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Banking structure and the bank lending channel of monetary policy transmission: Evidence from panel data methods

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Abstract: This study examines comprehensively the bank-lending channel of monetary policy for Zambia using a bank-level panel data covering the period Q1 2005 to Q4 2016. Specifically, the study investigates the effects of monetary policy changes on loan supply by commercial as well as the effect of bank-specific factors on response of loan supply to monetary policy shocks. In addition, the study investigates whether the level of bank competition does affect the bank-lending channel. Using a dynamic panel data approaches developed by Arellano-Bond (1991), the results indicate that a bank-lending channel exists in Zambia. In particular, the results show that loan supply is negatively correlated with policy rate implying that following monetary policy tightening loan supply shrinks. Further, the results indicate that size, liquidity and bank-competiveness have effects on credit supply while capitalization has no effect. Specifically, the results show that bank size has negative effect on credit supply while liquidity and market power were found to enhance credit supply. Most importantly, the results showed that bank-specific factors and bank-competiveness is responsible for the asymmetrical response of banks to monetary policy. Specifically, the results showed that larger banks, banks with more market power, well-capitalized banks and liquid banks respond less to monetary policy tightening.

Keywords: monetary policy transmission; bank lending channel; panel data; generalized method of moments; Zambia
JEL classification numbers: G18, G21

1. Introduction

In the aftermath of the global financial crisis, monetary policy has expanded to include financial system stability to its traditional objectives of price stability and supporting full employment. To achieve these objectives therefore, it is important for policy makers to have clear understanding of the mechanisms through which their actions affect real variables as well as the factors that influence these channels. This is more so important for developing countries, such as Zambia, where monetary policy is still considered ineffective (Tahir, 2012; Mishra et al., 2010).

Literature reveals that the propagating mechanisms of monetary policy are affected by a number factors (Chileshe and Akanbi, 2016; Mishra et al., 2010). Among factors that influence the proper functioning of the propagating mechanisms, include the structure of the economy, legal and financial structure in a specific country. In this regard, a good understanding of the channels of monetary policy as well as factors that influence them is key to designing tailored monetary policy strategies. In addition, such information is important for designing necessary reforms needed to improve the effectiveness of monetary policy. Further, the 2007–2010 global financial crisis revealed the importance of the financial sector, especially banks, in monetary policy transmission. In view of this, there is renewed interest among researchers and policy makers in understanding the role banks play in the transmission of monetary policy.

A number of empirical studies have investigated Zambia's monetary policy transmission (Chileshe et al., 2014; Zgambo and Chileshe, 2015; Mutoti, 2006; Simatele, 2004; Simpasa et al., 2015; Chileshe and Akanbi, 2016). All these studies, with an exception of Simpasa et al. (2017) as well as Chileshe and Akanbi (2017) uses aggregated time series data to investigate monetary policy transmission. Evidence from these studies suggest that the exchange rate channel is the strongest while there is only weak evidence for the bank lending channel (BLC) and no evidence for the interest rate channel. Simpasa (2015) specifically investigates the BLC using bank level data and the effects of bank specific characteristics on monetary policy transmission. This study finds that the BLC is stronger among larger banks than smaller and medium banks. On the other hand, Chileshe and Akanbi (2016) investigate the effect of market structure on the interest rate channel. They find evidence in support of the hypothesis that monetary policy transmission is adversely affected by lack of competition in the financial sector. In this study, the bank-lending channel in Zambia is assessed. In particular, it answers the following questions:

i)   Is there a bank-lending channel in Zambia?

ii) Does market structure affect the effectiveness of the bank-lending channel in Zambia?

iii) Does bank-specific factors such as capitalization, liquidity and size affect the bank-lending channel?

Although Simpasa et al. (2015) recently provided evidence on the BLC using panel data; however, this study differs in some important aspects. Unlike the study by Simpasa et al. (2015), this paper also investigates the effects of market structure on the bank-lending channel. Specifically, it investigates the effect of bank competition on the bank-lending channel, an issue that has not been tackled using the Zambian data. In addition, this study extends the dataset used by Simpasa et al. (2015) by four years or 16 quarters.

To tackle its objective and effectively answer the research questions, this study is divided into five sections. Section 2.0 provides theoretical and empirical literature on monetary policy transmission whereas section 3.0 overviews Zambia's financial sector and its implications for monetary policy

transmission. Section 4.0 discusses the empirical methodology, data sources and the variables used in the study while section 5.0 concludes and provides some policy implications.

2. Literature review

A lot of theoretical and empirical literature exists on the effects of monetary policy and its channels. In this section, theoretical and empirical literature on monetary policy transmission are reviewed. However, the focus of empirical literature review is on studies that focus on the bank-lending channel using panel data methods.

2.1. Theoretical literature

2.2.1. Interest rate channel

According to the interest channel, an increase in money supply leads to a decrease in the real interest rate due to the Keynesian assumption of sticky prices thereby inducing an increase in investment and consumer spending and consequently aggregate demand (Mishkin, 1996). This channel implicitly assumes that the central bank is able to influence long-term real interest rates through manipulation of short-term real interest rates. Mishkin (1996) notes that this suggests the rational expectation hypothesis of the term structure of interest rates holds true. Often in literature, the interest rate channel is referred to as the hallmark of the "Money View".

2.1.2. Credit channel

The credit channel is not seen as departure from the traditional interest rate channel but an enhancement of it (Buktiwiecz and Ozdogan, 2009). The credit channel explains the impact of monetary policy via the effects of informational asymmetry between the lender and the borrower (Mishkin, 1996). The credit view posits that due to informational asymmetries, two channels of monetary transmission arise: One that operate through the effects on bank lending and another that affect the balance sheet of economic agents. The bank lending channel is based on the assumption that financial intermediaries are best suited to solve problems of informational asymmetry in credit markets while the balance sheet channel is based on the effects of monetary policy on the net worth of firms and hence their collateral (Simatele, 2004). The bank-lending channel operates through the quantity of loans supplied by banks to households (Dabla-Norris and Floerkemeier, 2006). Expansionary monetary policy increases liquidity in the banking system-enabling banks to supply more loans for investment and consumer spending resulting in increased aggregate demand and consequently economic activity. The bank-lending channel is likely to be more effective in an economy where there are many bank dependent firms with no access to capital markets.

On the other hand, existence of informational asymmetries between borrowers and lenders make the role played by commercial banks as financial intermediaries to be important and thus comes in the balance sheet channel (Tahir, 2012). Existence of asymmetric information gives rise to moral hazard and adverse selection. There is consensus in literature that banks have a comparative advantage in assessing the balance sheets of borrowers thereby mitigating adverse selection and moral hazard (Tahir, 2012;

Bernanke and Gertler, 1995). Literature identifies several means through which monetary policy can affect balance sheet of agents. For example, expansionary monetary policy increases the net-worth of agents through increase in stock prices, reduction in debt servicing costs and increased sales. The increase in net-worth reduces the probability of moral hazard and adverse selection thereby enabling them to access loans. Easier access to loans increases borrowing leading to increased consumer spending and investment, and consequently economic activity. It is important to emphasize here that all the other channels operate mostly through the credit channel.

2.1.3. Exchange rate channel

The exchange rate channel is one of the primary transmission channels in open economies, especially those with flexible exchange rate regimes. Monetary policy can influence the exchange rate through interest rates (the popular uncovered interest rate parity condition), direct intervention in foreign exchange markets or through inflationary expectations (Dabla-Norris and Floerkemeier, 2006). In this channel, monetary policy affects economic activity (output) through net exports. For example, expansionary monetary policy, leads to a fall in domestic interest rates relative to the foreign interest rates inducing capital outflows leading to a depreciation of the local currency thereby making exports cheaper resulting in increased net exports and consequently aggregate demand and output (Mishkin, 1996; 2001).

The strength of the exchange rate channel is affected by several factors such as the exchange rate regime, sensitivity of the interest rates, the size and openness of the economy, degree of capital mobility and the degree of expenditure switching between domestic and imported goods (Boivin et al., 2010; Mishra et al., 2010; Tahir, 2012).

2.1.4. The asset price channel

Monetary policy affects asset prices such as bonds, equity and real estate, changing firms' stock market values and household wealth. Changes in stock market values and household wealth in turn affect aggregate demand. The asset price channel of monetary policy transmission is assumed to operate through two mechanisms, namely: The Tobin's (1969) Q-theory of investment and life cycle theory of consumption (Ando and Modigliani, 1963). The Tobin's Q theory works as follows, expansionary monetary policy increases the demand for equities (either by the Keynesian or by Monetarist argument), raising equity prices and thereby boost market value of firms relative to the replacement cost of capital. This will result in increased investment and therefore output. Furthermore, higher equity prices also raise the net-worth of firms and households and hence improve their credit worthiness and access to funds, the effects of which would partly reflect the balance sheet channel of monetary policy (Afandi, 2005). On the other hand, in the life cycle model monetary policy changes affect economic agents' long-term wealth and therefore, alter their consumption pattern. The basic premise of this theory is that consumers smooth out their consumption over time and this consumption depends on lifetime resources and not only current income (Mishkin, 1996). Expansionary monetary policy, which lowers interest rates, changes consumers' portfolio composition in accordance with the risk of each asset class. In this case, a decrease in the interest rates encourages people to reduce their holding of interest earning deposits and bonds and substitute them with equity/stocks, thereby increasing stock prices (Afandi, 2005). Given that

a major component of wealth is in common stocks, the increase in stock prices increases their wealth resulting in higher consumption expenditure and hence aggregate demand.

Tahir (2012) notes the following factors as the key determinants of the asset price channel: The participation of households in the capital market; the generation of funds by firms through issuance of shares; and the level of development of the stock market. Butkiewicz and Ozgdogan (2009) supports this assertion by arguing that capital markets in developing economies are shallower and uncompetitive in addition to high levels of macroeconomic instability.

2.1.5. The expectations channel

In modern macroeconomic theory, there is a consensus that expectations play a key role in shaping the behavior of economic agents. Although there is a consensus on the importance of expectations, economists differ on how these are generated. Friedman and other monetarists, postulate adaptive expectations while the new classical school lead by Lucas and the New Keynesian School argue for rational expectations.

Davoodi et al. (2013) notes that since economic agents are forward looking and rational, the expectation channel is in effect fundamental to the working of all channels of monetary policy transmission. Theoretically, this channel is mainly operational in developed economies with well-functioning and deep financial markets (Davoodi et al., 2013). For example, if economic agents expect future changes in the policy rate, this can immediately affect medium and long-term interest rates. Further, monetary policy can influence expectations of future inflation and thus price developments. Inflation expectations matter in two important areas. First, they influence the level of the real interest rate and thus determine the impact of any specific nominal interest rate. Second, they influence price and money wage-setting behavior and feed through into actual inflation in subsequent periods. Similarly, changes in the monetary policy stance can influence expectations about the future course of real economic activities by affecting inflationary expectations and the ex-ante real interest rate and guiding the future course of economic activities.

2.2. Empirical literature

The overall objective of this study is to assess the bank-lending channel (BLC) in Zambia, especially the effect of bank specific characteristics on monetary policy transmission. Therefore, in this subsection we provide empirical evidence on the BLC from across the global.

2.2.1. Studies from the USA

The difficulty associated with empirically identifying the BLC from aggregate data prompted researchers to turn to disaggregated data. Kashyap and Stein (1995) pioneered work on the BLC using a panel data from the USA for the period 1973 to 1991. Kashyap and Stein (1995) examines the effect of monetary policy tightening on the volume of loans provided by banks. In particular, they tested the hypothesis that smaller banks respond more to monetary policy than larger banks. Their results indicate that following monetary policy tightening the volume of loans decline for smaller banks but not for

larger ones. However, their study suffers from a limitation, as it does not take into account the effect liquidity holdings as a buffer to monetary policy shocks.

In response to the limitation, Kashyap and Stein (2000) controls for differences in liquidity across banks. They analyse the differences in bank response to monetary policy controlling for capital and liquidity using panel data for the period 1976 to 1993. Their results suggests that monetary policy has a strong impact on bank lending by banks with less liquid balance sheets-i.e. banks with less securities to asset ratio. This response was also found to be stronger among smaller banks. Although their results support the existence of a "bank lending channel", they are unable to provide statements about its quantitative importance.

Kishan and Opiela (2000) explores the credit channel of monetary policy transmission focussing more on the BLC using data from 1980 to 1995. Specifically, they test for the shifts in loan supply by segregating according to asset size and capital leverage ratio. In the study, monetary policy is represented by a federal funds rate and the Bernanke-Mihov (1995) indicator. In general, their empirical results suggest that monetary policy has larger effects on small under-capitalised banks. In a later study, Kishan and Opiela (2006) extends the data to 1999 while allowing for both expansionary and contractionary monetary policy. Using only the federal funds rate as a measure of monetary policy, they find that contractionary monetary adversely affect loan supply by undercapitalised banks but expansionary policy has no effect on loan supply.

In a recent study, Olivero et al. (2011) investigates the effects of bank consolidation on the bank lending channel using bank-specific panel data from Asian and Latin American countries for the period 1996 to 2006. In addition, they also investigate the role bank-specific factors play in the relationship between the BLC and consolidation. Their results indicate that bank consolidation weakens the bank-lending channel resulting in less effective monetary policy. Furthermore, they find that the adverse effects of bank consolidation on the BLC are most conspicuous on small banks. Hence, they argue that from a policy perspective it is important for the authorities to take keen interest of consolidation efforts in the banking sector to arrest the adverse effects on monetary policy effectiveness.

Another recent study was by Gambarcota and Marquez-Ibanez (2011) who uses bank specific panel data for the period Q1 1999 to Q4 2009 from Europe and USA. The objective of the study was to investigate the effects of bank specific characteristics on the BLC during the financial crisis. Using dynamic panel data methods for over 1000 banks, they find that banks business models had significant impact on the supply of credit or the bank-lending channel. Specifically, they find that short-term funding and securitisation activity have significantly changed the way banks react to monetary policy shocks. In addition, they find that banks with a higher level of non-interest income sources tend to be highly constrained during a financial crisis.

2.2.2. Studies from Europe

Comprehensive studies of the BLC on European countries started to appear towards the end of the 1990s. One of the earliest studies was undertaken by Bondt (1998) who investigates the credit channels in some European countries focussing on the role of bank specific factors. The study uses short-term interest rates and a monetary conditions index as measures of monetary policy stance. Using a panel data covering the period 1990–1995, empirical results provides evidence for the existence of the credit channel in Europe. Specifically, the bank-lending channel is found to be strong in German, Belgium and

Netherlands, while the balance sheet channel is strong in German and Italy. In the UK, the BLC is non-existent or dominated by loan and deposit demand factors of bank customers.

Brismiss et al. (2003) empirically analyse the role that bank lending has in monetary policy transmission using bank level data from Greece. They utilise two approaches: One in the spirit of Kashyap-Stein (1995) employing a reduced form equation linking monetary policy and loans while the second follows the Bernanke-Blinder approach. Their main results show that the Kashyap-Stein model does not yield conclusive results while the Bernanke-Blinder yields results that are more satisfactory. In general, they find the existence of a BLC. In addition, bank-specific characteristics were found to sshift the loan supply function. The results showed that large banks could to a certain extent shield their loan portfolio from monetary policy changes. Similar results hold for the liquid (healthy) banks.

Another country specific study by Ignacio and Martinez-Pages (2001) tests the existence of the BLC in Spain using a panel data for the period 1991 to 1998. Their empirical results suggest that there is no evidence for the existence of the bank-lending channel in Spain.

A study by Altunbas et al. (2002), examined the evidence of a BLC in Europe using panel data for the 1991 to 1999. The authors classify banks according to size and capitalisation to gauge whether these factors have an impact on bank lending. Using changes in short term interest rates as a measure of monetary policy and an approach suggested by Kishan and Opiela (2000) they find that undercapitalised banks (of any size) respond more to monetary policy change. Further, their results suggest that there is little evidence that smaller undercapitalised is the conduit of bank lending. However, they find that the BLC is much stronger in smaller countries than larger ones. Hence, they conclude by implication that undercapitalised banks operating in smaller countries tend to respond more to monetary policy changes.

Gambarcota and Mistrulli (2004) investigates the cross-sectional differences in the response of banks to monetary policy and GDP shocks owing to their differences in capitalisation using panel data of Italian banks. Their empirical strategy follows in the Kashyap-Stein (1995) spirit and estimated using the GMM estimator suggested by Arellano and Bond (1991). Their empirical results indicate that well-capitalised banks can better shield their lending from monetary policy shocks because they have easier access to uninsured fund raising. In addition, they find that "The Bank Capital Channel" has a stronger effect on smaller banks whose balance sheets contain a larger maturity mismatch between assets and liabilities. In addition, they also find that capital influences the way banks react to adverse GDP shocks.

A paper by Benkovskis (2008), explores the role of commercial banks in the transmission of monetary policy in Latvia using panel data methods developed by Kashyap and Stein (1995). Specifically, they estimate a bank loan function that takes into account not only monetary policy and macroeconomic variables but also bank-specific factors. Their empirical results suggest that there is heterogeneity in the response of banks to monetary policy. In particular, they find that some banks have a statistically significant negative reaction to monetary policy while others do not. Further, they find that monetary policy has an effect on small domestically owned banks with lower liquidity and lower capitalisation.

2.2.3. Studies from Africa

Studies on the BLC using bank level data have grown in recent years as more balance sheet data for commercial banks become available in Africa. Boughrara and Ghazouani (2010) investigate whether there are differential effects of monetary policy across bank size, capitalisation and liquidity in MENA countries of Jordan, Egypt, Morocco and Tunisia. Specifically they test for the presence of BLC in

MENA countries. Using panel data methods, they find that results are heterogeneous among the MENA countries. Further, they find that less capitalised banks respond more to monetary policy than more capitalised banks in all countries. Size and liquidity are significant in shaping the response of banks to monetary policy shocks.

Using a similar approach, Sichei and Njenga (2012) investigate the BLC in Kenya using bank level annual panel data covering 2001 to 2008. The main finding of this study was that the BLC exists in Kenya based on bank capitalisation and liquidity. Specifically, they find that banks with less liquid balance sheets and low total capital to risk-weighted asset ratios are hit most by monetary policy.

Mishi and Tsegaye (2012) empirically investigate the role played by private commercial banks in South Africa in transmitting the impulses of monetary policy shocks to the rest of the economy, focussing on the BLC. In their econometric approach, they use the dynamic panel data methods using the repo-rate as the monetary policy indicator. Their results indicate the presence of the BLC in South Africa with size of the playing a pivotal role. Specifically, they find that the size of the bank shifts the loan supply curve to the right but size does not affect the response of commercial banks to monetary policy changes.

Opolot (2013) examines the relevance of the bank-lending channel in monetary policy transmission of Uganda using a bank-level data for the period Q1 2001 to Q4 2012. Using the dynamic panel data methods in the spirit of Arellano and Bond (1991), the results indicate the existence of a bank-lending channel of monetary policy transmission in Uganda. Further, they find that bank specific characteristics such as capitalisation and liquidity are significant in influencing the supply of loans by commercial banks.

Olorunsora et al. (2014) assesses the existence of the BLC in Nigeria by examining whether changes in the bank policy rate feeds to the balance sheets of commercial banks. Using quarterly data for the period 2002 to 2012, the study uses OLS and VAR approaches to investigate the linkages between policy, commercial banks and real sector variables. Their results reveal the existence of balance sheet channel in Nigeria with a significance of the relationship between balance sheets variables and output as well as prices. However, they find that during the 2007–2010 financial crisis commercial banks did not react to monetary policy variations.

2.2.4. Studies from Zambia

The review of empirical literature on Zambia reveals very few studies on monetary policy transmission that uses panel data approaches (Chileshe and Akanbi, 2016; Simpasa et al., 2015). The paper by Chileshe and Akanbi (2016) investigates the effects of bank market power as well as bank-specific factors such as bank size and capitalisation on the interest channel using a quarterly panel data of Zambian banks between Q1 1998 to Q2 2015. Results from the dynamic panel data estimation suggest that competition enhances the interest rate channel. In addition, there is significant positive relationship between the HHI or Lerner Index and the interest rates in both the short- and long-run. However, capitalisation and liquidity have significant positive and negative effect on lending rates in the short-run only, respectively.

Simpasa et al. (2015) undertook study similar to this effort by investigating the BLC using bank level data. Specifically, they explore the effect of monetary policy on lending behaviour of commercial banks as well as the effect of bank specific factors in determining the response of banks to monetary policy changes. Using approaches similar to the Kashyap-Stein (1995); they find evidence that the BLC occurs through larger banks while it is moderate in medium sized banks and non-existent in smaller

banks. Furthermore, they find that price signals rather than quantities are more important in the transmission of monetary thereby supporting the transition of the Bank of Zambia to interest targeting. They also conclude that monetary policy changes will have the desired results if it affects the largest banks in the sample. Although this effort is similar to ours in every respect, it differs in two significant ways. First, this study includes a measure of bank competition to capture its effects on the BLC. Second, Simpasa et al. (2015) exclusively uses exchange rate volatility as an indicator of economic performance. However, an exchange rate is a very information sensitive variable and its volatility may be due to speculative behaviour among players in the foreign exchange market. Hence, in addition to exchange rate volatility the GDP growth is added as a measure of the state of the economy. Finally, this effort extends the data by four years or sixteen quarters making the analysis more rigorous.

3. The financial sector and monetary policy transmission in Zambia

3.1. Stylized facts about Zambia's financial sector

The financial system in Zambia comprises commercial and non-bank sector regulated by Bank of Zambia (BOZ), pensions and insurance regulated by the Pension and Insurance Authority (PIA), a stock exchange regulated by the Securities and Exchange Commission (SEC). In terms of size, the banking sector dominates the financial sector in Zambia holding over 70% of total assets over the years (see Table 1).

Table 1. Distribution of assets in Zambia's financial sector.

|	End-2011	End-2012	End-2013	End-2014	End-2015	End-2016
Banks	72.0	71.6	70.0	70.2	71.9	67.9
Pension Funds	20.1	20.1	20.6	22.4	21.6	24.8
Insurance	3.3	3.3	4.2	2.9	2.2	2.4
NBFIs	4.7	5.1	5.2	4.6	4.3	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: Source: Computations by Author.

Given its significant size in the financial system, the banking system remains the largest source of credit in Zambia averaging over 80% since 2011 followed by non-banks at 12.9%. In essence, the share of credit by institutions under the regulatory control of Bank of Zambia is 98.7% as at 2015. Although this could imply that the bank-lending channel might be stronger it could be hampered by the small size of the population with access to bank credit at only 8.2%, which imply very few individuals are directly affected by monetary policy changes. Further, although Zambia's capital market has shown growth over the years it remains underdeveloped with only 22 companies listed while market capitalization has been below 25% of GDP (see Table 3 and Figure 1). Table 3 shows that stock market capitalization, as a percentage of GDP at 20.9% is far lower than the sub-Saharan Africa average (46%) as well as the Low Income Countries (LICs) average of 43% as at 2012. This clearly shows that the stock market though growing is still in its infancy.

Table 2: Distribution of domestic credit in Zambia since 2011.

	End-2011		End-2012		End-2013		End-2014		End-2015		End-2016	
	K' mn	*% of total*	*K'mn*	*% of total*	*K' mn*	*% of total*	*K' mn*	*% of total*	*K' mn*	*% of total*	*K'mn*	*% of Total*
Banks	7,203.1	86.5	11,780.1	87.8	14,064.2	83.5	14,713.0	82.3	16,558.3	80.2	15,300.3	76.8
Pensions	4.9	0.1	10.6	0.1	101.1	0.6	10.9	0.1	9.5	0.0	777.9	3.9
Insurance	128.6	1.5	131.4	1.0	502.1	3.0	220.0	1.2	220.0	1.1	221.6	1.1
NBFIs	986.4	11.9	1,497.7	11.2	2,166.2	12.9	2,923.3	16.4	3,859.5	18.7	3609.8	18.1
Total assets	8,323.0	100.0	13,419.8	100.0	16,833.5	100.0	17,867.2	100.0	20,647.3	100.0	19909.5	100.0

Note: Source: Bank of Zambia financial corporations survey, 2011–2015.
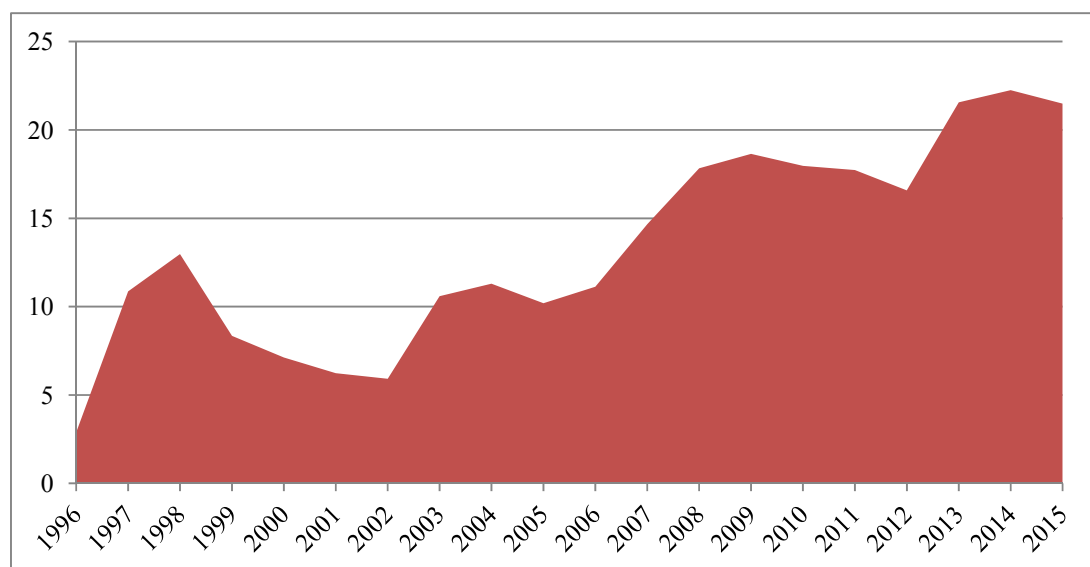
Figure 1. Stock market capitalisation is a percent of GDP since 1996.

Source: Federal reserve bank of St. Louis, FRED database and Lusaka stock exchange.

Compared to other developing economies, Table 3 shows that Zambia's financial sector is similar to those of its peers. Specifically, it shows that total deposits and credit in the financial sector is about 28.7% and 25% of the GDP, respectively. Further, although Zambia's access to formal financial institutions by its adult population is better than its peers it remains low at 37.2% while the use of formal and informal credit by the adult population is only 8.2% and 15.8%, respectively. It is clear from Table 4 that Zambia's financial sector performance is on average similar to other LICs and SSA regional average.

**Table 3:** Financial development in Zambia in comparison to other countries.

	Zambia	**SSA**	**LICs**
Breadth and Depth of Financial Sector			
Deposits as % of GDP	28.7	30	26
Domestic Credit from Banks % of GDP	25	25	26
Broad Money % of GDP	23.6	30	34
Other Financial Institutions Assets % GDP	24.4	29	7
Stock Market Capitalisation % of GDP	**20.9**	**46**	**43**
Access to Financial Services			
Account at Formal Institution (% of adult population)	37.3	24	24
Use of Formal Credit (% of adult population)	8.2	5	11
Use of Informal Credit (% of adult population)	15.8	45	37
Total Savings (% of adult population)	46	40	30

Note: Source: Compilation by author using Finscope surveys and adaptation from Massarongo (2012).

Furthermore, Zambia's securities market is in its formative stage despite having been in existence since 1995. Available data indicates that there are 10 public bonds and treasury bills outstanding with a market value of approximate of ZMW 19.5 billion or US $ 1.9 billion as at the end of 2015, which is 14.7% of GDP (see Figure 2). Furthermore, the stock market capitalisation is about 20.9% of GDP as at 2011, which is below the average for SSA, and LICs mean (Table 3).

The clear dominance of the bank sector in the financial sector suggests that the credit channel is the likely route for monetary policy transmission but may be hampered by poor access to financial services by majority of Zambians. On the other hand, the negligible role played by the securities and equities markets could imply that the asset price channel could be a weaker transmission channel of monetary policy.

In addition to the general limitations of the financial services, a very limited part of the population have access to financial services. According to Finscope surveys of 2005 and 2009, there were only 33.7% and 37.3% of the population accessing financial services, respectively. However, access to financial services has increased to over 60% in 2015. Furthermore, there were only 14.6% and 13.9% with bank accounts in 2005 and 2009, respectively (see Table 4) which later increased to over 24.8% in 2015 (Finscope, 2016). In addition, the proportion of the population who are served by a formal financial institution was 22.4% in 2005 marginally rising to 23.2% in 2009 while those receiving financial services from the informal sector were 11.3% in 2005 and 14.1% in 2009. In 2015, the proportion of adults receiving formal and informal financial services increased to 38.2% and 37.9%, respectively. This clearly shows that even if monetary policy affected credit supply and interest rates, its effect on consumer and investment spending and consequently on aggregate demand may be limited.
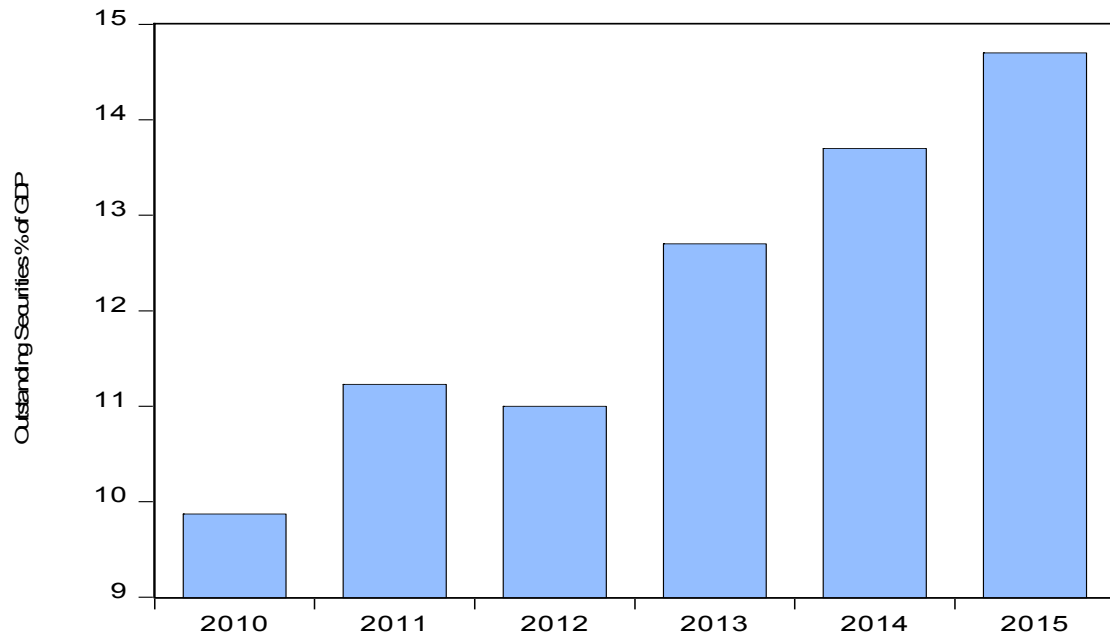
Figure 2. Share of outstanding bonds and treasury bills in GDP since 2010.

Source: Bank of Zambia database, 2010–2015.

Table 4. Access to financial services in Zambia.

	2005	2009	2015
Overall Adults Financial Access (%)	33.7	37.3	59.3
Adults Financially Excluded (%)	66.3	62.7	40.7
Adults Formally Served (%)	22.4	23.2	38.2
Adults Informally Served (%)	11.3	14.1	39.7
Adults Banked (%)	14.6	13.9	24.8

Note: Source: Compilation by author using the Finscope surveys 2005, 2009 and 2015.

3.2. Implications of the financial structure on monetary policy transmission

In recent years, especially after the 2007–2010 global financial crisis, empirical evidence has shown that the structure of the banking system as well as the regulatory framework is cardinal in the transmission of monetary policy shocks (Gambarcota and Marquez-Ibanez, 2011). These studies have shown that structural issues relevant for monetary policy transmission include the bank capital; the business model of the bank; securitization; the level of competition; the size of non-interest income sources; and the level of wholesale suppliers of funds (Gambarcota and Marquez-Ibanez, 2011). The recognition of the role that bank structure play in the monetary policy transmission has given rise to new regulatory regimes under the Basel II and the recent Basel III.

The current structure of Zambia's financial system, especially the banking system is the culmination of financial sector reforms, which have been undertaken since 1992. The early years of

financial sector reforms saw a progressive entry of new banks in the sector reaching 19 in 1995 from only 12 banks in 1989 (Brownridge, 1996). However, this positive result was reversed during the mid-1990s banking crisis, which saw the collapse of more than eight banks (Simpasa et al., 2015). The banking sector crisis of the mid-1990s created a scope for more prudential reforms that resulted in a more robust regulatory framework (GRZ, 2004; Simpasa et al., 2015).

The economic and structural reforms that have been implemented over the years have been cardinal in attracting foreign banks into the sector. As at the end of 2012, there were a total of 13 foreign-owned banks, four privately owned banks, and 2 banks with a government stake. In an effort to improve efficiency, the Government of the Republic of Zambia partially privatised the Zambia National Commercial Bank, the largest domestic bank, through offering a stake to a foreign bank (Rabobank) and offloading part of its shareholding on the Lusaka Stock Exchange to the private sector. Although government and other Zambian shareholders have a majority stake in the bank, management rights are with foreign shareholders (45%). In totality, there are 19 commercial banks operating in Zambia with a combined asset size equivalent to 30% of GDP (Simpasa et al., 2015).

Although there has been an increase in the number of commercial banks in Zambia's banking sector, it remains highly concentrated. The 4-firm concentration, a basic measure of market structure indicates that Zambia's banking sector is not competitive as it shows that four largest banks control nearly two-thirds of all market segments (see Table 5). In addition, nearly all the four banks have a foreign ownership stake in them. This state of affairs poses a danger to the effectiveness of monetary policy transmission in three important ways. Firstly, foreign ownership not only exposes the financial sector to external shocks facing parent companies but also these banks can use liquidity from parent banks to circumvent tight monetary policy in the host economy and hence render monetary policy ineffective. Secondly, high levels of concentration in the banking sector could undermine the effectiveness of monetary policy through sluggishness in the adjustments of interest rates in response to changes in monetary policy (Couttareli and Kourelis, 1994; Massarongo, 2012; Chileshe and Akanbi, 2016). Finally, most foreign banks may have policies regarding credit extension, which is dependent on the policies in foreign countries (Simpasa et al., 2015).

Table 5. 4-Firm concentration ratio since 1998.

	1998	2000	2002	2004	2006	2008	2010	2012	2013	2014	2015
Loans	80.9	78.3	76.2	75.5	73.6	75.7	62.9	66.4	65.6	62.6	62.3
Deposits	75.5	78.0	74.9	73.8	66.9	67.3	65.7	61.7	60.2	57.9	60.1
Assets	77.8	74.7	64	70.8	63.5	67.3	62.9	61.5	57.9	55.5	57.0
Bonds and Securities	58.9	58.6	69.8	71.5	60.7	62.2	64.9	66.7	62.1	54.8	59.8

Note: Source: Computations by author using BOZ database, 1998–2012.

Since 1998, a reflection in the level of competition has been most evident in the loans segment followed by the deposits while the assets segment and Bond/Securities segment has remained static over the last ten years. Similarly, banking activities have increased over time, as depicted by the composition of the banks' consolidated balance sheet (see Table 5). Furthermore, there has been an increase in banking activities in the country as indicated by the consolidated balance sheet which has shown that the

level of assets and liabilities have increased from only 1.5 billion kwacha in 1998 to over 49.6 billion in 2014 (see Table 6).

Table 6. Consolidated balance sheet of the commercial banks in Zambia.

	1998		2002		2006		2010		2012		2014	
	K' mn	Share	K' mn	Share	K' mn	Share	K' mn	Share	K' mn	Share	K' mn	Share
Liquid Assets	308.5	20.8	1752.3	37.5	4,491.3	42.1	10,446.7	43.1	12,759.9	36.1	21,762.1	43.9
Total Loans	499.8	33.7	947.7	20.3	3,866.6	36.2	9219.4	38.0	16,667.4	47.1	21,665.0	43.7
Foreign Assets	445.0	30.0	1226.4	26.6	1,718.4	16.1	2,426.0	10.0	4,440.2	12.5	6952.0	14.0
Other Assets	230.0	15.5	723.0	15.5	598.9	5.6	2,150.2	8.9	1,512.7	4.3	2,275.4	4.6
LIABILITIES												
Desposits	1,006.0	67.8	3257.5	69.7	7,866.5	73.9	17,296.6	71.3	25,214.3	71.3	34,942.5	70.4
Other Borrowed Funds	15.0	1.0	59.8	1.3	150.5	1.4	540.2	2.2	931.7	2.6	1,176.0	2.4
Foreign Funds	40.0	2.7	96.5	2.1	673.0	6.3	2,339.9	9.7	310.8	0.9	1,997.7	4.0
Shareholder Capital	161.0	10.9	573.7	12.3	1,029.3	9.6	2,208.4	9.1	3,960.5	11.2	7,273.9	14.7
Others	261.0	17.6	688.8	14.7	935.9	8.8	1,857.4	7.7	4,962.9	14.0	3,606.2	7.3
Assets=Liabilities	1,483.0	100.0	4,676.3	100.0	10,675.2	100.0	24,242.4	100.0	35,380.2	100.0	49,602.6	100.0

Note: Source: Computations by author using BOZ database, 1998–2012.

Over the review period, the commercial banks have increased the share of liquid assets (notes and coins, deposits at the Central Bank and holding of securities), although they showed a decline in 2012 and replaced by loans. Specifically, as at end-1998 liquid assets accounted for slightly less than 21% of the banking system's total assets against approximately 34% in loans. By the end of 2010, the share of liquid assets in total assets had reached 43.1% while total loans and advances accounted for 38%. However, by the end of 2012 the share of liquid assets dropped to 36% while loans and advances grew to 47.1%. At end 2015, total loans and advances fell to 43.7%. The rebound in the share of loans follows banks' increased exposure to the private sector following marked improvements in macroeconomic performance, underpinned by low inflation and strong economic growth, especially after the 2007–2010 global economic crisis (Simpasa et al., 2015). Although there has been a sustained increase in the level of credit extended to the private sector, it remains low even by regional standards. The increase in credit extended to the private sector could be due to a fall in yield rates on government securities. This low ratio of private credit extended to the private could essentially affect the effectiveness of monetary policy, especially the credit and interest rate channels.

In terms of foreign assets, Table 6 shows that before 2006 commercial banks acquired large amounts of foreign assets to hedge against high inflation and a rapidly depreciating domestic currency. However, as conditions have improved, the proportion of claims on foreign financial institutions in total assets by Zambian banks has significantly decreased, reaching 16% in 2006 and then 10% in 2010 and then edging slightly upwards to 12.5% in 2012.

On the liabilities side, deposits account for more than two-thirds of the banks' sources of funds. Although the bulk of deposits are attributed to the private sector, some large banks also hold substantial amounts of government deposits, which provide a buffer against swings in private sector deposits. On the other hand, shareholders' capital has remained relatively stable over the years, roughly around 9–10%

of total liabilities. This level of capitalisation reflects the robustness of the regulatory framework instituted in the aftermath of systemic bank failures in the mid-1990s.

In the continued effort to strengthen the banking sector and improve its resilience to external shocks, the Bank of Zambia (BoZ) increased regulatory capital further in April 2012 and introduced a tiered structure (GRZ, 2012). The minimum capital requirement for local banks was set at K104 billion (US $ 20 million) while that for foreign banks was set at K520 billion (US $ 100 million). Before the revision, minimum capital for all banks was K12 billion (approximately US $ 2 million). It is expected that the new capital requirement will be expected to attract additional resources into the industry and encourage lending to the private sector.

4. Methodology

In this section, the empirical approaches used to analyse data are presented. In particular, the the econometric model as well as specification tests that were utilized are presented. In the last sub-section, the study discusses the dataset used as well as describes the variables in the model.

4.1. Econometric approaches

4.1.1. Econometric model

This study utilizes a modified empirical specification first employed by Kashyap and Stein (1995) and used in many more empirical works (Gambarcota and Marquez-Ibanez, 2012; Gambarcota and Mistrulli, 2004; Boughrara and Ghazouani, 2010; Opolot, 2013; Simpasa et al., 2015). In particular, the study modified the Gambarcota and Mistrulli (2004) model in one important way. In addition to bank size, capitalisation and liquidity, it also assesses the effect of banks' market power on the BLC. This is because market power give banks the ability to set the price of their service well above marginal cost without risking their market share. Specifically, the following empirical model is estimated:

$$\Delta L_{it} = \gamma_i + \sum_{j=1}^{m} \beta_j \Delta lnL_{it-j} + \sum_{j=0}^{m} \emptyset_j \Delta lnGDP_{t-j} + \sum_{j=0}^{m} \theta_j \Delta exrisk_{t-j} + \sum_{j=0}^{m} \mu_j \Delta MPR_{t-j} + \sum_{j=1}^{4} \omega_j x_{it-1}$$

$$+ \sum_{l=1}^{4} \sum_{j=0}^{m} \varphi_{jk} \Delta MPR_{t-j} x_{it-1} + \sum_{i=0}^{m} \delta_j \Delta NPL_{it-j} + \varepsilon_{it} \tag{1}$$

where $j = 0,1 \dots m$, $i = 1,2, \dots N$ and $t = 1,2, \dots, T$ with m representing the number of lags, N is the total number of banks while t is number of time series observations. L_{it} is the total loans issued by bank i in period t to the non-bank sector while x_{it} represents bank specific variables, namely capitalisation, market power, liquidity and size. $\gamma, \emptyset, \alpha, \theta, \delta, \varphi, \omega, \mu, \partial$ are the parameters to be estimated, with γ_i capturing bank-specific fixed effects while ε_{it} is the white noise error term.

The regression above also includes (in addition to bank-specific variables) exchange rate volatility as in Simpasa et al. (2015) and GDP growth to account for demand effects. These two variables are introduced to allow the model to capture cyclical movements as well as to isolate the effects of monetary policy changes. Hence, they will enable us to gain further insights on the lending channel by reporting the effects of changes in the short-term interest rates changes on other balance items (Gambarcota, 2005).

Finally, the non-performing loan are included in the model to account for their cost implications on commercial banks when they need to make loan loss provisions.

In our model, the coefficient in front of monetary policy indicator (MPR) μ_j represents the effects of monetary policy changes on credit growth. The alternative hypothesis that $\mu_j \neq 0$ implies that commercial banks cannot shield their loan portfolio from monetary policy changes. Using a short-term interest rate as an indicator of monetary policy, a negative relationship is expected.

The parameter φ_{jk} captures the effects of bank-specific factors (liquidity, capitalisation, size and market power) on the impact monetary policy changes on loan demand or the effect of bank specific factors on the bank-lending channel (BLC). If a particular bank-specific factor reduces the impact of monetary policy changes on the ability of banks to extend loans then the coefficient is expected to be positive ($\varphi_{jk} > 0$). This imply that more liquid, larger and banks with more capital are less likely to respond to monetary policy changes. In other words, monetary policy has the greatest effect on smaller, illiquid and less capitalised banks. In addition, it implies that banks with more market power are expected to avoid the tightening of monetary policy.

4.1.2. Estimation strategy

The presence of lagged values of the dependent variable on the right hand side could imply that the error term is correlated with the independent variables thereby violating one key assumption of the Ordinary Least Squares approach (OLS). In other words, estimating a dynamic panel data model using fixed or random effects could produce biased and inconsistent results. In addition, estimating equation (1) above could lead to an endogeneity problem because monetary policy decisions maybe affected by the conditions in the financial sector. To overcome these problems, the Generalized Method of Moments (GMM), proposed by Arellano and Bond (1991) and later refined by Blundell and Bond (1998) is used.

In the GMM literature, it is proposed that the estimation be carried out in first differences in order to get rid of the individual effects as well as using instruments to help in obtaining unbiased and consistent estimates (Benkovkis, 2008). Utilising the orthogonality conditions between lagged values of the dependent variable and disturbances, lagged values of the dependent variable with second and more lags serve as instruments. Further, to deal with the endogeneity problem two approaches have been proposed. First, right-hand side variables enter the model with at-least one lag. Second, lagged levels of predetermined variables such as bank-specific variables are used as instruments. Finally, the strictly exogenous variables such as GDP in first differences are instrumented by higher lags of themselves.

4.1.3. Instrument selection tests

To check whether the instruments were chosen properly and the assumptions underlying the model hold, a few tests were proposed (Arellano and Bond, 1991). Consistency of our estimators relies on the fact that the disturbances follow MA (1) process and there is no second order autocorrelation of disturbances. Hence, we use AR (1) and AR (2) tests to check the null hypothesis of zero autocorrelation of order one and two, respectively. Further, to check the validity of the instruments employed the Sargan test is utilized.

4.2. Data sources, summary statistics and description of variables

4.2.1. Data and summary statistics

Data utilized in this study is obtained from three sources. Data on bank specific variables is obtained from the monthly prudential returns of all licensed deposit taking commercial banks operating in Zambia over the period Q1 2005 to Q4 2016. Prudential returns submitted by commercial banks consist of detailed income statements and bank balance sheets of all the 19 banks operating in Zambia as at 31st december 2016. Data on financial variables such as exchange rate and interest rates is from the Bank Zambia database while quarterly GDP is obtained from the Central Statistical Office. For estimates of the measures of market power proxied by the Lerner Index are obtained from estimates by Chileshe and Akanbi (2016). The descriptive characteristics of the variables are presented in table 7 below:

Table 7. Descriptive characteristics of the model variables.

Variable	Mean	Minimum	Maximum	Standard Deviation	Kurtosis	Skewness
Loan	735,995.50	0.000	5,175,014.00	1,025,271.00	6.568	2.044
Assets	1,731,511.00	24,190.20	11,436,667.00	2,113,501	6.231	1.880
Liquidity	0.364	0.037	0.851	0.133	2.824	0.252
Capital	0.153	−0.491	0.952	0.117	15.698	2.412
GDP	25,363.16	15,570.26	32,626.00	5316.68	1.800	−0.357
Exr. Volatility	0.203	0.028	1.203	0.234	9.705	2.044
Lerner	0.339	0.039	0.479	0.881	314.492	−14.833
Policy	0.109	0.034	0.218	0.047	2.800	0.715
NPLs	66,201.06	−930.00	678,947.00	108,639.40	10.656	2.559

Note: Source: Computations by the author.

4.2.2. Description of the variables

In empirical literature on the BLC, there are three bank specific variables, which are commonly considered, namely: Capitalisation, liquidity and bank size. This study goes beyond this literature by also incorporating the role of market power on the BLC. According to Ignacio and Martinez-Pages (2001), the bank-specific factors are used to proxy potential asymmetric information problems leading to a differential response across banks to a common monetary policy shock. Measures of size, liquidity, capitalisation and market power (Lerner Index) are calculated as follows:

$$SIZE_{it} = \ln(TA_{it}) - \frac{1}{N_t}\sum_{i=1}^{N} \ln(TA_{it}) \tag{2}$$

$$LIQR_{it} = \frac{LIQ_{it}}{TA_{it}} - \frac{1}{T}\sum_{t=1}^{T}\left(\sum_{i=1}^{N}\frac{LIQ_{it}}{TA_{it}}\right) \tag{3}$$

$$CAPR_{it} = \frac{CAP_{it}}{TA_{it}} - \frac{1}{T}\sum_{t=1}^{T}\left(\sum_{i=1}^{N}\frac{CAP_{it}}{TA_{it}}\right) \tag{4}$$

$$MKTP_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{5}$$

Like in much of the Literature, $SIZE$ is the deviation of total assets for bank i at time t expressed in natural logs from industry average in the same period. This normalization is done to ensure that the ever-increasing trend in total assets is removed over the sample period thereby making the series stationary (Ehrmann et al., 2001; Simpasa et al., 2015). The bank's liquidity is calculated as a sum of cash, securities holdings and funds at the central bank. The variable LIQR is calculated as the deviation of the ratio of total liquid assets to total asset from the industry average ratio over the sample period. Further, the CAPR is the deviation of the capital to asset ratio from the industry average over a period. Finally, MKTP is the market power of a bank, which represents the ability of a bank to charge a price above the marginal cost. As indicated in sub-section 4.2.1 above, the values of the Lerner Index are obtained from a study by Chileshe and Akanbi (2016) which is more comprehensive.

Macroeconomic performance indicators are included to control for loan demand effects. This is because a fall in credit growth following monetary policy tightening could be due to a fall demand for credit by borrowers (Ehrmann et al., 2001). To capture loan demand effects, the model includes GDP growth and quarterly exchange rate volatility.

It is generally agree in the literature that in developing and emerging economies, there is high-level asymmetry of information leading to moral hazard and adverse selection. In Zambia, for example it is common for banks to profile their clients according to their characteristics when granting loans (Simpasa et al., 2015). Hence, in addition to bank-specific characteristics indicated above we also include a risk variable to capture the effects of credit rationing behaviour among the banks. To capture credit-rationing behaviour, we introduce the non-performing loans (NPLs) as a proxy for credit risk.

In literature, a number of monetary policy indicators are proposed. In Zambia, monetary policy framework has evolved overtime causing a multiplicity of monetary policy indicators. Prior to 2012, the bank of Zambia implemented monetary aggregate framework (MAT), which entailed targeting monetary aggregates as the operating targets of monetary policy. However, despite having followed a MAT framework monetary policy operation was mostly informed by the cost of funds. Later starting in April 2012, the Bank of Zambia started transitioning to the inflation targeting regime with the interbank rate as the nominal anchor for monetary policy. In this study, we employ the 91-day TB rate as an indicator of monetary policy.

5. Empirical results and discussions

In this section, estimation results of the model presented in equation (1) above are presented. In total, there are five models estimated in the first four models only one bank-specific characteristic is included while the model in the last column all the variables are incorporated. Results presented in table

8 below, show that in all the estimations the Arellano and Bond tests indicate that the first order statistic (AR 1) is significant while the second order statistic (AR 2) is not significant, which is expected if the model error terms are serially uncorrelated in levels. Hence, the presence of serial correlation across banks is rejected implying that the GMM estimators are consistent. In addition, it is a requirement in the GMM procedure that there is no correlation between the over-identifying instruments and the residuals. The Sargan test also known as the J-test is performed to check if residuals are correlated with the over-identifying instruments. The large P-value from the Sargan test results given in table 8 below, indicate that there is no evidence to support that the over-identifying instruments used in the model are correlated with the error term.

The results in table 8 provide estimation results of the loan equation presented in equation (1). The results show that the effects of macroeconomic variables are significant and robust across all the models. With an exception of the full model, the results indicate that although monetary policy has the expected negative contemporaneous effect on bank lending it is not significant. However, the lagged monetary policy variable has a significant negative effect on credit growth. Specifically, a 100 basis points rise in the policy lead to a fall in credit growth of between 16–25 basis points after one quarter. The lagged relationship between the monetary policy variable and credit growth is expected in the sense that tight or loose monetary policy would first affect the short-term rates before affecting credit rates and consequently growth in credit. In addition, banks may not adjust their lending activities immediately as they may have already negotiated loan agreements, which they have to honour. Furthermore, in all models the loan demand effects represented by GDP and exchange rate volatility are significant. Specifically, the estimation results indicate that growth of GDP has a positive effect on credit growth indicating a positive elasticity of total loans growth as expected. On the other hand, increased exchange rate volatility has a negative effect on credit growth, which could mean that higher exchange rate volatility could signal an increase in credit risk, especially for foreign exchange denominated loans.

Looking at the bank-specific characteristics, results show that bank size, liquidity and market power have significant effects while capitalization has insignificant effect on loan growth. These results imply that size, liquidity and market power are responsible for the asymmetrical response of banks to monetary policy changes in Zambia. Specifically, the coefficient of the bank-size measure is negative and significant in the full model and the model that only incorporates a measure of bank size. This result is similar to those obtained by Simpasa et al. (2015), and Heryan and Tzemeres (2016). This finding is consistent with the argument that small banks that have just started their operations tend to growth their loan books faster than larger well-established banks in order to gain market share. As for liquidity, the results show a positive significant effect on loan growth in Zambia. The positive sign of the coefficient on liquidity is expected in the sense that banks with higher liquidity levels have the ability to extend more credit than banks with lower liquidity levels. In addition, this result could be because of existing regulatory rules in the banking system such as the Basel Committee Rules, which may stipulate that more liquid banks lend their financial resources mostly through bank loans. Finally, the coefficient for market power is positive and significant implying that banks that have more market power will supply more loans than those with less market power.

Furthermore, to assess the asymmetrical effects of monetary policy on loan supply, there is need to examine the coefficients of the interaction terms between the bank-specific characteristics and the monetary policy variable (Heryan and Tzemeres, 2016; Ignacio and Martinez-Pages, 2001). It is argued that significant interaction terms would imply that banks adjust their loan supply heterogeneously in

response to monetary policy changes. In case of bank size, the results indicate that the interaction terms between size and monetary policy variable is not significant in the model in which it enters alone but it is significant in the full model. The significant positive interaction term of bank-size and monetary policy variable implies that larger banks are likely to respond less to monetary policy shocks than smaller banks. This result is consistent with theoretical literature on the bank-lending channel, which assumes that lending volume by larger banks are less sensitive to monetary policy shocks than that of small banks. Furthermore, this result is consistent with Kashyap and Stein (1995) prediction that lending volume of smaller banks is more sensitive to monetary policy changes than that of larger banks as well as findings by Simpasa et al. (2015) on Zambia. However, the coefficient of the interaction is close to zero, which could be consistent with the hypothesis that bank-size has no differential effect on credit growth response to monetary policy similar to findings by Ehrmann et al. (2003) among European countries.

With regard to the interaction term between capitalization and monetary policy indicator, results in table 8 show that it is not significant in the model in which it enters alone while it is significant in the full model. The interaction term is negative implying that banks in good shape in terms of their capital respond more to monetary policy more than those, which are in bad shape. These results are similar to those obtained by Heryan et al. (2016) but at variant with those obtained by Gambacorta and Mistrulli (2004). This result could be explained in the sense that well capitalized banks are likely to avoid increasing their exposure to risk following monetary policy tightening which increase the likelihood of loan default compared to undercapitalized banks.

Furthermore, the interaction term between liquidity measure and monetary policy indicator is significant and positive in both the model with only liquidity and the model including all bank specific characteristics. Precisely, this result implied that the loan response of banks with lower liquid assets share is significantly stronger than that of more liquid banks. In other words, banks with higher liquid assets are better able to protect their lending activities from changes in monetary policy consistent with results by Ehrmann et al. (2003), Heryan et al. (2016) and Gambacorta (2005). The underlying reason is that banks with a more liquid balance sheet can use their liquid assets to maintain their loan portfolio and as such are affected less heavily by a monetary policy tightening (Erhmann et al., 2003).

To capture the effects of bank-specific market power on the bank-lending channel, the model includes an interaction term between the Lerner Index and a monetary policy indicator. The coefficient of the interaction term is positive in all cases but significant in the model that only includes the market power to explain asymmetrical response to monetary policy changes by commercial banks. The positive term imply that banks with more market power are better able to shield their lending activities from monetary policy changes than banks with less market power. This result is consistent with findings by other studies (Chileshe and Akanbi, 2016; Li and Lee, 2015). The reason for this could be that in the absence of vigorous competition among banks; banks with market power find it relatively easy to access alternative sources of liquidity to finance their lending activities such as certificate of deposits and interbank loans. In other words, banks having less market power find it more difficult to access alternative sources of funding. Hence, high-level competition means that changes in monetary policy influence the availability of funds so that changes in monetary policy will more directly influence the supply of bank loans.

Table 8. Arellano-Bond One-step GMM estimates.

Variables	$Coeff.$	$Model\ 1$	$Model\ 2$	$Model\ 3$	$Model\ 4$	$Full\ Model$
$\Delta\ln(loan)_{it-1}$	β_1	−0.508 (−12.54)***	−0.534 (−5.378)***	−0.535 (−5.16)***	−0.537 (−5.17)***	−0.493 (6.43)***
$\Delta\ln(mpr_t)$	μ_0	0.417 (0.58)	−0.347 (−1.36)	0.507 (0.903)	0.399 (0.966)	−0.016 (6.49)***
$\Delta\ln(mpr_{t-1})$	μ_1	−0.238 (−3.14)***	−0.182 (−3.49)***	−0.230 (−2.50)**	−0.193 (−1.77)*	−0.133 (−1.74)*
$\Delta\ln(gdp_t)$	$\emptyset_0$	0.162 (7.45)***	0.102 (4.27)***	0.143 (6.80)***	0.135 (6.41)***	0.140 (3.18)***
$\Delta\ln(gdp_{t-1})$	$\emptyset_1$	0.155 (5.10)***	0.135 (1.92)*	0.180 (2.56)**	0.157 (1.78)*	0.021 (1.43)
$\Delta\ln(exrvol_t)$	θ_0	−0.041 (−2.03)**	−0.069 (−1.49)	−0.073 (−1.78)*	−0.081 (−1.52)	−0.051 (−3.25)***
$\Delta\ln(exrvol_{t-1})$	θ_1	−0.078 (−3.43)***	−0.102 (−1.82)*	−0.124 (−2.43)**	−0.118 (1.77)*	−0.064 (3.27)***
$Size_{it}$	ω_1	−0.009 (−3.55)***				−0.009 (−5.82)***
$Capr_{it}$	ω_2		−0.007 (−1.09)			−0.003 (−1.14)
Liq_{it}	ω_3			0.018 (2.92)***		0.016 (5.96)***
MKP_{it}	ω_4				0.006 (2.055)**	0.001 (1.64)*
$Size_{it}*\Delta\ln(mpr_t)$	φ_{10}	−0.002 (−0.84)				0.0004 (0.73)
$Size_{it}*\Delta\ln(mpr_{t-1})$	φ_{11}	−0.003 (−0.58)				0.0001 (2.92)***
$Capr_{it}*\Delta\ln(mpr_t)$	φ_{20}		−0.011 (0.82)			0.001 (0.797)
$Capr_{it}*\Delta\ln(mpr_{t-1}$	φ_{21}		0.044 (0.62)			−0.008 (−1.69)*
$Liq_{it}*\Delta\ln(mpr_t)$	φ_{30}			−0.003 (−1.12)		0.001 (0.85)
$Liq_{it}*\Delta\ln(mpr_{t-1})$	φ_{31}			0.030 (1.76)*		0.002 (1.66)*
$MKP_{it}*\Delta\ln(mpr_t)$	φ_{40}				0.003 (1.41)	−0.082 (−1.37)

Variables	$Coeff.$	$Model\ 1$	$Model\ 2$	$Model\ 3$	$Model\ 4$	$Full\ Model$
$MKP_{it} * \Delta\ln(mpr_{t-1})$	φ_{41}				0.007 (1.16)	0.014 (1.76)*
$Size_{it} * \Delta\ln(gdp_t)$	α_{10}	0.005 (1.37)				0.002 (0.76)
$Size_{it} * \Delta\ln(gdp_{t-1})$	α_{11}	0.004 (1.95)**				−0.001 (−0.58)
$Capr_{it} * \Delta\ln(gdp_t)$	α_{20}		−0.078 (1.42)			−0.017 (−1.57)
$Capr_{it} * \Delta\ln(gdp_{t-1})$	α_{21}		−0.001 (0.98)			−0.040 (−1.14)
$Liq_{it} * \Delta\ln(gdp_t)$	α_{30}			0.016 (0.83)		0.046 (1.22)
$Liq_{it} * \Delta\ln(gdp_{t-1})$	α_{31}			0.054 (3.39)***		0.035 (1.20)
$MKP_{it} * \Delta\ln(gdp_t)$	α_{40}				0.025 (1.46)	0.138 (0.463)
$MKP_{it} * \Delta\ln(gdp_{t-1})$	α_{41}				0.025 (1.73)*	0.132 (1.08)
$Size_{it} * \Delta\ln(exrvol_t)$	θ_{10}	−0.001 (−0.91)				−0.0002 (−0.92)
$Size_{it} * \Delta\ln(exrvol_{t-1})$	θ_{11}	0.002 (1.08)				0.0001 (1.66)*
$Capr_{it} * \Delta\ln(exrvol_t)$	θ_{20}		0.006 (1.85)*			0.005 (1.69)*
$Capr_{it} * \Delta\ln(exrvol_{t-1})$	θ_{21}		−0.001 (−1.02)			0.007 (1.77)*
$Liq_{it} * \Delta\ln(exrvol_t)$	θ_{30}			0.002 (1.14)		0.003 (0.95)
$Liq_{it} * \Delta\ln(exrvol_{t-1})$	θ_{31}			0.001 (0.65)		0.001 (0.42)
$MKP_{it} * \Delta\ln(exrvol_t)$	θ_{40}				0.002 (0.96)	0.006 (0.71)
$MKP_{it} * \Delta\ln(exrvol_{t-1})$	θ_{41}				0.004 (1.11)	0.005 (0.95)
$LNPL_t$	δ_0		−0.002 (−2.09)**	−0.003 (−2.84)***	−0.001 (−3.57)***	−0.0005 (−3.29)***
$LNPL_{t-1}$	δ_1		−0.0002 (−1.72)*	−0.002 (−1.08)	−0.018 (−1.97)**	−0.0002 (−0.91)

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Variables	Model 1	Model 2	Model 3	Model 4	Full Model
			Diagnostics		
Number of Obs.	661	661	661	661	626
Estimation Procedure	One-step AB	One-step AB	One-step AB	One-step AB	One-step AB
	−7.775***	−2.792***	−2.076**	−2.459**	−2.028**
AB Autocorrelation AR(1)	P-value = 0.000	P-value = 0.005	P-value = 0.038	P-value = 0.014	P-value = 0.041
	−1.616	−0.9618	−1.5789	−1.0171	−1.1739
AB Autocorrelation AR(2)	P-Value = 0.124	P-value = 0.336	P-Value = 0.114	P-value = 0.314	P-value = 0.239
Sargan Test(P − value)	0.35	0.48	0.52	0.66	0.62

Note: Source: Computations by author. *, **, *** Imply significant at 10%, 5% and 1% respectively. T-values are reported in parentheses.

6. Conclusions and policy implications

In this study, an attempt was made to provide evidence for the existence of the bank-lending channel in Zambia using a panel data covering the period Q1 2005 to Q4 2016. Specifically, the study attempted to examine the response of bank loans to monetary policy changes. In addition, the study attempts to evaluate the effects of bank specific factors of capitalization, size, liquidity and market power on the bank-lending channel. In other words, it attempts to provide evidence for the source of asymmetrical response of banks to monetary policy changes.

The results obtained in this study show that there is a bank-lending channel in Zambia. The results generally show that loan growth is negatively related to monetary policy implying that following monetary policy tightening loan supply generally falls. However, the size of the coefficients are smaller compared to those from more developed countries.

To analyze the asymmetrical responses of banks to monetary policy changes, the study followed a procedure prescribed by Kashyap and Stein (1995). The results generally show that size, liquidity and market power have effects on the supply of credit by commercial banks while bank capitalization is found to have no effect. Most importantly, the results in this study showed evidence to support the argument that bank specific factors of size, capitalization, liquidity and market power explains the asymmetrical response of banks to monetary policy changes. Specifically, the results show that bank size has a negative effect on credit or loan supply, which is consistent with argument that smaller banks tend to lend more in order to, gain more market share. Liquidity and market power, on the other hand are found to enhance the supply of credit or loan supply by commercial banks. Concerning asymmetry, results show that larger banks, banks with more market power, well capitalized and liquid respond less to monetary policy tightening.

Conflict of interest

The author is a Research Economist at Bank of Zambia. However, the comments and views expressed in this paper do not represent the views of the Board, Management and Staff of the Bank of Zambia but solely those of the researchers.

References

Afandi A (2005) Monetary policy transmission and structural breaks in Indonesia. PhD Dissertation. University of Wollong, New South Wales.

Altubanus Y, Molyneux P, Fazylov O (2002) Evidence on the bank lending channel in Europe. *J Bank Fnanc* 26: 2093–2110.

Ando A, Modigliani F (1963) The "Life Cycle" hypothesis of saving: Aggregate implications and tests. *AMER* 53: 55–84.

Arellano M, Bond S (1991) Some tests of specification for panel data: Monte Carlo Evidence and an application to employment equations. *Re Econ Stud* 58: 277–297.

Benkovskis K (2008) Is there a bank lending channel of monetary policy in Latvia? Evidence from bank level data. *Working Papers*.

Bernanke BS, Gertler M (1995) Inside the black box: The credit channel of monetary policy transmission. *JEP* 9: 27–48.

Blundell R, Bond S (1998) Initial conditions and moment restrictions in dynamic panel data models. *J Econometrics* 87: 115–143.

Boivin JM, Kiley M, Mishkin F (2010) How has the monetary transmission mechanism evolved over time? *Handb Monetary Econ* 3: 369–422.

Bondt *GJ* (1997) Credit and asymmetric effects of monetary policy in six EU countries: An overview. *Wo Res Memoranda*.

Boughrara A, Ghazouani S (2010) Is there a bank-lending channel of monetary policy in selected Mena countries? A comparative analysis. *Middle East Dev J* 2: 251–282.

Brismiss SN, Kamberogiou NC, Simigiannis GT (2001) Is there a bank-lending channel in Greece? Evidence from bank level data. *Working Papers*.

Brownbridge M (1996) Financial policies and the banking system in Zambia. Available from: https://www.ids.ac.uk/files/Wp32.pdf.

Butkiewcz J, Ozdogan Z (2014) *Financial* crisis, monetary policy reform and the monetary transmission mechanism in Turkey. *Middle East Dev J* 6: 66–83.

Chileshe P, Akanbi O (2016) The effect of bank competition on the effectiveness of the interest rate channel of monetary policy transmission. *Int J Econ Sci* 5.

Chileshe P, Akanbi O (2017) The relative importance of the channels of monetary policy transmission in a developing country: The case of Zambia. *Afr J Econ Rev* 2: 149–174.

Couttarelli C, *Kourelis* A (1994) Financial structure, bank lending rates, and the transmission mechanism of monetary policy. *Staff Pap* 41: 587–623.

Davoodi HR, Dixit S, Pinter G (2013) Monetary transmission mechanism in East African *Community*: An empirical investigation. *Imf Working Pap*.

Ehrmann M, Gambacorta L, Martinezpagés J, et al. (2001) Financial systems and the role of banks in monetary policy. *Soc Sci Electron Publ* 4: 33–39.

Gambacorta L (2005) Inside the bank lending channel. *European Econ Rev* 49: 1737–1759.

Gambacorta L, Marquesibanez D (2011) The bank lending channel: Lessons from the crisis. *Econ Policy* 26: 135–182.

Gambacorta L, Mistrulli EP (2004) Does bank capital affect bank-lending behavior? *J financ Int* 13: 436–457.

Heryan T, Tzemeres PG (2016) The bank-lending channel of monetary in EU countries during the global financial crisis. *Econ Model*.

Ignacio H, Martínezpagés J (2001) Is there a bank lending channel of monetary policy in Spain? *Working Papers* 7–43.

Kashyap A, Stein J (1995) The impact of monetary policy on bank balance sheets. *Carnegie-Rochester Conf Ser Public Policy* 42: 151–195.

Kashyap A, Stein J (2000) What do a million observations on banks say about the transmission of monetary policy? *AER* 90: 407–428.

Kishan R, Opiela T (2000) Bank size, bank capital, and the bank lending channel. *J Money Credit Bank* 32: 121–141.

Kishan R, Opiela T (2013) Bank capital and loan asymmetry in the transmission of monetary policy. *Econ Rev* 30: 259–285.

Li N, Lee Y (2015) The bank-lending channel of monetary policy transmission in China: A comparison between Chinese and foreign banks. *Korea World Econ* 16: 167–193.

Massarongo F (2012) An analysis of the effectiveness of monetary policy in Sub-Saharan Africa developing Countries: The Case of Mozambique. MA dissertation. University of London: United Kingdom.

Mishi S, Tsegaye A (2012) The role of banks in monetary policy transmission in South Africa. *Working Papers* 249–257.

Mishkin F (1996) The channels of monetary transmission: Lessons for monetary policy. *Nber Work Pap*.

Mishra P, Montiel P, Spilimbergo A (2010) Monetary transmission in Low-Income Countries. *Imf Work Pap*.

Mutoti N (2006) Monetary policy transmission in Zambia. *Bank Zambia*.

Olivero M, Li P, Jeon BN (2011) Consolidation in banking and the lending channel of monetary transmission: Evidence from Asia and Latin America. *J Int Money Financ* 30: 1034–1054.

Olorunsola OE, Bada A, Basseey K, et al. (2014) The balance sheet channel of monetary policy transmission: Evidence from Nigeria. *CBN J Appl Stat* 5: 95–115.

Opolot J (2013) Bank lending channel of the monetary policy transmission mechanism in Uganda: Evidence from panel data analysis. *Working Papers*.

Sichei M, Njenga G (2012) Does the bank-lending channel exist in Kenya: Bank level panel data analysis? *Int Res J Financ Econ*.

Simatele MCH (2004) Financial sector reforms and monetary policy in Zambia. *Mpra Pap* 58: 29–50.

Simpasa A, Nandwa B, Nabassaga T (2015) Bank lending channel in Zambia: Empirical evidence from bank level data. *J Econ Stud* 42: 1159–1174.

Tahir MN (2012) Relative importance of monetary transmission channels: A structural investigation; a case of Brazil, Chile and Korea. *Eco Mod*.

Tobin J (1969) A general equilibrium approach to monetary theory. *J Money, Credit Bank* 1: 15–29.

Zgambo P, Chileshe P (2014) The effectiveness of monetary policy in Zambia, In: Opolot, J. (Ed), *The empirical analysis of the effectiveness of monetary policy in selected COMESA member countries*, Nairobi, Kenya: COMESA monetary institute, 240–292.

Appendices

Table 1A. Empirical literature.

Authors	Tittle	Country/Region	Methodology	Main conclusions
Kashyap, A., and Stein, J. (1995).	The Impact of Monetary Policy on Bank Balance Sheets	USA	Cross-section data OLS and IV approaches	- Tight MP has impact on smaller banks and not big banks - BLC exists through small banks
Kashyap, A., and Stein, J. (2000).	What do a Million Observations on Banks Say about the Transmission of Monetary Policy?	USA	Panel data Pooled dynamic OLS	- MP has greater impact on less liquid banks and smaller banks - Hence, BLC exists
Kishan, R. and Opiela, T. (2000)	Bank Size, Bank Capital, and the Bank Lending Channel	USA	Panel Data Pooled dynamic OLS	- monetary policy has larger effects on small under-capitalised banks
Kishan, R. and Opiela, T. (2006)	Bank capital and loan asymmetry in the transmission of monetary policy	USA	Panel Data Pooled dynamic model	- Contractionary monetary adversely affect loan by undercapitalised banks but expansionary policy has no effect on loan supply.
Olivero, M., Li, P., and Jeon, B. N. (2011)	Consolidation in banking and the lending channel of monetary transmission: Evidence from Asia and Latin America	Asia and Latin America	Annual panel data of 8 Asian and 10 LA Pooled OLS	- Bank consolidation weakens the BLC - These effects are greater on smaller banks - Hence, increased market power hampers MP effectiveness

Authors	Tittle	Country/Region	Methodology	Main conclusions
Gambacorta, L., and Marques-Ibanez, D. (2011)	The Bank Lending Channel. Lessons from the Crisis	Europe and USA	Panel Data Panel Dynamic Model	- Business models has significant impact on BLC - Bank with a higher share of non-interest rate income tend to highly constrained during tight policy
Heryan, T. & Tzemeres, P. (2016)	The Bank Lending Channel in the EU during and after the global financial crisis	Europe	Panel data AB GMM	- Banks in the post GFC react differently to monetary policy
Brismiss, S. N., Kamberogiou, N.C. & Simigiannis, G.T. (2003)	Is there a bank-lending channel in Greece? Evidence from bank level data	Turkey	Panel Data SUR weighted Least Squares	- they find the existence of a BLC - Bank specific factors shift the loan supply - Large and liquidity respond less to tight MP
Altubanus, Y., Molynuex, P. and Fazylov, O. (2002)	Evidence on the bank lending channel in Europe	Europe	Panel data Random effects model	- Undercapitalised banks respond more to MP - BLC is stronger in smaller countries than larger countries - Hence, they conclude that undercapitalised banks operating smaller countries respond more to MP

Authors	Tittle	Country/Region	Methodology	Main conclusions
Sichei, M. and Njenga, G. (2012)	Does the bank-lending channel exist in Kenya: Bank level panel data analysis?	Kenya	Panel data AB GMM approach	- BLC exists through Bank capital and liquidity - Illiquid and undercapitalised banks respond more to MP
Opolot, J. (2013)	Bank Lending Channel of the Monetary Policy Transmission Mechanism in Uganda: Evidence from Panel Data Analysis	Uganda	Panel data AB GMM approach	- BLC exists in Uganda - Capitalisation and Liquidity affect the response of banks to MP
Olorunsola, O.E, Bada, A., Basseey, K., and Dzaan, K. (2014)	The balance sheet channel of monetary policy transmission: Evidence from Nigeria	Nigeria	Time series OLS and VAR	- BSC exists in Nigeria - However, during the GFC MP was less effective
Mishi, S. and Tsegaye, A. (2012	The Role of Banks in Monetary Policy Transmission in South Africa	South Africa	Panel data Panel SVAR	- BLC exists in RSA - Size shifts the loan supply function but does not affect the response of banks.
Simpasa, A., Nandwa, B. and Nabassaga, T. (2015).	Bank lending channel in Zambia: empirical evidence from bank level data	Zambia	Panel data AB GMM approach	- BLC exists through larger banks - BLC is non-existent in smaller and medium banks