (Figure 4). As a ratio of GDP, money supply has been steadily rising.

Figure 4: Selected banking sector indicators



Source: Reserve Bank of Malawi 2016 Bank Supervision Report

3. Literature review

Empirical findings on interest rate pass-through differ between and within advanced and developing economies. Van Leuvensteijn *et al.* (2013) found that in the Euro area, bank competition depresses interest rates and causes stronger pass-through. Banks with a stable pool of deposits smooth interest rates and require a higher spread as compensation. Gambacort (2008) found heterogeneity in the pass-through, but only in the short run in the Italian banks. He also found that interest rates on short-term lending of liquid and well-capitalized banks react less to changes in the official rates. Karagiannis *et al.* (2010) found less than complete pass-through of 0.67 between the policy rate and the deposit rate. De Graeve *et al.* (2007) found that the long-term pass-through to lending rates is substantially heterogenous and less than one-for-one in the Belgian banking system. Demand and savings deposits display the most rigid prices. Fuertes and Heffernan (2009) found that official and retail rates move together in the long run in the United Kingdom.

The divide in literature is reflected in the emerging economies. Liu *et al.* (2008) found complete long-term pass-through for some but not all retail rates in New Zealand. After adopting an official policy rate, the pass-through of floating and deposit rates improved but not for fixed mortgage rates. The authors found that monetary policy rate has more influence on short-term interest rates. A similar result was found by Bogoev and Petrevcki (2012) who showed that in the long-run there is more than complete adjustment of the money market rates to the key policy rate in Macedonia. However, in the short-run, the size and speed are quite low and sluggish. Horvath and Podpiers (2012) provided evidence that the pass-through differs across banks in the short term and that pricing becomes homogeneous only in the long term in the Czech Republic. Zulkhibri (2012) found that the pass-through is incomplete in Malaysia and that the speed of adjustment varies across institutions and retail rates.

In Africa, the literature is also divergent. Aziakpono *et al.* (2007) found that the speed of adjustment varies across the rates in South Africa. The highest speed occurs for lending rate, followed by T-bill rate and money market rates. Deposit rates and government bond yield have the least speed of adjustment. They also found evidence of the negative customer reaction hypothesis and collusive behaviour of banks. Dube and Zhou (2013) showed that in the long run, T-bill rate pass-through to the mortgage bond rates ranges from 1.0 to 1.3 in South Africa. The higher than unity results are attributed to overshooting of the exchange rate. The pass-through between the repo rate and the lending rate is estimated between 0.8 to 1.2. Samba and Yan (2010) found evidence of very low and incomplete long-run pass-through of the policy rate to the deposit rate in the Central African Economic Monetary Union. They further showed that the lending rate exhibits huge overshooting. A study by Ogundipe and Alege (2013) showed that in Nigeria, the Central Bank's short-term interest rate transmits to long-term rates with an estimated immediate pass-through of 0.72 on the lending rate and 0.65 on the deposit rate.

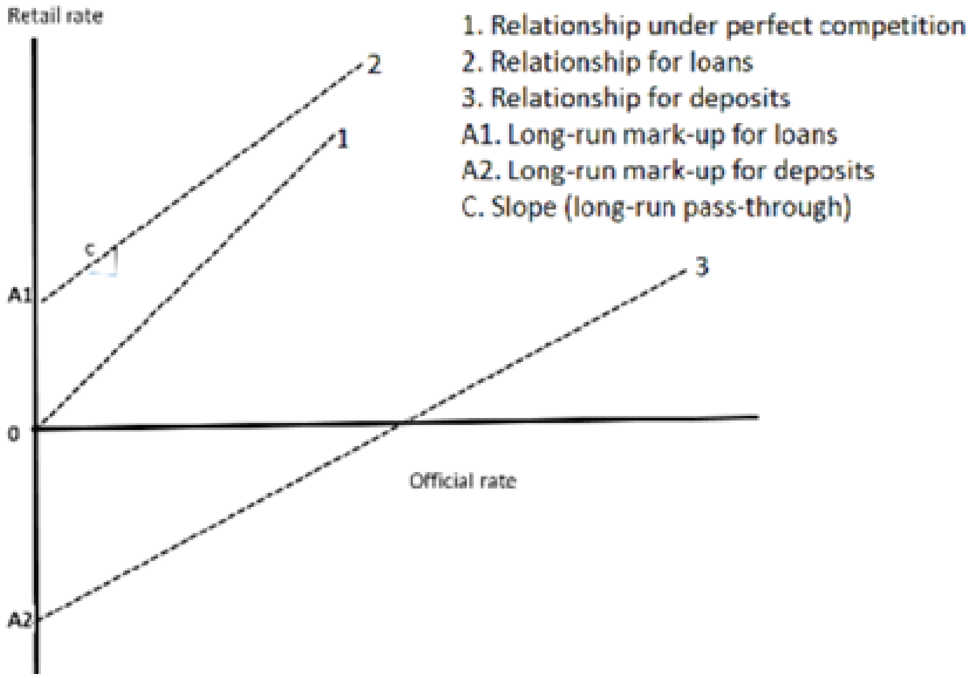
In Kenya, Mahashi and Pokhariyal (2013) found that it takes 7 days, 90 days and 1 year for monetary policy shocks to transmit to the repo rate, T-bill rate and the interbank rate respectively. Misati *et al.* (2011) found incomplete pass-through in the short-run and long-run. The study further found that it takes 11 to 22 months for policy interest rates in Kenya to be fully transmitted to long-term interest rates. Another study on Kenya, conducted by Sichei and Njenga (2012), found that monetary policy signals are asymmetrically transmitted in the banking system. They attributed this to relatively low liquidity and less capitalized banks which account for about 82% of the banking system's credit. Sheefeni (2013) found incomplete pass-through of the policy rate to market rates in Namibia. He found relatively low pass-through in the long-run than in the short-run but the coefficients are closer to one. In the short-term, the lending rates are found to be stickier than the deposit rates.

From the surveyed literature, two prominent approaches to modelling interest rate pass-through appear. One approach is to examine the response of retail rates to changes in the money market rates, that is, the cost of funds approach. Several studies follow this approach (de Bondt, 2005; Freixas and Rochet, 2008; Horvath and Podpiers, 2012; Van Leuvensteijn *et al.*, 2013). The other approach is to examine directly the response of retail interest rates to the official policy rate innovations, that is, the monetary policy approach. Among others, evidence for this approach has been documented by Sanders and Kleimeier (2004) and Fuertes and Heffernan (2009). The monetary policy approach assumes a stable yield curve which makes it possible to take a shortcut by looking directly at the relationship between policy rate and retail rates.

Due to the relatively less developed financial system, there might be a disjoint in the transmission of money market rates to retail rates in many LICs. The monetary policy approach becomes handy in circumstances where economies do not have well developed money market instruments which can relay monetary policy signals to the retail rates via money market rates. In countries where money markets are better developed, the cost of funds approach is most appropriate. In this approach the stance of monetary policy is proxied by the levels of short-term rates or operating objective. Proxying policy stance with the short-term rates is also appealing when changes in actual policy rates are too infrequent.

In addition, some studies, such as Aziakpono *et al.* (2007) and Dube and Zhou (2013), report the pass-through using aggregated time periods like immediate, short-run or long-run and others like Mahashi and Pokhariyal (2013) and Misati et al. (2011) report pass-through in discrete periods like weeks and months. While monetary policy is conducted in discrete periods, the variability in asset prices takes effect in continuous time. Furthermore, the interest rates are subjected to other market dynamics which may affect their variability daily. These factors would make reporting discrete periods less favourable than continuous periods.

Figure 5: Graphical representation of interest rate pass-through



Source: Fuertes and Hefferman (2009)

Based on Fuertes and Heffernan (2009), we used Figure 5 to provide a summary of various empirical findings on the pass-through of the interest rate to the market rates. The condition represented by the 45° line denoted with 1 is that of perfect competition and complete pass-through of unity. In the long-run, there are no mark-ups in this scenario. Some studies, however, find incomplete pass-through. Incomplete pass-through reflects less efficient markets and is portrayed by lines 2 and 3. In line 2, there is a clear long-run mark-up amounting to "A" over the lending rates and the pass-through which is represented by c is lower than unity. Similarly, the savings behaviour can be represented by line 3 where the banking system places a negative mark-up. The comparatively flatter line implies that the pass-through is much weaker to the savings rate than to the lending rate.

The literature reviewed suggests that studies lack consensus on interest rate pass-through. The lack of consensus reflects:

i) differences in modelling approaches; and
ii) the fact that interest rate pass-through may depend on country and bank specific characteristics.

In Malawi, research has concentrated on financial development and its impact on the performance of the banking industry (Chirwa and Mlachila, 2006). Related literature has focussed on assessing the impact of monetary developments on prices (Mangani, 2012; Simwaka et al., 2012). While interest rate pass-through is critical in understanding the monetary policy transmission process and hence the success of monetary policy, no known study to this effect has been conducted on Malawi.

4. The model

The empirical model adopted in this paper follows those of Cottarelli and Kourelis (1994) and Sanders and Kleimeier (2004) and is represented as follows:

$$mr_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, mr_{t-i} + \beta_1 pr_t + \sum_{j=1}^{n} \beta_j \, pr_{t-j} + \varepsilon_t \qquad (1)$$

where *pr* is the independent variable and *mr* stands for the dependent variable. Under the cost of funds approach, *pr* would represent the money market rates, such as the T-bill rate or the interbank rate while mr would represent the lending rate (LR) or saving rate (SR). The subscript t stands for time period. Karagiannis et al. (2010) argued that the money market rates are considered as policy-controlled variables since the Central Bank can easily influence them through short-term interest rate policy. They can therefore be used as a proxy for the official policy rates.

The coefficient β_1 is the impact multiplier and follows a null hypothesis of $\beta_1 = 1$ (i.e., complete pass-through) and is tested against the alternative hypothesis of $\beta_1 \neq 1$ (either an under or overreaction of the retail rates). As in Liu *et al.* (2008), under the null hypothesis we used the Wald test for coefficient restrictions. The Wald statistic has an asymptotic $\chi^2(q)$ distribution, where $q = 1$ is the number of restrictions under the null hypothesis. When $\beta_1 < 1$, then the adjustment is deemed sluggish or incomplete. The smaller the value of β_1, the more sticky are the market rates. When $\beta_1 > 1$, then the market rates overreact, implying that the pass-through is more than complete.

The term $\varepsilon_{i,t} \sim IID(0, \sigma_i^2$. Parameter α_0 is the intercept which captures the mark-up over lending or deposit rates. Letters i and j represent the number of lags chosen based on the AIC or the SIC. The stability of the long-run relationship requires that $\beta_1 + \sum_{j=2}^{n} \beta_j > 0$ while $\sum_{i}^{p} \alpha_i < 1$. The stationarity conditions describing the co-integrating relationship lead to a steady state mark-up. The long-run multipliers for the lending and savings rates can be recovered from Equation 1 as follows:

$$\theta_1 = \left(\frac{\beta_j + \sum_{j=2}^{n} \beta_j}{1 - \sum_{i=1}^{p} \alpha_i}\right) \qquad 2$$

We can restate the steady state version of Equation 1 using Equation 3 as follows:

$$mr_t = \theta_0 + \theta_1 pr_t \quad 3$$

Similar to De Bondt (2005), coefficient θ_1 is the long-run pass-through and follows a null hypothesis of θ_1=1, that is, complete pass-through. The alternative hypothesis is that $\theta_1 \neq 1$, that is, under or overreaction of the retail rates. Under the null hypothesis, we used the Wald test which has an asymptotic $\chi^2(q)$ distribution, where q = 1 is the number of restrictions. When $\theta_1 < 1$, then the adjustment is deemed incomplete. The smaller the value of θ_1, the more sticky are the rates. When $\theta_1 > 1$, then the market rates overreact implying that the pass-through is more than complete. Equation 1 can be estimated in levels only if the interest rates are I(0) processes. If, however the interest rates are I(1) processes then Equation 1 must be restated and estimated as follows:

$$\Delta mr_t = \alpha_0 + \sum \alpha_i \Delta mr_{t-j} + \beta_1 \Delta pr_t + \sum \beta_j \Delta pr_{t-j} + \varepsilon_t \quad 4$$

As shown by Kwapil and Scharler (2010), under Equation 4, the immediate pass-through is given by β_1 while the short-run pass-through is given by $\beta_1 + \sum_{j=1}^{n} \beta_j$ long-run pass-through can be recovered from Equation 4 as follows:

$$\theta_1 = \left(\frac{\sum_{j=0}^{n} \beta_j}{1 - \sum_{i=1}^{p} \alpha_i}\right)$$

Equation 4 is appropriate if the interest rates are established as I(1) processes only. If, however, besides being I(1), the series are also cointegrated, then estimating Equation 4 avoids spurious outcomes but leads to loss of important long-run relationship between the series. This information is contained in the following cointegrating relationship:

$$v_t = mr_t - \theta_0 - \theta pr_t \quad 5$$

The lagged form of Equation 5 can be added back to Equation 4 as an error correction term (ect_{t-1}) to incorporate the long-run relationship between the policy rate and the savings or lending rate. Equation 4 can thus be restated as:

$$\Delta mr_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta mr_{t-i} + \beta_1 \Delta pr_t + \sum_{j=1}^{n} \beta_j \Delta pr_{t-j} + \delta ect_{t-1} + \varepsilon_t \quad 6$$

Equation 6 describes both short-run and long-run dynamics of the interest rates. Parameter δ measures the speed of adjustment of the market rates to the long-run equilibrium. A priori, $\delta < 0$, and must be statistically significant.

Conditioning the pass-through

From the theoretical point of view, the structure of the Malawi banking system poses unique challenges in transmitting monetary policy signals. Table 3 shows that the main source of funding for the overall banking system is deposits, accounting for around 75% of total funding. This is followed by total capital which constitutes about 15% of the sources of funds. Therefore, around 90% of the sources of funds of commercial banks arise from deposits and total capital. However, Table 2 reveals that the three largest banks command about 60% of total banking sector deposits and about 72% of total banking sector capital. This is reflected in the loans extended by the 3 large banks which constitute 55% of total loan volume. This signifies a considerable degree of market power in both the loan and deposit markets. Given that deposits are the main sources of funds, deposit rates of smaller banks would be expected to respond more and faster to interest rate changes than deposit rates for the bigger banks, that is, as smaller banks strive to enhance their market share.

The interest rate pass-through can be conditioned on macroeconomic factors, bank specific characteristics and on the financial landscape. Gigineishvili (2011), Cottarelli and Kourelis (1994), Mojon (2000) and Sanders and Kleimeier (2004) used both macro and financial sector conditions and found a positive relationship between inflation, degree of capital mobility and money market volatility. Sorensen and Werner (2006) found negative relationship of the pass-through elasticities with respect to banks' excess liquidity, excess capital, and rigidity in bank funding costs proxied by the share of deposits in total liabilities. Sanders and Kleimeier (2004) also found that the health of the banking system which is proxied by non-performing loans as a percentage of total loans, reduces interest rate sluggishness. Mojon (2000) found that the higher the operating costs, measured as ratio of staff costs to gross income, the lower the pass-through.

Literature suggests several other factors which influence the response of retail rates. For example, Ayogu and Dezhbakhsh (2004) developed an inter-bank rivalry model and found that banks change their lending rates not only in response to changing own cost conditions but also in recognition of mutual interdependence or strategic competition within the industry. The other factors cited in literature are oligopolistic tendencies and ownership of the banking system. According to Cottarelli and Kourelis (1994), a state dominated banking system results in banking concentration or some form of monopoly, which may cause rigidity in the interest rates. In addition, due to political pressures or simple inefficiencies, bank interest rates will be more rigid in state owned banks. Finally, if banks perceive the risk of default to be very high, they may maintain a relatively large spread between lending and deposit rates. If this spread is large enough, then the lending rates may be relatively insensitive to small changes in the policy rate. This factor may introduce sluggishness in response of the market rates to changes in the policy rate. This sluggishness is expected to be higher in banks which have relatively better risk analysis tools.

In this study, we followed Grigoli and Mota (2017) and conditioned the pass-through estimates on several financial market variables. Departing from traditional format, we extended the empirical equations (4) and (6) to include a vector of exogenous covariates X_t. Literature defines X_t as containing macroeconomic and financial sector characteristics. However, following Grigoli and Mota (2017), we restricted X_t to contain financial sector characteristic in order to enhance model tractability. Therefore, contained in X_t are four variables. First, it is a measure of financial market risk (risk). A priori, we would expect the lending rates to rise within rising risk while the saving rates would be negatively related to the market volatility. Second, as in Sanders and Kleimeier (2004), we incorporated non-performing loans (NPLs) to capture increases in interest rates that compensate for losses when NPLs rise. However, when NPL are high, banks may be compelled to reduce interest rates to curtail default. The link between lending rates, savings rate and the NPLs might therefore be ambiguous. Third, we included excess reserve (ExRes) to capture the implications of excess liquidity on the pass-through. Higher excess reserves are expected to depress lending and savings rates. Fourth, we included financial development (FinDev) to capture the implication of financial market development on pass-through. A priori, financial development is expected to lead to a decline in retail rates and enhance interest rate pass-through. Lastly, we conditioned the pass-through estimation on market share. All measures of market share led to similar ranking for the banks in our sample. We thus used the share of bank's deposits (Depo). For the long-run models, we thus estimated the following model:

$$\Delta mr_t = \alpha_0 + \alpha_1 \Delta pr_t + \sum_{i=2}^{p} \alpha_i \, \Delta pr_{t-i} + \theta_1 \Delta X_t + \sum_{l=2}^{m} \theta_l \, \Delta X_{t-l} + \sum_{j=0}^{n} \beta_j \, \Delta mr_{t-j} + \gamma ect_{t-1} + \varepsilon_t \quad 7$$

where ɣ is the percentage of the previous period deviation from the long-run equilibrium that is corrected in every period t. As in Kwapil and Scharler (2010), where no cointegration is found, estimation proceeds using Equation 8:

$$\Delta mr_t = \alpha_0 + \alpha_1 \Delta pr_t + \sum_{i=2}^{p} \alpha_i \, \Delta pr_{t-i} + \theta_1 \Delta X_t + \sum_{l=2}^{m} \theta_l \, \Delta X_{t-l} + \sum_{j=0}^{n} \beta_j \, \Delta mr_{t-j} + \varepsilon_t \quad 8$$

We estimated the model using the Cost of Funds (COF) approach based on De Bondt (2005). This procedure applies standard marginal cost pricing to the banking system. The underlying theory is that money market rates reflect marginal or opportunity costs of funds especially when banks rely on these for short-term financing. In terms of households and enterprises, they also represent opportunity cost of deposits given the alternative possibility of investing in money markets or short-term government bonds.

Data and estimation

Data

We estimated our model using the following series: savings rate and lending rate which represent retail rates; T-bill rate and interbank rate representing money market rates. The savings rate is the annualized rate on deposits of a tenor of more than one year. The lending rate is the monthly average of the annualized maximum and minimum lending rates. The treasury bill rate is the three months yield on government bonds while the interbank rate is calculated as average of the daily interbank rates for a particular month. Sanders and Kleimeier (2004) suggested choosing a money market rate that displays higher correlation with the official policy rate to act as a proxy for the policy rate as well as for the marginal cost of funds (see Table 5).

Table 5: Correlation in interest rates

	Lending rate	IBR	Policy rate	Sav. rate	T-bill rate
IBR	0.65	-	-	-	-
Policy rate	0.99	0.66	-	-	-
Savings rate	0.90	0.74	0.87	-	-
T-bill rate	0.92	0.76	0.90	0.88	-

Source: Own calculation

Based on Sanders and Kleimeier (2004) and Grigoli and Mota (2017), the conditioning variables were defined as follows:

- financial market risk was proxied by the three months moving variance of the US dollar bilateral nominal exchange rate;
- non-performing loans were calculated as bank's NPLs over total loans for a particular bank;
- excess reserves were calculated as a ratio of excess reserves to total deposits; and
- financial development was proxied by the ratio of broad money supply to nominal GDP.

We used the share of bank's deposits in total banks' deposits to capture market share of individual banks.

The model was estimated using monthly data from January 2009 to December 2015 obtained from the Reserve Bank of Malawi. This sample period helped increase the number of banks assessed. Going back before 2009 would imply examining fewer banks due to lack of data on some banks. The banks considered in this analysis are: National Bank of Malawi, Standard Bank of Malawi, First Merchant Bank of Malawi, Ned Bank Malawi, Indebank Malawi Limited, Eco Bank Limited, New Building Society Bank, Opportunity Bank of Malawi and Malawi Savings Bank. These banks have been coded using the alphabetical letters A up to I due to ethical concerns (Hofman and Mizen, 2004).

Estimation

Some studies estimate interest rate pass-through using the panel technique. However, panel data may suffer from convoluted asymptotics which makes meaningful inferences problematic. Furthermore, variables that do not vary over time must be excluded from some panel data models such as the fixed effects regression even though they may be necessary to explain some behaviour. With these caveats, the estimation technique followed in this study was based on the Pesaran and Shin (1998) Autoregressive Distributed Lag model (ARDL). We used single equation models as in de Bondt (2005). The ARDL technique is a standard least square estimator that uses lags of both dependent and explanatory variables. The ARDL therefore automatically captures inertia in interest rates due to the inclusion of the lagged dependent variable on the right-hand side of the equation. Due to poor risk analysis tools, interest rate smoothing by commercial banks may reduce adverse impact of uninformed reaction to policy rate changes. Central banks in LICs, including Malawi, may also lack necessary tools to exhaustively analyse macroeconomic risks. Therefore, policy mistakes may filter through to banking system and cause unnecessary volatility in interest rates. By making retail rates to partly depend on their previous levels, the ARDL technique inherently captures interest rate smoothing.

According to Pesaran and Shin (1998), another advantage of the ARDL model is its flexibility to handle I (1) variables alongside I (0) variables. Non-stationarity is a common feature in several financial time series. The use of the ARDL technique therefore circumvents the problem of spurious regressions and preserves information that is otherwise lost from transformations that generate stationarity under alternative models. Another advantage of the ARDL model observed by Laurenceson and Chai (2003) is that it can accommodate sufficiently large numbers of lags to capture the data generating process in a general-to-specific modelling framework. These lags do not need to be symmetric across variables.

Seasonal factors were removed using X-12 census. An L in front of a letter implies a lending model for that bank while an S in front of a letter shows a savings model for that bank. Where aggregate models are estimated, we simply captured them as

L for the aggregate lending model and S for the aggregate savings model. The same model together with the estimation technique were applied to aggregate models without any loss of generality.

Unit root tests

While the ARDL approach is capable of handling I(0) and I(1) variables, it practically breaks down in the presence of I(2) variables. Therefore, testing for the unit root in variables is necessary to ensure that series are not integrated of orders higher than 1. Figures 1 and 2 show that the series have an intercept with some probable breaks in the data series but may not have a trend. Therefore, we specified a Break Point Augmented Dickey Fuller unit root test with a constant. The ADF unit root with break test implements the Bai-Perron (2003) break test and proceeds to examine the stationarity of the series after correcting for the breaks. This is an important feature because the ordinary ADF test can be misleading in the presence of structural breaks. The test was specified as follows:

$$\Delta xt_{1t} = \beta + (\rho - 1)x_{1t-1} + \sum_{j=1}^{m} \sigma_j \, \Delta x_{1t-j} + \mu_t$$

where xt represents the interest rate series. The null is stated as $H_0 = \rho\text{-}1 = 0$, that is, the interest rates are non-stationarity against an alternative of $H_0 < \rho\text{-}1$. The number of lags m is chosen by the AIC. We further used the Bai andPerron (2003) multiple break test for structural breaks. Bai and Perron (2003) provide theoretical and computational results that further extend the Quandt-Andrews framework by allowing for multiple unknown break points instead of a priori break dates. The test allows for a maximum number of breaks, employs a trimming percentage of 15 and uses the 0.05 significance level for the sequential breaks. We detected breaks in 2012 M07 and proceeded to use the dummy variable to correct for this.

5. Results

Unit root test results are presented in Appendix (i). Overall, the results are rather mixed with most of the dependent variables being marginally non-stationery at 5%. The bounds tests, as proposed by Pesaran, Shin and Smith (2001), evaluated at 5% show inconclusive results for model LB, LA, LH, LG, LD, LE, SF, SG and SE. Cointegration is established in LF, LC, LI, LB, SB, SA, SH, SI, SD and SC (Appendix iii). The different levels of integration together with varying levels of significance make the ARDL model more suitable for our analysis.

Descriptive statistics

In Table 6, we present the descriptive statistics. The banks are arranged by asset size from the biggest bank (A) to the smallest bank (I). This arrangement remains relatively unaffected if banks are ordered by size of deposits, capital and loans extended. Banks A and B which are biggest have highest lending rates but offer the lowest savings rates. This outcome is consistent with Horvath and Podpiers (2012). The opposite holds for the smaller banks. The two largest banks have comparatively highest interest rate spreads. In terms of the volatility of the lending rate, the two biggest banks have the lowest variance in the lending rate. At 12.08, the highest standard deviation of the lending rates is recorded under bank F while the lowest is recorded for bank A at 6.40.

Table 6: Descriptive statistics

Bank	A	B	C	D	E	F	G	H	I
Lending rates									
Mean	31.54	32.18	25.71	25.53	26.05	26.60	26.40	25.27	26.12
Median	28.50	28.50	21.00	2050	22.50	21.00	21.50	21.00	21.00
Std.dev	6.09	7.03	9.65	9.55	9.79	12.08	9.89	8.42	10.63
Savings Rates									
Mean	6.40	6.26	6.51	6.49	6.49	7.40	787	7.00	495
Median	4.83	3.75	5.50	6.00	6.00	5.88	5.81	4.75	4.75
Std.dev	4.13	4.30	2.63	1.73	1.73	3.61	4.23	451	2.76
Spread									
	25.14	25.92	19.20	19.04	19.56	19.20	18.53	18.27	21.17

Source: Authors' calculations

Parameter estimates

Estimated results are presented in Tables 7 to 11. All models have high R^2 values indicating sufficient explanatory power. The models were selected based on the Akaike Information Criterion. The models were subjected to diagnostic tests which include the Breusch-Godfrey LM serial correlation and the Breusch-Pagan-Godfrey heteroskedasticity test. All models suggest no basis of failing to accept the null hypothesis of no serial correlation. However, most of the models show signs of heteroskedasticity. In order to account for this, the models with heteroskedasticity were estimated using the Heteroskedasticity Autocorrelation Consistent (HAC) covariance estimator. The HAC estimator accounts for heteroskedasticity by adjusting upwards the standard error and hence reduces the value of the t-statistics. This corrects for the otherwise false statistical significance that would occur without such correction.

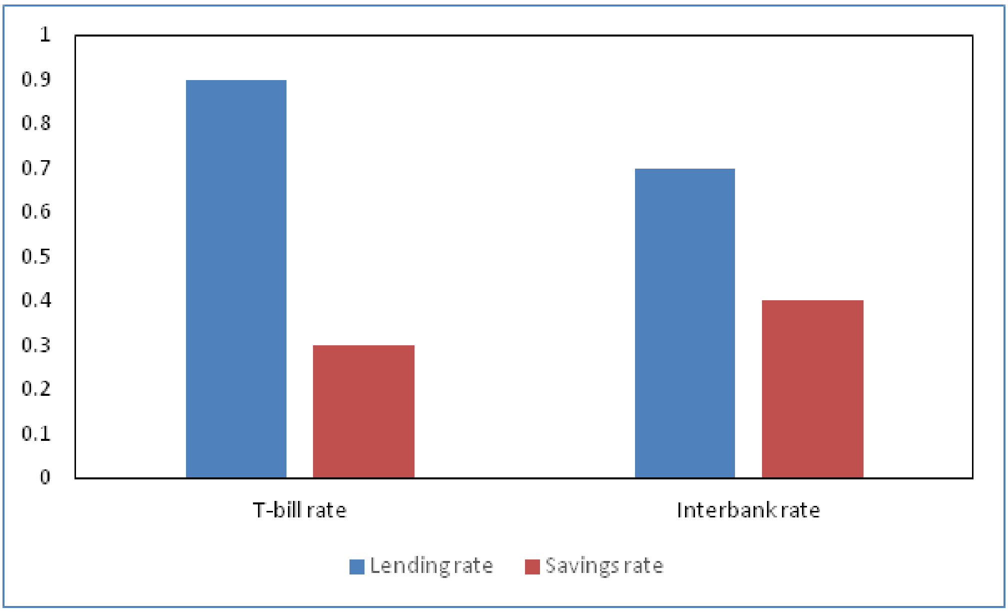
Parameter estimates for the vector Xt show that the market risk, measured by exchange rate volatility, is not significant in driving lending and savings rates in the banking system. This finding is robust across all banks. Another finding is that an increase in NPLs is mostly associated with lower lending and deposit rates. However, it is not significant in some of the banks. We also found evidence of the negative relationship between excess reserves and the lending rate. We further found a positive relationship between level of deposits and lending rates signifying the ability of banks to influence lending rates due to their size. The higher the level of deposits, the higher the lending rates. Consistent with theoretical expectations, we mostly found a negative relationship between the level of deposits and the deposit rate. The financial development indicator was negatively related to lending rates. The higher the financial market development, the lower the lending and savings rates. This measure is, however, not significant in most of the banks. Excess reserves and financial development are key determinants of aggregate lending ad savings rates in the short run but not in the long run.

The aggregate estimates are presented in Table 11. The estimated long-run pass-through to the lending rate is 0.90. This finding is consistent with the findings of Dube and Zhou (2013) and Bogoev and Petrevcki (2012). The long-run pass-through to the savings rate is estimated at 0.31. Samba and Yan (2010) found a similar result. The results suggest lower pass-through to the savings rate compared to the lending rate, both in the long-run and the short-run. The change in the policy rate has implications on the T-bill rate. The high appetite of borrowing by government implies that the banking system has a steady loan market. The private sector therefore competes with government over resources from commercial banks. Given the risk-free nature of T-bills and the high risk premium, commercial banks adjust lending rates to cover the high risk premium associated with private borrowers. The adjustment on official rates is therefore met with near complete adjustment in the lending rates.

The lower pass-through to the savings rate may reflect high liquidity levels in the banking system which could be a reflection of high risk premium as well. The scramble for deposits is dwarfed by the prevalence of excess reserves. This has the effect of keeping deposit rates low thereby negatively affecting the transmission of monetary policy. Although not complete, the high pass-through of 0.90 to the lending rate is a good signal for monetary policy effectiveness. However, the lower pass-through to deposit rates poses policy challenges, especially as interest rates may not affect intertemporal consumption. The difference in the pass-through to lending and savings rates implies that for any policy adjustment, the interest rate spread widens. The relatively high transmission of the short-term rates to long-term lending rates signals some efficiency of the banking system in transmitting monetary policy signals to the lending rate. The lower pass-through to the savings rate puts speed bumps in the inter-temporal consumption substitution channel. Aggregate models yield relatively lower estimates than individual models, suggesting that controlling for bank specific characteristics is key in explaining interest rate pass-through and the transmission of monetary policy.

As can be seen from Figure 5, the pass-through from the T-bill rate to lending rates is higher that the pass-through from the interbank rate to the lending rates. However, in terms of the savings rate, the pass-through from the IBR is higher compared to that of the T-bill rate.

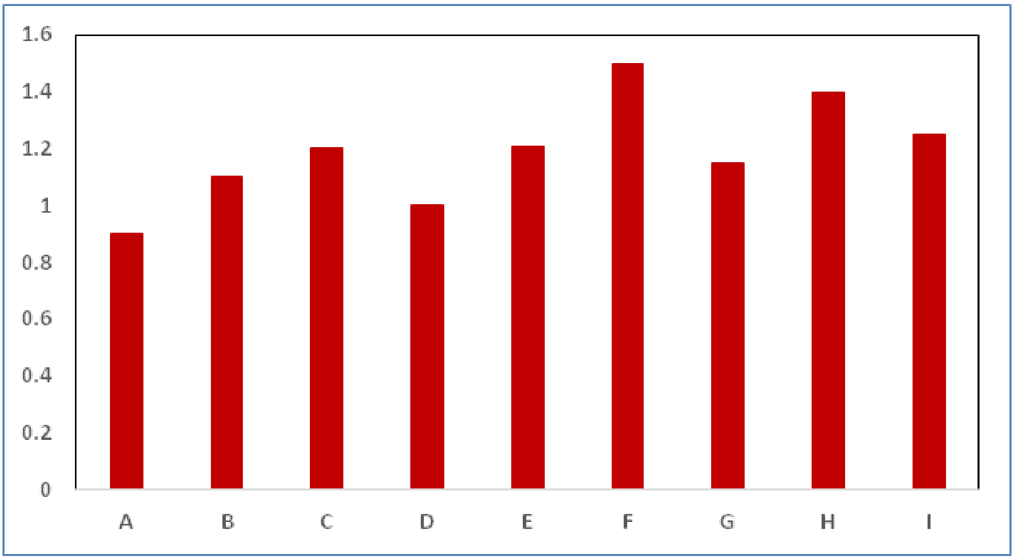
Figure 6: Long-run pass-through to lending and savings rates



Source: Authors' calculations

The simple average of the long-run pass-through to the lending rate for the top four banks is 1.05 while that of the bottom five banks is 1.41. To the contrary, in the long-run, the pass-through to the savings rate is estimated at 0.42 for the top 4 larger banks compared to 0.34 for 5 smaller banks. Larger banks are therefore found to have lower pass-through to the lending rates than smaller banks while they have relatively high pass-through to the savings rate than the smaller banks. This can partly be explained by a higher drive by the bigger banks to protect their major source of funds which is deposits. A relatively higher pass-through implies that full adjustment of the deposit rate happens relatively faster in larger banks than in the smaller banks allowing them to maintain their deposit base. There is also heterogeneity in individual bank specific pass-throughs. As shown by Gambacort (2008) and De Graeve *et al.* (2007), this heterogeneity in pass-through reflects market segmentation, low financial development and uncompetitive nature of the banking sector in Malawi.

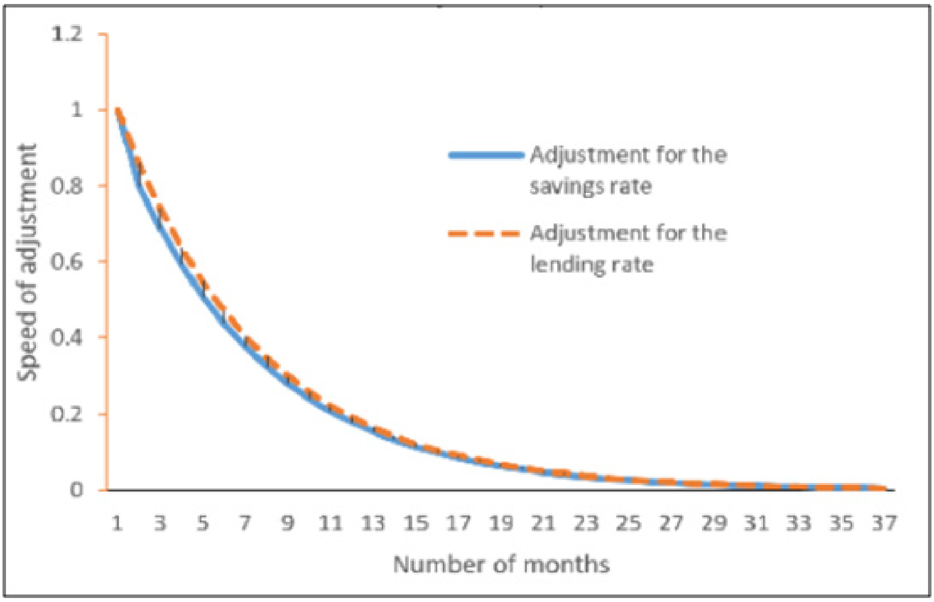
Figure 7: Long-run pass-through of the T-bill rate to lending rates by banks



Source: Authors' calculations

Two other key results appear. First, the pass-through in the short- un are significantly lower than in the long run. Second, the speed of adjustment is heterogenous across banks but is higher under the savings rate than in the lending rate. On aggregate, the speed of adjustment is estimated at 0.14 for the lending rate and 0.16 for the savings rate (Table 11). Evidence from Tables 7 and 11 suggests that under aggregate models, the pass-through is lower than unity while under individual banks, the pass-through is greater than unity. The average mark-up over lending rates is estimated at 13% compared to a mark down of 12% over the deposit rate (see Table 11). However, these mark-ups significantly vary across banks, with larger banks displaying higher mark-up than smaller banks (see Figure 6). As observed from Figure 7, it takes about 6 months for the shock to the lending rate to reach half-life, that is, where 50% of the shock has been absorbed. It takes about 33 months for the shock to fully dissipate. However, it takes 5 months for the shock to reach half-life under the savings rate and about 30 months for the adjustment to fully occur. The savings rate therefore adjusts faster than the lending rate.

Figure 8: Speed of adjustment



Source: Authors' calculation

Table 7: Long-run parameter estimates: Lending rates

	LA	LB	LC	LD	LE	LF	LG	LH	LI
TBR	0.89***	1.12***	1.19***	1.02***	1.31***	1.60***	1.17***	1.51***	1.46***
	[0.05]	[0.07]	[0.15]	[0.12]	[0.35]	[0.24]	[0.13]	[0.43]	[0.06]
Risk	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00
	[0.00]	[0.00]	[0.0]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
NPL	-0.17***	0.13***	-0.02	-0.37***	-0.60	-0.07	-0.91	2.23**	2.03
	[0.05]	[0.09]	[0.29]	[0.15]	[0.89]	[0.21]	[0.38]	[1.4]	[1.94]
ExRes.	-0.01	1.40***	0.54**	1.57***	2.62	0.65	0.84	1.78	-0.30
	[0.10]	[0.44]	[0.29]	[0.58]	[2.47]	[1.08]	[0.63]	[1.52]	[0.63]
FinDev	-0.03	-0.41***	-0.50	-0.38**	-0.28	-1.17***	-0.15	-0.36	-0.27**
	[0.15]	[0.13]	[0.34]	[0.20]	[0.63]	[0.33]	[0.33]	[0.50]	[0.15]
Depo	0.26***	-0.17***	-0.23	0.59***	0.33	1.03***	0.57	1.75	2.61***
	[0.08]	[0.05]	[0.27]	[0.28]	[0.61]	[0.60]	[0.44]	[1.43]	[0.81]
Dum	-	28.47***	25.7***	11.7***	-	-	-	-	14.38***
	-	[7.92]	[8.49]	[4.39]	-	-	-	-	[4.02]
Const.	12.07***	19.74***	18.9***	18.58***	13.13	13.07***	13.92***	7.4	7.20***
	[3.07]	[2.78]	[8.06]	[5.14]	[16.9]	[4.84]	[3.10]	[9.19]	[3.09]
χ^2 for TBR	120.02	313.13	120.12	98.27	99.23	301.54	205.67	100.76	98.01
i.e (θ_1=1)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LM	(0.58)	(0.24)	(0.53)	(0.25)	(0.72)	(0.37)	(0.16)	(0.82)	(0.72)
R^2	0.98	0.96	0.97	0.89	0.98	0.95	0.82	0.98	0.98
BPG	(0.07)	(0.01)	(0.19)	(0.16)	(0.06)	(0.01)	(0.05)	(0.01)	(0.06)

[] Std. errors; () P-values; *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant.

Table 8: Short-run parameter estimates-lending equations

	LA	LB	LC	LD	LE	LF	LG	LH	LI
D(TBR)	0.19***	0.20***	0.18***	0.13***	0.12***	0.10**	0.18***	0.15***	0.14***
	[0.05]	[0.04]	[0.04]	[0.04]	[0.04]	[0.06]	[0.03]	[0.09]	[0.06]
D(Risk)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.07]
D(NPL)	-0.06***	-0.04***	-0.00	-0.09**	-0.04	-0.07	-0.11	-0.04	0.34
	[0.02]	[0.02]	[0.04]	[0.05]	[0.05]	[0.06]	[0.08]	[0.15]	[0.46]
D(ExRes)	-0.00	-0.39***	-0.08***	-0.46***	-0.36***	0.15	0.14	0.15	0.14
	[0.04]	[0.11]	[0.03]	[0.13]	[0.13]	[0.18]	[0.10]	[0.13]	[0.13]
D(FinDev)	-0.10***	-0.11***	-0.08***	0.09**	-0.02	-0.28***	-0.08	-0.03	-0.03
	[0.05]	[0.04]	[0.04]	[0.06]	[0.04]	[0.08]	[0.06]	[0.04]	[0.05]
D(Depo)	-0.02	-0.05***	-0.03	0.16***	0.07***	-0.09	-0.10	0.28	-0.62**
	[0.04]	[0.01]	[0.04]	[0.08]	[0.03]	[0.19]	[0.10]	[0.62]	[0.32]
Dum	-	5.2**	3.89***	3.08**	-	-	-	-	4.63***
	-	[3.3]	[0.88]	[0.93]	-	-	-	-	[0.98]
χ^2 TBR	129.01	119.23	131.01	229.01	104.31	111.43	129.01	117.27	98.01
(θ_1=1)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ECM	-0.34***	-0.27***	-0.15***	-0.26***	-0.07***	-0.24***	-0.15***	-0.09***	-0.32***
	[0.08]	[0.04]	[0.03]	[0.05]	[0.03]	[0.04]	[0.03]	[0.03]	[0.06]

[] Std. errors; () P-values; *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant.

Table 9: Long-run estimates for savings equations

	SB	SC	SF	SH	SI
TBR	0.40***	0.35***	0.86***	0.56***	0.30***
	[0.10]	[0.05]	[0.23]	[0.08]	[0.05]
Risk	0.00	0.00	0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]	0.00
NPL	0.28**	-0.02	-0.50***	-1.02**	-3.94**
	[0.15]	[0.09]	[0.24]	[0.65]	[2.56]
Ex Res	0.68	-0.12	0.13	-0.83	-0.08
	[0.51]	[0.09]	[0.52]	[0.72]	[0.27]
FinDev	0.02	-0.05	-0.12	-0.33	0.27**
	[0.26]	[0.11]	[0.22]	[0.19]	[0.17]
Depo	-0.23***	-0.12	0.46	-3.81**	-0.41
	[0.09]	[0.10]	[0.36]	[2.20]	[0.57]
Dum	-9.16	-4.2	9.36***	16.43***	0.43
	[8.35]	[3.9]	[4.51]	[7.45]	[3.89]
Const.	-11.7**	-14***	-11.9***	-14.1***	-14***
	[5.26]	[2.8]	[3.93]	[5.92]	[3.50]
χ^2 TBR i.e (θ_1=1)	89.02	113.23	137.01	279.01	192.33
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

[] Std. errors; () P-values; *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant.

Table 10: Short-run savings rate parameter estimates

	SA	SB	SC	SD	SE	SF	SG	SH	SI
D(TBR)	0.08***	0.07***	0.06***	0.11***	0.07***	0.01	0.03	0.11***	0.05***
	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.04]	[0.02]	[0.03]	[0.02]
D(Risk)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	[0.00]	[0.0]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
D(NPL)	0.01	0.07	-0.01	0.17***	0.01	0.04	-0.18	0.17***	-0.16
	[0.04]	[0.26]	[0.03]	[0.07]	[0.03]	[0.04]	[0.30]	[0.07]	[0.29]
D(ExRes)	-0.04	-0.2***	-0.1***	0.07	0.06**	0.03	-0.02	0.07	-0.01
	[0.04]	[0.08]	[0.02]	[0.08]	[0.04]	[0.11]	[0.05]	[0.08]	[0.05]
D(FinDev)	-0.02	-0.03	-0.01	0.03	-0.01	-0.02	0.05**	0.03	0.05**
	[0.03]	[0.04]	[0.03]	[0.04]	[0.02]	[0.04]	0.03	[0.04]	0.03
D(Depo.)	-0.00]	-0.1***	-0.03	-1.3***	[-0.00]	0.10	-0.07	-1.3***	-0.07
	[0.02]	[0.02]	[0.02]	[0.33]	[0.02]	[0.07]	[0.09]	[0.33]	[0.09]
Dummy	1.03***	0.96**	2.12**	3.28***	2.23***	2.06***	-	3.28***	-
	[0.33]	[0.55]	[0.55]	[0.70]	[0.35]	[0.80]	-	[0.70]	-
χ^2 (θ_1=1)	211.2	232.2	198.2	102.2	331.2	132.2	89.2	111.2	121.9
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ECM	-	-0.16***	-0.28***	-	-	-0.21***	-	-0.13***	-0.10***
	-	[0.05]	[0.10]	-	-	[0.06]	-	[0.05]	[0.08]
LM	(0.89)	(0.94)	(0.87)	-	(0.99)	(0.53)	-	(0.92)	(0.36)
BPG	(0.07)	(0.13)	(0.09)	-	(0.00)	(0.07)	-	(0.05)	(0.97)
R^2	0.78	0.99	0.96	-	0.60	0.94	-	0.97	0.98

[] Std. errors; () P-values; *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant.

Table 11: Parameter estimates for aggregate equations

Long-run equations						Short-run equations				
	L	S	L	S			L	S	L	S
TBR	0.90***	0.31***	-	-		D(TBR)	0.12***	0.05***	-	-
	[0.15]	[0.06]	-	-			[0.03]	[0.01]	-	-
IBR	-	-	0.73***	0.42***		D(IBR)	-	-	0.13***	0.04***
	-	-	[0.32]	[0.14]			-	-	[0.04]	[0.01]
Risk	0.00	0.00	0.00	0.00		D(Risk)	0.00	0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]	[0.00]			[0.00]	[0.00]	[0.00]	[0.00]
ExRes	0.99	0.48**	1.95	0.74		D(ExRes)	-0.41***	-0.26***	-0.13***	-0.08***
	[0.81]	[0.29]	[1.89]	[0.54]			[0.13]	[0.05]	[0.06]	[0.03]
FinDev	-0.27	-0.03	-0.78	-0.24		D(FinDev)	-0.04**	-0.01	-0.06	-0.02
	[0.29]	[0.12]	[0.63]	[0.26]			[0.02]	[0.02]	[0.05]	[0.02]
NPLs	-0.55	-0.12	1.50***	-0.16		D(NPLs)	0.08	0.03	0.12	0.05
	[0.47]	[0.20]	[0.78]	[0.44]			[0.08]	[0.04]	[0.10]	[0.04]
Const.	12.86***	11.58***	20.16**	15.2***		ECM	-0.14***	-0.16***	-0.08***	-0.10***
	[5.65]	[2.48]	[11.48]	[5.6]			[0.04]	[0.05]	[0.03]	[0.05]

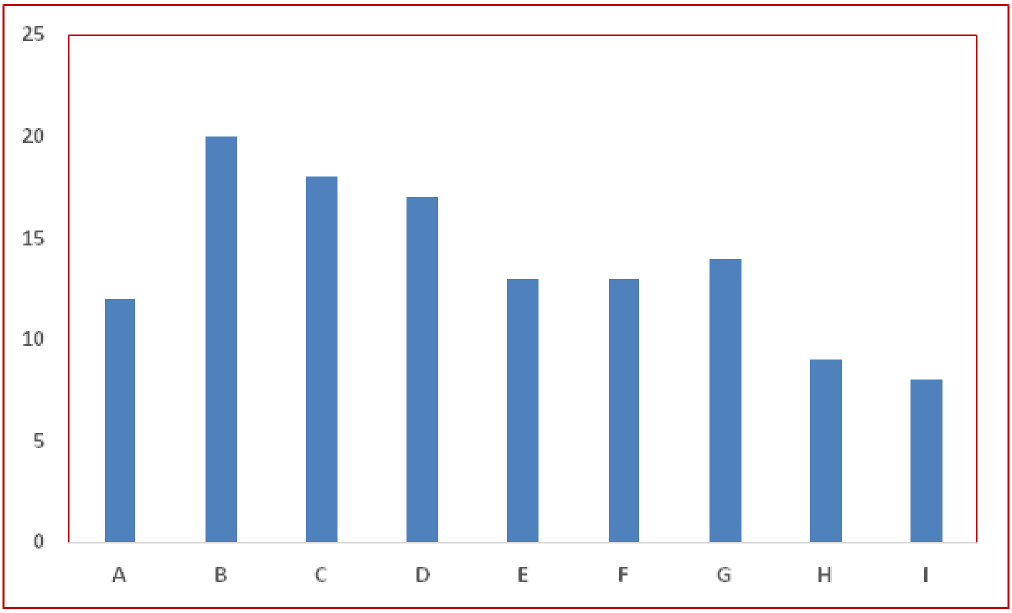
continued next page

Table 11 Continued

Long-run equations						Short-run equations				
	L	S	L	S			L	S	L	S
χ^2 (θ_1=1)	231.2	132.2	98.2	102.2		-	-	-	-	-
	(0.00)	(0.00)	(0.00)	(0.00)		-	-	-	-	-
LM	(0.71)	(0.75)	(0.77)	(0.31)		-	-	-	-	-
BPG	0.41	0.35	0.01	0.02		-	-	-	-	-
R^2	0.98	0.97	0.98	0.96		-	-	-	-	-

[] Std. errors; () P-values; *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant.

Figure 9: Mark-ups over lending rates by individual banks (%)



For robustness, we briefly compared the estimated parameters under the cost of funds approach with the monetary policy approach (MPA). The long-run pass-through estimate for the lending rate under the MPA is relatively high and is estimated at above unity (see appendix III). The pass-through to the savings rate are also relatively high under the MPA than under the COF (see Appendices iv and v). One caveat to this comparison is that the estimates under the MPA were not conditioned on Xt as was the case under the cost of funds approach. The comparison must therefore be viewed with caution.

6. Conclusion

This paper investigates the interest rate pass-through and its implications for effectiveness of monetary policy in Malawi. We used the T-bill rate to capture official policy stance and estimated our models using the cost of funds approach for each of the nine banks. We also estimated the aggregate models. The estimates were conditioned on several financial sector variables. Results show that there is incomplete pass-through to the lending and savings rate. However, the pass-through to lending rates is significantly higher than to the savings rate. The higher pass-through to the lending rate signifies that authorities can use short-term rates as operating objectives in order to improve monetary policy performance. It also signifies a relatively high transmission mechanism of policy signals to the lending rates. This is a necessary step for the effectiveness of monetary policy. Our results also reveal that bigger banks maintain relatively higher lending rates than smaller banks but have lower savings rates than smaller banks. The big banks have low (higher) volatility of lending (savings) compared to smaller banks. The magnitude of the pass-through is higher under larger banks compared to smaller banks. Our results also show that non-performing loans, financial development and excess liquidity have a bearing on the levels of interest rates.

These results have several policy implications. First, the relatively high transmission of the short-term rates to long-term lending rates signals some efficiency of the banking system in transmitting monetary policy signals to the lending rate. The lower pass-through to the savings rate puts speed bumps in the inter-temporal consumption substitution channel. There is also heterogeneity in pass-through which, according to Gambacort (2008) and De Graeve *et al.* (2007), may reflect market segmentation. Policies that deal with financial market segmentation may reduce the heterogeneity and enhance monetary policy effectiveness. Where oligopolistic tendencies are clearly visible, appropriate banking supervision may be necessary to smoothen market operations. Due to differences in mark-ups over deposit and lending rates, changes in the official policy stance tend to contribute to the widening of the interest rate spread. This could partly reflect differences in risk definitions between the authorities and the financial sector, which results in over or under-reaction of the retail rates to monetary policy signals. Improved communication between the authorities and the market participants may help to reduce this discrepancy.

Overall, our results suggest that the structure of the banking industry (banking environment) matters. Also, market power is important in understanding the resulting variation in the savings and lending rates across banks in the market as well as the transmission of monetary policy impulses. Overall, our findings suggest that short-term rates as operating target are consistent with inflation targeting as a monetary policy objective in Malawi.

Note

1. As of 2016 bank G was acquired by bank A while bank F was acquired by bank J. Despite having relatively more assets, banks J and K are relatively new and do not have sufficient data. They are thus excluded from the analysis.

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Appendix

Appendix i: Unit root test results

		Lending rate	Savings rate
B	levels	-5.1099	-4.9305
	Δ	-13.861	-10.33
A	levels	-5.1501	-4.2287
	Δ	-15.253	-13.219
F	levels	-4.3471	-0.1776
	Δ	-11.14	-9.1159
H	levels	-5.2052	-5.0171
	Δ	-16.571	-14.43
I	levels	-5.106	-4.7744
	Δ	-12.11	-12.14
G	levels	-5.1174	-0.7166
	Δ	-13.288	-10.976
D	levels	-4.9434	-4.6173
	Δ	-12.062	-11.864
E	levels	-5.0662	-2.4367
	Δ	-13.04	-11.663
C	levels	-5.1292	-4.0869
	Δ	-12.60	-21.13
Policy rate	levels	-4.16	
	Δ	-12.4	

Critical values: 1% (-5.7113); 5% (-5.1550); 10% (-4.8609)

Appendix ii: Break point ADF unit root test statistics

	Exchange rate Volatility	NPL	M2/GDP
levels	-8.71	-21.55	-3.88
Δ			-9.77

Critical values: 1% (-4.949); 5% (-4.44); 10% (-4.19)

Appendisx iii: Bounds test results at 5%

	Lending rates model				Savings rates model		
	T. Stat.	I(0)	I(1)		T. Stat.	I(0)	I(1)
B	5.18	4.68	5.15		5.33	4.68	5.15
A	4.68	4.68	5.15		6.67	4.68	515
F	5.23	4.68	5.15		4.95	4.94	5.73
H	5.01	4.94	5.73		15.23	4.94	5.73
I	5.93	4.68	5.15		6.13	4.68	5.15
G	5.21	4.94	5.73		5.78	4.68	5.15
D	3.63	3.62	4.16		7.47	4.68	5.15
E	4.70	4.68	5.15		5.21	3.62	4.16
C	5.01	4.68	5.15		7.78	3.62	4.16
Avg.	1.94	4.68	5.15		7.58	3.62	4.16

Critical values: 1% (-5.7113); 5% (-5.1550); 10% (-4.8609)

Appendix iv: Parameter estimates under the monetary policy approach-lending eqs

	θ_0	β_0	θ_1	δ	LM	BGP	R^2
LF	0.11	1.03***	1.33***	-0.04***	(0.65)	(0.02)	0.74
	[0.08]	[0.10]	[0.42]	[0.01]			
LI	0.38***	0.67***	0.98***	-0.04***	(0.47)	(0.10)	0.4
	[0.09]	[0.10]	[0.37]	[0.01]			
LB	0.31***	0.92***	1.06***	-0.02**	(0.51)	(0.02)	0.72
	[0.10]	[0.09]	[0.43]	[0.01]			
LA	0.07***	0.82***	0.99***	-	(0.04)	(0.31)	0.73
	[0.03]	[0.16]	[0.15]				
LH	0.06	0.80***	1.17***	-	(0.06)	(0.93)	0.55
	[0.05]	[0.07]	[0.50]				
LD	0.12	0.77**	1.24***	-	(0.05)	(0.01)	0.57
	[0.10]	[0.06]	[0.46]				
LE	0.08	0.66***	1.33***	-	(0.57)	(0.38)	0.62
	[0.06]	[0.08]	[0.52]				
LG	0.10	0.69***	0.65***	-	(0.54)	(0.04)	0.62
	[0.05]	[0.17]	[0.20]				
LC	0.14***	0.97***	1.07***	-	(0.24)	(0.01)	0.66
	[0.07]	[0.08]	[0.45]				
AVLR	0.22	0.66***	1.11***	-	(0.98)	(0.04)	0.76
	[0.14]	[0.07	[0.09]				

[] Std. errors, () P-values, *, **, *** denote significance at 10%, 5% and 1% respectively. Otherwise not significant; AVRL = average lending rate.

Appendix v: Parameter estimates under the monetary policy approach-savings eqs

	θ_0	β_0	θ_1	δ		LM	BGP	R^2
SF	-0.01	0.56***	0.40***	-		(0.49)	(0.53)	0.57
	[0.07]	[0.13]	[0.13]	-				
SH	-0.29***	0.65***	0.49***	-0.10***		(0.22)	(0.14)	0.76
	[0.06]	[0.07]	[0.10]	[0.02]				
SI	-0.42***	0.55***	0.43***	-0.20***		(0.92)	(0.15)	0.78
	[0.10]	[0.04]	[0.04]	[0.05]				
SD	-1.87***	0.66***	0.66***	-0.27***		(0.41)	(0.05)	0.57
	[0.40]	[0.09]	[0.04]	[0.06]				
SC	-0.33***	0.43***	0.29***	-0.27***		(0.52)	(0.00)	0.56
	[0.08]	[0.08]	[0.05]	[0.05]				
SG	-0.23***	0.58***	0.19**	-0.06***		(0.88)	(0.39)	0.62
	[0.02]	[0.08]	[0.31]	[0.02]				
SE	-0.51***	0.25***	0.19***	-0.16***		(0.75)	(0.29)	0.60
	[0.13]	[0.06]	[0.05]	[0.04]				
SB	-0.47***	0.63***	0.58***	-0.10***		(0.47)	(0.11)	0.60
	[0.16]	[0.07]	[0.13]	[0.03]				
SA	-1.07	0.81***	0.39***	-0.06***		(0.28)	(0.03)	0.72
	[3.13]	[0.07]	[0.16]	[0.01]				
AVSR	-2.5***	0.63***	0.49***	-0.19***		(0.25)	(0.05)	0.82
	[0.87]	[0.04]	[0.05]	[0.04]				

[] Std. errors, () P-values, *, **, *** denote significance at 10%, 5% and 1% respectively; otherwise not significant; θ1 is calculated using the Delta method; AVSR = average savings rate.

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Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org