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Aggregate Demand and Monetary Policy Transmission Mechanism in Zambia

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Abstract

This study employs a three-stage least squares (3SLS) technique to investigate the role of aggregate demand in the transmission of monetary policy to inflation in Zambia over the period 2012q2 – 2022q4. The results reveal the importance of investment and consumption in monetary policy transmission. When investment is used as a proxy for aggregate demand, both the interest rate and bank lending channels are found to be operative, but the latter is stronger. As a robustness check, the interest rate channel is revisited by considering consumption rather than investment as a proxy for aggregate demand. The results reveal a relatively weaker pass-through from the Monetary Policy Rate to inflation. All the step-by-step coefficients of interest in the transmission process are statistically significant, implying that investment and consumption are critical for the transmission of monetary policy in Zambia. However, the coefficients for the eventual effect of monetary policy on inflation for both interest rate and credit channels are modest. This possibly indicates that other components of aggregate demand, such as Government expenditure and net exports could play a more significant role, a subject which future research can look at.

Keywords: Interest rate, bank lending, monetary policy, inflation
JEL Classification: E50 E52 E58

Contents

1. Introduction

There are convergent views on the long-run neutrality of monetary policy and its effect on real economic activity in the short-run (Boughrara, 2009). However, views on how monetary policy actions are transmitted to the real economy remain divergent**.** This is despite vast literature on monetary policy transmission mechanisms (MTM), defined as the process by which changes in monetary policy impact economic growth or inflation (Taylor, 1995). Broadly, some authors emphasise 'price' based channels such as the interest rate, exchange rate and asset price channels. Others underscore 'credit' transmission channels, which include variants of the bank lending channel while another strand of literature finds the expectations channel to be operative (Cecchetti, 1994; Bernanke and Gertler, 1995).

This study considers the transmission of monetary policy through two channels: interest rate and bank lending (credit) channels. Theoretically, the interest rate channel, for instance, dictates that changes in monetary policy affect interest rates, then investment or consumption, and ultimately aggregate output or inflation whereas the bank lending channel transmits monetary policy to the real economy through changes in the supply of loanable funds by deposit-taking institutions (Iddrisu and Alagidede, 2020). The tightening of monetary policy under the interest rate channel should lead to an increase in both nominal and real interest rates. This raises the user cost of capital, prompting a postponement of consumption or reduction in investment spending and ultimately output and prices. The downside impact of increasing interest rates on aggregate demand may, nonetheless, be negated by a consequent increase in investment arising from increased savings, although this is expected to occur with a lag. Under the bank lending channel, the tightening of monetary policy reduces the supply of loanable funds as bank deposits and reserves become less available. For instance, when the central bank tightens monetary policy, yield rates on Government securities also increase (Chanda and Musonda, 2023). Hence, banks may rather invest more funds in these risk free instruments than on-lend to retail consumers where credit risk is high. Thus, the reduction in loans created would induce a decline in deposits (Goh *et al,* 2007). Given that firms and households depend on bank loans, consumer and firm investment spending declines, which then slows down output and inflation. Mishkin (1996) provides a comprehensive discussion of monetary policy transmission channels.

A good understanding of the effectiveness of monetary policy transmission channels is useful in choosing an appropriate anchor for monetary policy (Tahir, 2012). Thus, for an inflation targeting framework to be successful, it is cardinal for monetary authorities to have a sound understanding of the channels through which monetary policy shocks are transmitted to the real sector (Mukherjee and Bhattacharya, 2011).

In Zambia, authors that have explored monetary policy transmission dynamics have relied mostly on vector autoregressions (VARs) to infer the impact of monetary policy shocks directly on inflation with little or no regard to the role of aggregate demand in this process (see for example Simatele, 2004; Mutoti, 2006; Zgambo and Chileshe, 2014). Meanwhile, the theoretical prescriptions underlying the channels of monetary policy transmission are far from a direct monetary policy-real economy relationship. Moreover, a key downside of the widely used VARs in monetary policy studies is the disagreement among authors on the identification of monetary policy shocks. As argued by Iddrisu and Alagidede (2020), the theoretical ordering of variables in VARs remains subjective among authors, leading to distinct inferences. In addition, VAR methodologies only capture the impact of unanticipated or 'surprise' changes (identified as shocks) in monetary policy, inherently ignoring the possibility that monetary policy can be systematic and tailored to achieve a desired outcome in the real economy (Bernanke et al., 2004). Although authors such as Mutoti (2006) and Chisha (2017) who employed structural VARs in the analysis of monetary policy transmission in Zambia could order the variables in accordance with theoretical assumptions, they neither provide a quantitative overall eventual effect of monetary policy on inflation nor consider the role of aggregate demand in this process. Hence, hitherto, little is known about the role of aggregate demand or its components in the transmission of monetary policy in Zambia.

In view of the identified gap in the literature, this study uses the three-stage least squares (3SLS) technique to investigate the transmission of monetary policy to inflation via the interest rate and bank lending channels, considering the role of aggregate demand (investment and consumption), while capturing the effect at each stage of the transmission process in line with Zellner and Theil (1992), Nosier and El-Karamani (2018) and Iddrisu and Alagidede (2020). The approach specifies a system of equations that is simultaneously estimated, thereby establishing how changes in monetary policy eventually impact inflation through subcomponents of the respective channels. The technique provides quantifiable monetary policy effects in a step-by-step fashion and the eventual effect that is more intuitive than the widely used VAR technique where mostly impulse responses and variance decompositions are discussed without structural interpretation of coefficients. As a robustness check, this study extends earlier work by Iddrisu and Alagidede (2020), revisiting the interest rate channel so as to consider consumption, rather than investment, as a proxy for aggregate demand and a conduit through which monetary policy is transmitted to inflation.

Investment and consumption are found to be significant in the transmission of monetary policy in Zambia. Further, both the interest rate and the bank lending channels are found to be operative, but the latter is much stronger. This is broadly in line with extant literature, which established an effective credit channel and a less potent interest rate channel, a result which is tenable given the magnified role that bank deposits play in the asset base of commercial banks in Zambia (see Section 3). An additional feature of the results is that they enable policy makers to identify the stages of the transmission process at which their actions are more impactful and where they are less prominent.

The rest of the paper is organised as follows. Section 2 provides a brief background to the monetary policy framework in Zambia, Section 3 presents an overview of the banking sector. Section 4 combines the theoretical review of the interest rate and bank lending channels of monetary policy transmission with an empirical review of relevant literature. Methodological aspects are covered in section 5, Sections 6 and 7 comprise the discussion of results and conclusion, respectively.

2. Brief background to the Monetary Policy Framework in Zambia

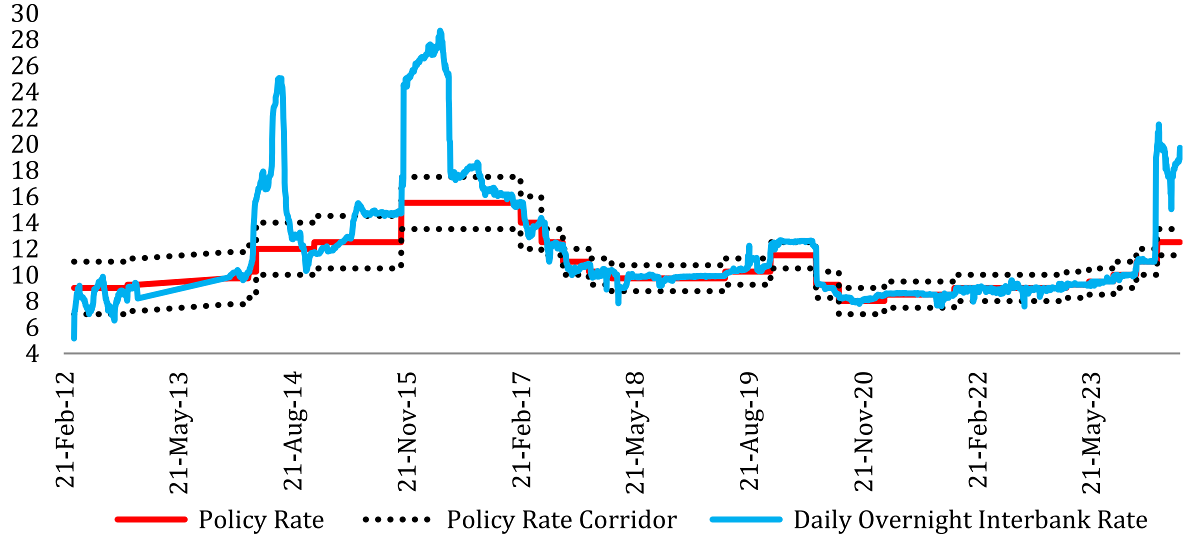
The evolution of monetary policy in Zambia can be broadly segmented into two periods: pre and post 1991. The first period (pre-1991) was mostly characterised by multiple objectives and there was no coherent monetary policy framework (Chipili and Zgambo, 2024). However, post 1991 until April 2012, the Bank of Zambia (BoZ) pursued a monetary aggregate targeting (MAT) monetary policy framework. Reserve money was used as an operational target while broad money was the intermediate target with inflation as the ultimate target. The link between the operational and intermediate targets was based on the theoretical construct that reserve money is related to broad money via the money multiplier. Thus, if the money multiplier is stable and predictable, the central bank could control monetary conditions in the economy by keeping reserve money at a level that is consistent with desired broad money growth. The desired expansion of broad money would in turn be consistent with the inflation target. However, evidence emerged that the link between money supply and inflation weakened overtime, suggesting that monetary aggregates had become less reliable as indicators of inflation developments (Simpasa et al, 2014). This prompted the central bank to seek an alternative monetary policy framework.

In April 2012, the Bank of Zambia (BoZ) introduced the Monetary Policy Rate (MPR) as the first step towards a full fletched inflation targeting (IT) regime. Reserve money as the operational target was replaced by the short-term (overnight) interbank rate. The Bank of Zambia also adopted a mid-rate interest rate corridor system with the MPR in the middle of the corridor. In the current framework, the overnight interbank rate is expected to fluctuate within the corridor, but as close as possible to the MPR. In this regard, if the overnight interbank rate tends towards the lower bound of the corridor, the Bank of Zambia undertakes contractionary open market operations (OMOs) to keep the interbank rate within the corridor. Conversely, if the interbank rate tends towards the upper bound of the corridor, expansionary OMOs are conducted to abate the overnight rate breaching the upper bound of the corridor (Zgambo, 2017). However, in exceptional circumstances, the interbank rate can be allowed to drift away from the target band (Figure 1) consistent with the prevailing policy objectives.

Commercial banks use the MPR as the base rate when setting the price or interest rates on their loans and advances. The MPR also guides OMOs and is expected to influence the rate at which banks borrow funds from each other overnight and in turn demand for credit, aggregate demand and ultimately inflation. Amid the transition to a full fletched inflation targeting regime that relies solely on price signals of the monetary policy stance, the Bank of Zambia still utilises the statutory reserve ratio (SRR), albeit sparingly, to influence liquidity conditions in tandem with the price stability objective. For instance, the Bank of Zambia raised the SRR by 900 basis points to 26 percent in February 2024 to complement other liquidity tightening measures in the face of persistent exchange rate depreciation and resultant inflationary pressures (Bank of Zambia, 2023). Hence, it has been argued that the current framework can best be described as an inflation-targeting-lite regime (Chisha, 2017).

Since the introduction of the inflation-targeting-lite regime, the interbank rate has largely been contained within the Policy Rate Corridor and close to the MPR (Figure 1). Exceptional cases in March to August 2014, November 2015 to May 2016 and February 2024 periods when the interbank rate was allowed to stay above the Policy Rate Corridor in the quest to contain persistent depreciation of the exchange rate. From figure 1, it can be deduced that the transmission of monetary policy from the MPR to the interbank rate has been strong. This has also been empirically established in previous research (Ngoma and Chanda, 2022). Hence, what remains to be ascertained, and is the focus of the present study, is the strength of the transmission to the ultimate target (inflation) through the various channels at each stage of the transmission process while considering the role of aggregate demand.

Figure 1: Monetary Policy Rate, Interbank Rate and Policy Rate Corridor (percent)



Source: Bank of Zambia

3. Brief overview of the Banking Sector in Zambia

The number of licensed commercial banks in Zambia stood at 17 in 2023, with 10 of them being subsidiaries of foreign banks while 4 were partially owned by the Government of the Republic of Zambia, and 3 were local privately owned (Bank of Zambia, 2023). Subsidiaries of foreign banks dominated the banking sector in terms of total assets, loans, deposits, and profit before tax. The sector asset base was dominated by deposit liabilities which was the major source of asset funding[1]. For instance, total banking sector assets grew by 21.8 percent to K238.9 billion as deposit liabilities rose by 21.3 percent to K178.4 billion in 2023 relative to 2022. Net loans and advances as well as investments in Government securities formed a large share of total banking sector assets.

Much of the credit extended by banks in 2023 went to the manufacturing sector followed by households, wholesale and retail trade, as well as transport, storage and communication

[1] This is a key pre-requisite for the effectiveness of the bank lending (credit) channel of monetary policy transmission.

sectors[2]. Growth in domestic credit has been steady, hovering around 15 percent per quarter since 2021. This has been characterised by growth in credit to the private sector amid fiscal consolidation measures, which have induced a contraction in credit to the Government over this period. In absolute terms, domestic credit rose to K178.4 billion in 2023 from K151.1 billion in 2022 with lending to the private sector remaining robust, growing by 41.3 percent compared to 34.2 percent in 2022 (Bank of Zambia, 2023).

Simpasa and pal (2016) contend that the banking sector in Zambia is highly concentrated with liquidity held by few large banks that largely extend liquidity to a few sectors that are deemed less risky. This implies that credit risk plays a crucial role in the determination of commercial banks' lending decisions and interest rates. By and large, to maintain profitability margins, commercial banks tend to consider bank competition, statutory reserve ratios and yield rates on government securities when setting deposit rates (Ngoma and Chanda, 2022).

4. Literature Review

The actions of monetary authorities are transmitted to the economy, as reflected in the price level and income, through different channels. These include the interest rate , credit (bank lending) , the exchange rate, expectations and asset price channels (Taylor 1995; Mishkin 1996). This study focuses on the interest rate and credit channels and the theoretical underpinnings of these channels presented below are based on Mishkin (1996), Boivin et al (2010) and Bwire (2019).

The interest rate channel hinges on the notion that the transmission of monetary policy depends on private expenditures being elastic. The basic idea is that given some degree of price stickiness, the tightening of monetary policy through reduced money supply M, for example, translates into an increase in nominal interest rates (i) and the real rate of interest (r). Hence, the user cost of capital increases leading to a postponement of consumption (C) or a reduction in investment spending (I), and hence, the output level (Y) and prices (π). The fundamental Keynesian IS-LM model for the interest rate channel is summarised as follows:

$M \downarrow \rightarrow i \uparrow \rightarrow r \uparrow \rightarrow I \downarrow$ or $C \downarrow \rightarrow Y or\ \pi \downarrow$

However, the central bank can only directly influence short-term nominal interest rates. Thus, the effectiveness of this channel depends on the ability of such actions impacting the real interest rate and the sensitivity of consumption and/or investment to changes in the price of intertemporal substitution (Mishkin, 1996).

The underlying assumption of the credit channel is that banks cannot easily substitute retail bank deposits with other sources of funds. In addition, firms and individuals are mainly reliant on bank credit as a source of finance as they can hardly access financing through the issuance of stocks or other securities in the capital market (Gertler and Gilchrist, 1993).

[2] This gives credence to the consideration of investment and consumption as conduits of monetary policy transmission.

Since banks are required to maintain a stipulated portion of deposits received as reserve requirement, central banks have the leverage to directly influence the quantity of money that banks can have through adjustments to the statutory reserve ratio (Iddrisu and Alagidede, 2020). Hence, tightening of monetary policy, through increased statutory reserve ratios for instance, reduces banks' excess reserves and bank deposits leading to a fall in the quantity of loanable funds. This causes investment and consumer spending to fall and output or inflation recedes in response. The credit channel is made up of sub-channels such as bank capital and balance sheet channels.

In the bank capital channel, the state of banks and other financial intermediaries' balance sheets has an impact on lending. A fall in asset prices can lead to losses in banks' loan portfolios. Alternatively, a decline in credit quality disincentivises or reduces the ability of borrowers to pay back their loans which in turn reduces the value of bank assets and leads to a diminution of bank capital. In response, banks shrink their asset base by cutting back on lending, particularly in the absence of external financing, to increase their capital to asset ratio. Consequently, firms that depend mainly on bank lending for financing respond by reducing investment spending since they can no longer access as much credit. This dampens aggregate demand and output or inflation declines (Mishkin, 1996).

Monetary policy affects firms' balance sheets in several ways. Contractionary monetary policy, for instance, leads to a decline in asset prices, particularly equity prices, which lowers the net worth of firms. This can lead to a decline in lending, spending and aggregate demand. Another way is through cash flows, the difference between cash receipts and cash expenditure. Contractionary monetary policy, which raises interest rates, causes firms' interest payments to rise leading to a fall in cash flow. With less cash flow, a firm has fewer internal funds and must raise funds externally. Since external funding is subject to asymmetric information problems and hence an external finance premium, additional reliance on external funds boosts the cost of capital, curtailing lending, investment, and economic activity (Mishkin, 1996).

An important implication of the bank lending channel is that monetary policy will have a greater effect on expenditure by smaller firms, which are more dependent on bank loans, than it will on large firms, which can get funds directly through stock and bond markets (and not only through banks). Under this channel, the tightening of monetary policy (reduction in money supply, M) reduces the supply of loanable funds as bank deposits and reserves become less available. Since firms and households depend on bank loans, consumer and firm investment spending (I) declines, which then slows down output(Y) or inflation (π)(Mishkin, 1996). The transmission through this channel can be summarised as follows.

$M \downarrow \rightarrow bank\ deposits \downarrow \rightarrow bank\ loans \downarrow \rightarrow I \downarrow \rightarrow Y or\ \pi \downarrow$

From the theoretical review, the role of aggregate demand in the transmission of monetary policy is vivid and yet most extant empirical literature has given it little or no attention. There is vast literature on the channels of monetary policy transmission in both developed and emerging economies (Bernanke and Gertler 1995; Tahir, 2012; Dabla-Norris and Floerkemeier, 2006; Boivin *et al*, 2010). Studies on Zambia are replete but inconclusive

(Simatele, 2004; Kalikeka and Sheefeni, 2013; Zgambo and Chileshe, 2014; Simpasa *et al*, 2014; Chileshe, 2017; Chileshe and Akanbi, 2017; Chisha, 2017). However, there is increasing evidence in support of the bank credit channel while the interest rate channel is generally found to be weak.

Brooks (2007) employed the difference-in-differences approach on data from 2005 to 2007 to examine the role of commercial banks in monetary policy transmission in Turkey. The results show that bank liquidity significantly impacts loan supply and is, therefore, important for monetary policy transmission. In addition, Aban (2013) found evidence for the bank lending channel of monetary policy transmission in the Philippines using panel ordinary least squares methods on quarterly data spanning 2008 to 2011. However, these results contrast Goh *et al* (2007) who found no evidence for the bank lending channel of monetary policy transmission in Malaysia based on the autoregressive distributed lag (ARDL) and monthly data over the period 1990 - 2004.

As argued by Gertler and Gilchrist (1993), a necessary condition for the bank lending channel to be operative is that banks do not offset the monetary policy shock by substituting capital market funds for deposit funds. Hence, in countries with developed financial sectors such that banks have access to non-deposit funding sources, it has been established that the impact of monetary policy shock on deposits can be offset by accessing funds from the capital market thereby rendering the bank lending channel ineffective.

Nonetheless, Kabiro and Nyamongo (2014) employed a panel data approach using bank level data to investigate the effectiveness of the lending channel of monetary policy in Kenya. They found support for the bank lending channel as banks' total assets and liquidity levels had a significant effect on loan supply while capitalization was found to be weakly significant. This result appears to be robust to different estimation techniques and geographical jurisdictions. For instance, Ebire and Ogunyika (2018) established the effectiveness of the bank lending channel in Nigeria using the vector error correction mechanism (VECM) approach, in agreement with Opolot and Nampewo (2014) who found evidence in support of the bank lending channel of the monetary policy transmission mechanism in Uganda using a dynamic panel data framework based on a generalised method of moments (GMM) dynamic panel estimator.

The effectiveness of the interest rate and lending channels of monetary policy transmission channels in South Africa was examined by Iddrisu and Alagidede (2020). They employed a three stage least squares estimation technique to estimate a system of equations that provides a step-by-step transmission of monetary policy to inflation through investment, a component of aggregate demand. They found both channels to be operative although the interest rate channel was weak.

Literature on monetary policy transmission channels in Zambia is also mixed. Chileshe and Akanbi (2017) used vector autoregressive methods to examine the strength of the interest rate, exchange rate, credit, and asset price channels of monetary policy transmission. Their results indicate that the exchange rate and credit channels are effective while the interest channel is found to be weak while the equity or asset price channel is not important. These findings align closely with Zgambo and Chileshe (2014) who employed the VAR framework and established that monetary aggregates (broad money) were important in the transmission of monetary policy in Zambia while interest rates were found to have no significant effect on output and prices.

Funda (2014) investigated the effectiveness of the interest rate channel of monetary policy transmission by employing a vector autoregression approach, focusing on the reduced-form relationships between money supply, inflation, real interest rate and real output using annual data for the period 1980 to 2011. The study contends that monetary policy affects output and inflation, but the interest rate channel is not effective.

However, Simpasa *et al* (2014) showed that monetary policy anchored on price signals is more potent than that based on quantity aggregates. Kalikeka and Sheefeni (2017) reinforced this result based on annual data and using the VAR approach. They found evidence of a functional interest rate channel in Zambia.

The effectiveness of the interest rate channel in Zambia partly depends on the level of competition in the interbank market. Chileshe and Akanbi (2016) undertook this exercise using error correction models and found that higher competition in the interbank market enhanced the transmission of monetary policy changes to retail rates.

The pass-through from the monetary policy rate to commercial bank retail rates via the interbank market was addressed by Ngoma and Chanda (2022) using the Johansen cointegration approach. Their results suggest the existence of a significant, but incomplete pass-through of monetary policy changes to commercial bank interest rates in Zambia via the interbank market. Although they do not extend the analysis to inflation, the ultimate target of monetary policy, these results provide a basis for the interest rate channel of monetary policy transmission. Chanda and Musonda (2024) established a significant passthrough from the Policy Rate to government securities yield rates.

Chisha (2017) documented the nature of the credit channel transmission of monetary policy in Zambia by assessing the response of private sector credit to changes in monetary policy. Using a VECM approach, the results indicate that positive changes in monetary policy led to higher lending rates and a negative impact on private sector credit in the long-run. Other authors have used a structural vector autoregression (SVARs) method to analyse the transmission process of monetary policy in Zambia. For instance, Mutoti (2006) uses the structural cointegrated VAR framework to investigate the role of money in the transmission process. The results suggest that monetary policy is effective at dampening inflationary pressures induced `by exchange rate shocks. This is akin to Chisha (2017) who found that tight monetary conditions lead to contracting economic activity and falling inflation in Zambia using a structural vector autoregression.

In conclusion, literature on the effectiveness of monetary policy transmission channels is vast but divergent. A common feature is for authors to employ variants of vector autoregressions in the analysis. In view of this, existing studies, particularly on Zambia, largely do not capture the step-by-step effect of monetary policy on inflation. More so, the transmission to inflation through the components of aggregate demand such as investment or consumption is not considered by most authors. Hence, much of the extant literature does not account for the theoretical stipulations of monetary policy transmission channels. This study attempts to address this.

5. Model Specification, Methodology and Data

Model Specification

The model specification and selection of variables in this study closely follows Nosier and El-Karamani (2018) as well as Iddrisu and Alagidede (2020). The estimated model features simultaneous equations for both interest rate and credit channels of monetary policy transmission based on the underlying theoretical stipulations. For each channel, the model set-up has three equations, each capturing a stage of the transmission process. The model for the interest rate channel is presented below:

$$LENDING\ RATE = f(POLICY\ RATE, CONTROL\ VARIABLES) \quad (1)$$

$$INVESTMENT/CONSUMPTION = f(LENDING\ RATE, CONTROL\ VARIABLES) \quad (2)$$

$$INFLATION = f(INVESTMENT/CONSUMPTION, CONTROL\ VARIABLES) \quad (3)$$

where control variables in equation 1 refer to: deposit rates which represent the initial cost of funds for commercial banks, yield rates on Government bonds representing the risk free-rate commercial banks can use as a reference rate in setting lending rates and real gross domestic product (GDP) growth rate which can be used by banks to determine the risk premium based on their assessment of the default risk. In equation 2, control variables are: inflation, a key macroeconomic indicator in investment decisions, and private sector credit measuring the direct impact of bank lending to the private sector on investment. In equation 3, control variables are lending rates by banks measuring the direct impact of changes in interest rates on inflation that does not occur through changes in investment captured in equation 2[3] and the Kwacha per US dollar exchange rate capturing the pass-through to inflation.

The credit channel model is as follows:

$$PRIVATE\ SECTOR\ CREDIT = f(POLICY\ RATE, CONTROL\ VARIABLES) \quad (4)$$

$$INVESTMENT/CONSUMPTION = f(PSC, CONTROL\ VARIABLES) \quad (5)$$

$$INFLATION = f(INVESTMENT/CONSUMPTION, CONTROL\ VARIABLES) \quad (6)$$

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[3] This could reflect changes in inflation as a result of adjustments to inflation expectations by economic agents once they observe adjustment in interest rates.

where control variables in equation 4 refer to: deposit rates and real GDP growth for the same reasons explained under the interest rate channel above. The additional variable here is the exchange rate which is included to control for the opportunity cost of lending to the private sector as banks could instead choose to hold foreign currency positions when they anticipate a weaker exchange rate. The control variables in equations 5 and 6 are as those in equations 2 and 3 under the interest rate channel.

Theoretically, changes in the monetary policy rate are expected to affect market interest rates, which in turn affect consumption and investment and ultimately output or inflation. In this regard, the empirical model features three simultaneous equations specified below to capture the stages of transmission of monetary policy impulses to inflation. The system of equations for the interest rate channel is given as:

$$DALR_t = \gamma_0 + \gamma_1 DMPR_{t-k} + \gamma_2 GDPG_t + \gamma_3 D\_BOND\_RATE_t + \gamma_4 DDPSR_t + \varepsilon_t \quad (7)$$
$$DLOG\_GFCF_t = \beta_0 + \beta_1 DALR_t + \beta_2 DLOG\_PSC_t + \beta_3 DLOG\_CPI_t + \varepsilon_t \quad (8)$$
$$DLOG\_CPI_t = \alpha_0 + \alpha_1 DLOG\_GFCF_t + \alpha_2 DALR_t + \alpha_3 DLOG\_EXCH_t + \varepsilon_t \quad (9)$$

where *DALR, DMPR, D_BOND_RATE* and *DDPSR* are first differences of the average lending rate, monetary policy rate, 5-year Government bond yield rate and 180-day deposit rate, respectively; *DLOG_CPI, DLOG_GFCF, DLOG_PSC* and *DLOG_EXCH* denote the first log differences of the consumer price index, gross fixed capital formation, private sector credit and the Kwacha per US dollar exchange rate; and ε_t is the error term. The transformations of the variables is informed by the results of unit root tests, so that the system of equations is stationary and does not yield spurious results. In line with the empirically established construct that monetary policy impacts the real economy with a lag, this study follows Iddrissu and Alagidede (2020) by employing standard lag selection criteria to choose an optimal lag for the monetary policy rate in equation 7.

Equation (7) captures the impact of changes in the monetary policy rate and some control variables on commercial banks' lending rates. The theoretical expectation is that tightening monetary policy (increase in MPR) should exert a positive effect on the lending rate (LR) making the cost of borrowing higher. This is captured by γ_1 in equation 7. In equation 8, the resulting impact of changes in the lending rate, given by β_1, on investment is captured. On the premise that firms and households largely depend on bank loans to finance investments, increases in lending rates should disincentivise investment. Hence, β_1 is expected to be negative. There exists a positive correlation between investment and aggregate demand as well as inflation. Thus, a decline in investment following the tightening of monetary policy leads to a slowdown in economic activity, which, ceteris paribus, reduces inflation. This is captured by α_1 in equation 9.

The eventual effect of monetary policy on inflation through investment is captured by the product of γ_1, β_1 and α_1 (see Nosier and El-Karamani, 2018; Iddrissu and Alagidede, 2020). Following Oehlert (1992), the delta method is applied to calculate the standard error of the eventual effect of monetary policy on inflation coefficient $(\hat{\phi})$ and test for statistical significance. This is actualised through equations 10 and 11 under the assumption of zero co-variance among γ_1, β_1 and α_1:

$$SE(\hat{\vartheta}) = \sqrt{\hat{\beta}_1^2 SE(\hat{\gamma}_1^2) + \hat{\gamma}_1^2 SE(\hat{\beta}_1^2)} \quad (10)$$

$$SE(\hat{\phi}) = \sqrt{\hat{\alpha}_1^2 SE(\hat{\vartheta}^2) + \hat{\vartheta}^2 SE(\hat{\alpha}_1^2)} \quad (11)$$

In the first step, the effect of monetary policy on investment through the lending rate is estimated as $\hat{\gamma}_1 x\, \hat{\beta}_1 = \hat{\vartheta}$ and the associated standard error is obtained via equation (10). The second step involves the estimation of the eventual effect of monetary policy on inflation through investment given by $\hat{\vartheta}\ x\ \hat{\alpha}_1 = \hat{\phi}$ and the associated standard error depicted in equation (11). The null hypothesis $\hat{\phi} = 0$ is then tested to determine the statistical significance of the computed coefficient.

Similarly, the system of equations for the bank lending channel is estimated as:

$$DLOG\_PSC_t = \rho_0 + \rho_1 DMPR_{t-k} + \rho_2 GDPG_t + \rho_3 DLOG\_EXCH_t + \rho_4 DDPSR_t + \varepsilon_t \quad (12)$$
$$DLOG\_GFCF_t = \delta_0 + \delta_1 DLOG\_PSC_t + \delta_2 DALR_t + \delta_3 DLOG\_CPI_t + \varepsilon_t \quad (13)$$
$$DLOG\_CPI_t = \mu_0 + \mu_1 DLOG\_GFCF_t + \mu_2 DALR_t + \mu_3 DLOG\_EXCH_t + \varepsilon_t \quad (14)$$

where all the variables are as described under the interest rate channel. Equations 12, 13 and 14 are analogous to equations 7, 8 and 9 but the average lending rate is now replaced by private sector credit in equation 12.

The theoretical prescriptions of the bank lending channel dictate that changes in monetary policy tend to impact the amount of credit that banks can provide under the assumption that banks are highly reliant on deposit funding (captured by equation 12). Changes in bank credit in turn affect investments by firms (as in equation 13), especially those that rely heavily on bank loans for financing, which ultimately affects economic activity and inflation (via equation 14).

The apriori expectation is that tightening of monetary policy reduces the amount of credit banks can extend to the private sector captured by ρ_1 in equation (12). Since private sector credit is positively correlated with investment, the decline in credit should result in reduced investment captured by δ_1 in equation 13. As earlier argued, a fall in investment then slows economic activity and overall inflation reduces captured by μ_1 in equation (14).

The eventual effect of monetary policy on inflation through investment via the bank lending channel, given by $\hat{\lambda}$, is then captured by the product of ρ_1, δ_1 and μ_1 such that $\hat{\rho}_1 x\ \hat{\delta}_1 = \hat{\pi}$ and $\hat{\pi}\ x\ \hat{\mu}_1 = \hat{\lambda}$.

Following the logic and steps explained under the interest rate channel in equations (10) and (11), the standard error of the resulting coefficient is calculated as shown in equations (15) and (16) to determine the statistical significance of monetary policy's eventual effect on inflation through the bank lending channel.

$$SE(\hat{\pi}) = \sqrt{\hat{\delta}_1^2 SE(\hat{\rho}_1^2) + \hat{\rho}_1^2 SE(\hat{\delta}_1^2)} \tag{15}$$

$$SE(\hat{\lambda}) = \sqrt{\hat{\mu}_1^2 SE(\hat{\pi}\ ) + \hat{\pi} SE(\hat{\mu}_1^2)} \tag{16}$$

As an extension of the earlier work by Iddrissu and Alagidede (2020), this study revisits the interest rate channel by considering consumption, rather than investment, as a proxy for aggregate demand and a conduit through which monetary policy is transmitted to inflation. This is implemented by simultaneously estimating the lending rate, consumption and inflation equations as follows:

$$DALR_t = \gamma_0 + \gamma_1 DMPR_{t-k} + \gamma_2 GDPG_t + \gamma_3 D\_BOND\_RATE_t + \gamma_4 DDPSR_t + \varepsilon_t \tag{17}$$

$$DLOG\_RS_t = \beta_0 + \beta_1 DALR_t + \beta_2 DLOG\_EXCH_t + \beta_3 DLOG\_CPI_t + \varepsilon_t \tag{18}$$

$$DLOG\_CPI_t = \alpha_0 + \alpha_1 DLOG\_RS_t + \alpha_2 DALR_t + \alpha_3 DLOG\_EXCH_t + \varepsilon_t \tag{19}$$

where $DLOG\_RS$ is the first log difference of aggregate retail sales and the rest of the variables are as described earlier. Equations 17 and 19 are analogous to equations 7 and 9 and the rationale for selection of variables is as explained earlier. In equation 18, consumption is modelled to be influenced by lending rates and the following control variables: exchange rate which can affect the quantity of imported goods and inflation which captures the impact of changes in consumers' purchasing power on consumption. Equation 17 captures the responsiveness of lending rates to changes in monetary policy (given by γ_1) and some control variables. Equation 18 is the consumption equation depicting the contemporaneous impact of changes in interest rates (given by β_1) and some control variables on consumption. The resultant impact of changes in consumption (given by α_1) and some control variables on inflation is captured by equation 19. The eventual impact of a percent increase in the MPR on inflation under the revisited model is computed following the steps explained earlier. Equations 10 and 11 are applied to compute the associated standard error and thus test for statistical significance.

Methodology

In the frequentist approach, the equations above would be estimated one after the other using the ordinary least squares (OLS) technique. However, OLS fundamentally assumes that the regressors are necessarily exogenous, implying that they do not correlate with the errors. A violation of this assumption renders estimates from the OLS inconsistent and biased. One of the alternatives in such a case is the two-stage least square approach in a simultaneous equation set-up. This consists of two steps: the first estimates the moment matrix of the reduced-form disturbances and the second estimates the coefficients of one single structural equation after it's jointly dependent variables are "purified" by means of the moment matrix just mentioned (Zellner and Theil, 1992). This, nonetheless, is only to the extent that the errors in the specified simultaneous equations are not themselves correlated. Where the errors are correlated, then the two-stage least square technique lacks efficiency although the estimates can still be consistent. Thus, the three-stage least squares method adopted in this study goes one step further by using the two-stage least squares estimated moment matrix of the structural disturbances to estimate all coefficients of the entire system simultaneously. The technique alleviates the problem of endogeneity inherent in unrestricted VARs using instrumental variables.

The three-stage least squares technique delivers estimates that are superior to the two-stage least squares because, even though they both maintain consistency, the former churns out coefficients that are efficient asymptotically as it utilizes information inherent in the correlations among the errors within the structural equations specified (Nosier and El-Karamani, 2018). A further appealing feature of the three-stage least squares technique is that it has the complement of complete information, which enhances its efficiency and accounts for the parameter restrictions in the distinct structural equations being considered (Zellner and Theil, 1962).

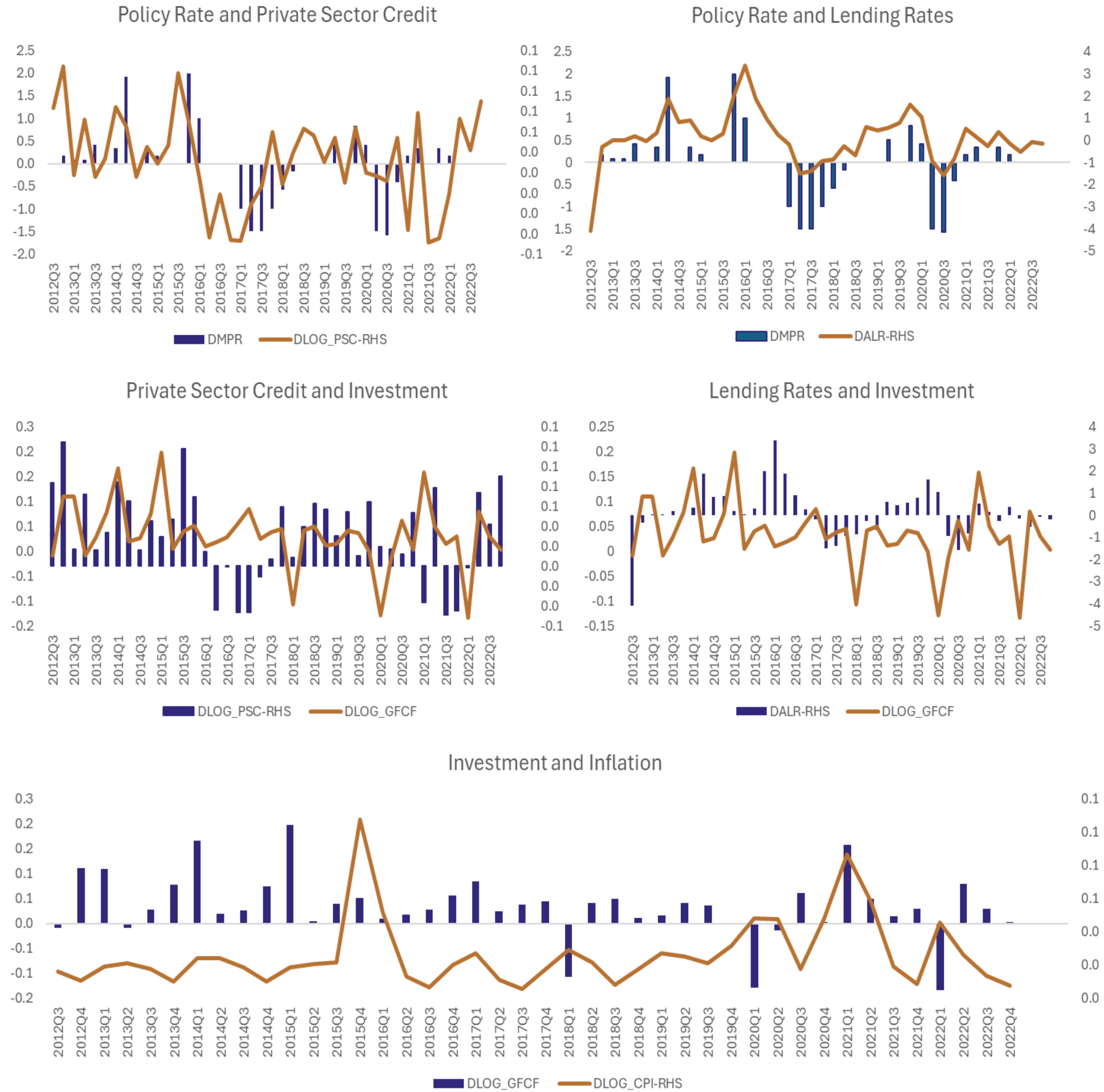
Data

The study uses quarterly data, spanning 2012 to 2022, on the consumer price index (CPI), investment (proxied by real gross fixed capital formation), consumption (proxied by aggregated retail sales)[4], private sector credit, commercial banks average lending and deposit rates, exchange rate, monetary policy rate, real gross domestic product (GDP) growth and the yield on the 5-year Government bond. Data on real GDP and gross fixed capital formation were collected from the Zambia Statistics Agency while the rest of the data was obtained from the Bank of Zambia. Data on gross fixed capital formation, a measure of resident producers' investments in fixed assets less disposals, is only available at an annual frequency and was thus converted to quarterly using the underlying trend in quarterly GDP. Aggregate data on retail sales by major chain stores was collected at a quarterly frequency. The rest of the data was converted from monthly to quarterly using simple averages. The period of analysis was conveniently chosen to focus mostly on the implementation period of the current inflation-targeting-lite regime in April 2012.

Trends in the key variables in the transmission process are presented in Figure 2. Changes in the MPR are positively correlated with changes in banks' lending rates while changes in lending rates and investments are mostly antagonistic. The relationship between the MPR and private sector credit is not immediately clear, but the latter seems to positively correlate with investment. The response of inflation to changes in investment, equally, is not vivid possibly reflecting the multifaceted nature of inflation.

[4] Retail sales from three major chain stores in Zambia were aggregated and used as a proxy for consumption.

Figure 2: Relationships among key variables in the transmission of Monetary Policy, first differences



Source: Bank of Zambia

6. Empirical Results and Discussion

The stationarity properties of the data are reported in Table 1. The results for the interest rate and credit channels (with investment as proxy for aggregate demand) are presented in Table 3 and Table 4, respectively. Table 5 presents the results of the revisited interest rate channel (where aggregate demand is proxied by consumption). The full estimation outputs for the models are in the appendix.

To determine how the variables could be treated in the model, stationary tests were conducted. This ensures that the system of equations estimated is stationary and does not yield spurious results. The results presented in Table 1 reveal that all the variables are integrated of order one except for real GDP growth which is stationary at level. Hence, the I(1) variables were modelled at first difference.

Table 1: Unit Root Tests

	ADF t-statistic (Level)	ADF t statistic (First log-difference)	Order of Integration
GFCF	-0.469228	-6.078627*	I (1)
ALR	-2.593892	-3.073709**	I (1)
EXCH	-0.791004	-4.720447*	I (1)
PSC	0.366762	-4.651968*	I (1)
CPI	1.535122	-4.664425*	I (1)
MPR	-1.933998	-3.538278**	I (1)
GDPG	-3.683279*	-8.979280*	I (0)
DPSR	-2.157039	-3.587686*	I (1)
RS	-0.261734	-4.611904*	I (1)
BOND_RATE	-2.387827	-4.338408*	I(1)

Source: Statistical output from E-views

Note: * and ** denotes statistical significance at 1 and 5 percent levels of significance, respectively

where GFCF, ALR, EXCH, PSC and CPI denote gross fixed capital formation, average lending rate, nominal exchange rate of the Kwacha against the US dollar, private sector credit and consumer price index, respectively, whereas MPR, GDPG, DPSR, RS and BOND_RATE refer to the monetary policy rate, real gross domestic product growth, deposit rate and the 5-year bond yield rate, respectively.

To choose an optimal lag length for the monetary policy rate, a VAR is estimated with a maximum lag length of 4. Based on the Likelihood Ratio, Forecast Prediction Error, Akaike Information Criterion, Schwarz Criterion and Hannan-Quinn Criterion, an optimal lag of 2 is chosen and applied to the MPR variable (Table 2). The model set-up is such that it brings out long-run relationships among the variables. However, since monetary policy is expected to be neutral in the long run, the MPR is allowed to have lags to capture short-run dynamics. This is in line with the empirically established construct that monetary policy impacts the real economy with a lag in the short-run (Iddrissu and Alagidede, 2020).

Table 2: Lag selection criteria for Monetary Policy Rate

Lag	Log Likelihood	Likelihood Ratio	Forecast Prediction Error	Akaike Information Criterion	Schwarz Criterion	Hannan-Quinn Criterion
0	6.772823	NA	0.002649	-0.257990	-0.170914	-0.227292
1	52.84933	84.68115	0.000273	-2.532396	-2.271166	-2.440300
2	63.69124	18.75358*	0.000189*	-2.902229*	-2.466846*	-2.748736*
3	65.41328	2.792487	0.000215	-2.779096	-2.169560	-2.564206
4	66.69788	1.944258	0.000251	-2.632318	-1.848628	-2.356030

Source: Statistical output from E-views

* Indicates lag order selected by the criterion

Interest Rate Channel

Lending rates are significantly impacted by deposit rates and the MPR while investment is influenced by lending rates and inflation. The coefficient on deposit rate in the lending rate equation is significant and in excess of unity, implying a more pronounced response of lending rates to changes in deposit rates. This indicates widening profit margins as commercial banks mark up lending rates more than the increase in deposit rates, mostly reflecting an underdeveloped and less competitive market (Chanda and Ngoma, 2022). The coefficients on investment, exchange rate and average lending rate in the inflation equation are statistically significant.

The transmission from MPR to inflation is expected to occur firstly through market interest rates (commercial bank lending rate in this case) which then affect investment decisions of firms that rely on borrowing from banks to finance their operations. As shown in the second column of Table 3, a percent increase in the MPR raises commercial bank lending rates by approximately 0.39 percent with a two-quarter lag, and the effect is statistically significant at 10 percent. This aligns closely with existing evidence on the incomplete pass-through from the MPR to commercial banks' retail rates (Ngoma and Chanda, 2022; Chanda and Musonda, 2024). On one hand, this transmission reflects the use of the MPR as a benchmark rate in commercial banks retail pricing decisions. On the other hand, the transmission could reflect the role of the risk-free rate (yield rate on Government securities) in retail interest rates decisions by commercial banks. As established by Chanda and Musonda (2024), when the MPR increases, yield rates on Government securities typically tend to increase and this raises the opportunity cost of commercial banks' lending to firms or households. Given that Government securities have lower risk than lending to firms or households, it takes higher interest rates for banks to lend to firms or households at the expense of investing these funds in Government securities. Hence, restrictive monetary policy exerts a positive impact on commercial banks retail lending rates in line with theory.

The increase in borrowing costs reduces profit margins for firms and disincentivises capital investments, particularly for firms which produce goods that are highly price elastic such that higher borrowing costs cannot be easily transferred to end-consumers. Thus, the relationship between lending rates and investment is theoretically expected to be negative. As shown in the third column of Table 3, a rise in commercial banks' lending rates dampens investment by 0.02 percent and the effect is statistically significant at 10 percent.

Changes in investment are expected to move in tandem with inflation. That is, a decline in investment leads to a slowdown in economic activity and tends to reduce inflation. Accordingly, the study finds that the decline in investment induces a 0.179 percent fall in inflation as depicted in the fourth column of Table 3. This could occur in two ways. Firstly, through the reduction in productivity firms cut back production following decreased capital investments. Secondly, a decrease in firm production implies an increase in unemployment and a consequent weakening of consumer spending. The coefficient on inflation in the investment equation exceeds 1 possibly reflecting that much of the investment is in real assets, such as property or commodities, in which case, the larger-than-proportionate impact of inflation could suggest that investors are responding to inflation by increasing investment in such assets as a way of hedging against a deterioration in real returns due to inflation.

The overall eventual impact of monetary policy on inflation, through the interest rate channel, computed by the product of the step-by-step estimated coefficients explained in section 5, is reported in the fourth column of Table 3. A percent restriction in monetary policy leads to a 0.0015 percent decline in inflation although the effect is not statistically significant. This demonstrates weak transmission of monetary policy impulses through the interest rate channel consistent with extant literature (Funda, 2014; Chanda and Ngoma, 2022). The weakness of the interest rate channel has mostly been attributed to the underdevelopment and segmentation of the financial markets. In this study, an additional explanation is established of weak elasticity of investment to intertest rates. The overall eventual effect of monetary policy computed here is more intuitive than the mostly used VAR approach, which mostly reports impulse responses and variance decompositions. Although authors that use structural VARs can employ theoretical prescriptions in the ordering of variables, they do not provide such a quantifiable overall eventual effect of monetary policy on inflation (Iddrissu and Alagidede, 2020).

Table 3: The Interest Rate Channel

	Lending Rate Equation	Investment Equation	Inflation Equation
$\mathbf{DMPR_{t-2}}$	0.390 (1.669) ***		
GDPG	0.065 (0.901)		
D_BOND_RATE	0.049 (0.742)		
DDPSR	1.036 (3.518) *		
DALR		-0.022 (-1.915) ***	
DLOG_PSC		-0.161 (1.915)	
DLOG_CPI		1.243 (1.963) ***	
DLOG_GFCF			0.179 (2.341) **
DALR			0.007 (1.837)***
DLOG_EXCH			0.099(1.954)***
Constant	-0.127 (-0.521)	-0.009 (-0.399)	0.022 (5.319) *
Eventual Effect of MPR on Inflation ($\widehat{\boldsymbol{\phi}}$)			-0.0015 (1.271)

Source: Estimation output from E-views

Note: *, ** and *** denote statistical significance at 1, 5 and 10 percent levels of significance, respectively. The corresponding t-statistics are in parenthesis.

Bank Lending Channel

The pass-through to inflation from the MPR via the bank lending channel occurs initially through responses of private sector credit to the changes in monetary policy, which are transmitted to inflation through investment. Private sector credit is impacted by the MPR and exchange rate as the coefficients on GDP growth and deposit rates are statistically insignificant. Changes in credit to the private sector and inflation affect investment, which in turn impacts inflation. The exchange rate also exerts a significant effect on inflation.

The second column of Table 4 presents results from the credit equation. In line with theory, a percent tightening of monetary policy reduces the amount of credit that banks extend to the private sector by 0.03 percent, and the impact is statistically significant at 5 percent level. The decline in credit extended to the private sector results in decreased investment expenditure. This is depicted in the third column of Table 4 where investment declines by 0.61 percent and the effect is statistically significant at 10 percent significance level. In countries where firms rely largely on bank loans to fund investment, such a decline may be pronounced. Since the relationship between inflation and investment is expected to be positive, the decline in investment should occasion a decrease in inflation. In line with this, it is found that inflation falls by 0.24 percent in response to the decline in investment. This would occur as economic activity slows down on the back of decreased investment expenditure as explained under the interest rate channel.

As in the interest rate channel, the overall eventual effect of a restriction in monetary policy on inflation through the bank lending channel is computed by the product of the step-by-step estimated coefficients (see section 5). This is reported in the fourth column of Table 4 showing a 0.0049 percent fall in inflation, significant at 10 percent. Under this channel, the transmission is weakest in the first instance where changes in private sector credit weakly respond to adjustments in the MPR, with a coefficient of 0.034. This finding is plausible as the availability of credit for lending by banks is more likely to be impacted by direct (quantitative) measures such adjustments to the statutory reserve ratio than indirect measures based on price signals.

Overall, while both the interest rate and credit channels are found to be operative in Zambia similar to Iddrisu and Alagidede (2020) for South Africa, the transmission of monetary policy to inflation is found to be stronger under the credit channel than the interest rate channel reflected in the statistically significant eventual impact coefficient under the former. This is comparable to earlier results by Zgambo and Chileshe (2014), Funda (2014), as well as Chileshe and Akanbi (2017). The results are tenable given the magnified role that bank deposits play in the asset base of commercial banks in Zambia (see section 3). As argued by Cottalerri and Kourelis (1994), financial markets in low-income countries tend to be less flexible to lending rates thereby limiting the effectiveness of monetary policy transmission mechanism through the interest rate channel. This is evidenced in the modest coefficient on lending rates of 0.022 in the investment equation under the interest rate channel, which partly explains the weakness of the interest rate channel in Zambia.

Table 4: The bank lending (credit) channel

	Credit Equation	Investment Equation	Inflation Equation
$\mathbf{DMPR_{t-2}}$	-0.034 (-2.408) **		
GDPG	-0.003 (-0.531)		
DLOG_EXCH	0.317 (2.097) **		
DDPSR	0.009 (0.559)		
DLOG_PSC		0.611 (1.859) ***	
DALR		-0.007 (-0.437)	
DLOG_CPI		1.813 (2.287) **	
DLOG_GFCF			0.239 (2.382) **
DALR			0.009 (1.758) ***
DLOG_EXCH			-0.064 (-0.804)
Constant	0.021 (1.284)	-0.040 (-1.508)	0.023 (4.912)*
Eventual Effect of MPR on Inflation ($\hat{\boldsymbol{\phi}}$)			-0.0049 (1.745)***

Source: Estimation output from E-views

Note: *, ** and *** denote statistical significance at 1, 5 and 10 percent levels of significance, respectively, t-values are in parenthesis.

Robustness Check: Interest Rate Channel Revisited

The interest rate channel is revisited by considering the transmission of monetary policy to inflation through consumption, rather than investment as a proxy for aggregate demand. The results are reported in Table 5. In line with theory, a percent restriction in monetary policy increases lending rates by 0.38 percent. The assumption here is that market interest rates broadly rise in response, which incentivises saving and induces a postponement of consumption in the current period. As a result, consumption, denoted by *LOG_RS* in Table 5, reduces by 0.03 percent as shown in the third column. This slows down aggregate demand and leads to a 0.13 percent decline in inflation. The estimated coefficients of interest throughout the transmission process are all statistically significant at conventional levels of significance.

Following the steps explained earlier, the eventual effect of a percent restriction in the monetary policy rate is recalculated. The earlier results are robust to changing the component of aggregate demand as the eventual impact of a percent tightening of monetary policy on inflation in the revisited interest rate channel is largely unchanged at 0.0017 percent.

Table 5: The Interest Rate Channel Revisited

	Lending Rate Equation	Consumption Equation	Inflation Equation
$DMPR_{t-2}$	0.382 (1.710) ***		
GDPG	-0.010 (-0.155)		
D_BOND_RATE	0.103 (1.493)		
DDPSR	0.861(3.311)*		
DAL		-0.034 (-2.035) **	
DLOG_EXCH		0.178 (0.804)	
DLOG_CPI		1.679 (2.152)**	
DLOG_RS			0.131 (2.364) **
DALR			0.008 (1.431)**
DLOG_EXCH			0.099(1.954)***
Constant	0.265 (-0.509)	-0.017 (-0.719)	0.024 (6.342)*
Eventual Effect of MPR on Inflation ($\hat{\phi}$)			-0.0017 (1.503)

Source: Estimation output from E-views

Note: *, ** and *** denote statistical significance at 1, 5 and 10 percent levels of significance, respectively

Given the nature of the model specifications employed, a plausible expectation is for the results to be affected by multicollinearity. However, the results from variance inflation factors (VIF) tests for multicollinearity reported in Table 6 indicate no evidence of multicollinearity as all VIFs in the individual equations are less than the threshold of 10.

Table 6: Variance Inflation Factors tests for Multicollinearity Results

	Lending Rate Equation	Investment Equation	Inflation Equation	Credit Equation	Consumption Equation
DLOG_GFCF			1.00		
DALR		1.123	1.035		1.128
DLOG_EXCH			1.036	1.156	1.755
DLOG_PSC		1.011			
D__BOND_RATE	1.119				1.306
DLOG_CPI		1.111			1.525
$DMPR_{t-2}$	1.365			1.265	
GDPG	1.028			1.127	
DDPSR	1.341			1.246	

Source: Estimation output from E-views

7. Conclusion

There is a wide consensus on the long-run neutrality of monetary policy and its affect on real economic activity in the short-run (Boughrara, 2009). However, there is considerable disagreement on how monetary policy is transmitted to the real economy. Some studies have identified different channels of monetary policy transmission, broadly classified as 'price', 'credit' and expectations transmission (Cecchetti, 1995; Bernanke and Gertler, 1995). Available literature has shown that monetary policy changes have important implications for aggregate demand, and thus on both output and prices. Further, literature identifies several ways in which policy actions get transmitted to the real economy (Mishkin, 1996). However, hitherto, little is known about the role of aggregate demand or its components in the transmission of monetary policy in Zambia. Authors that have explored monetary policy transmission dynamics in Zambia have relied mostly on vector autoregressions to infer the impact of monetary policy shocks directly on inflation with little or no regard to the role of aggregate demand in this process.

This study employed the three-stage least squares (3SLS) technique to investigate the transmission of monetary policy to inflation via the interest rate and bank lending channels while capturing the effect at each stage of the transmission process in line with Zellner and Theil (1962), Nosier and El-Karamani (2018) and Iddrisu and Alagidede (2020). This technique provides quantifiable monetary policy effects in a step-by-step fashion and the eventual effect that is more intuitive compared to the widely used VAR technique where impulse responses and variance decompositions are mostly discussed.

Under the interest rate channel, a percent increase in the monetary policy rate increases commercial banks lending rates by approximately 0.39 percent. This dampens investment by 0.022 percent and induces a 0.179 percent fall in inflation. The overall eventual effect of a percent restriction in monetary policy on inflation is 0.0015 percent but is statically insignificant. These results are robust to varying components of aggregate demand as the eventual impact of a percent tightening of monetary policy on inflation, when consumption is used to proxy demand, only increases marginally to 0.0017 percent from 0.0015 percent, when aggregate demand is proxied by investment.

For the credit channel, a percent increase in the MPR reduces the amount of credit that banks extend to the private sector by 0.03 percent. This leads to a decline in investment expenditure by 0.61 percent and in inflation by 0.24 percent. The eventual effect of a percent restriction in monetary policy on inflation under the credit channel is 0.0049 percent and is statistically significant. Hence, the credit channel is more effective than the interest rate channel. This is broadly in line with existing literature which established a stronger credit channel and a less potent interest rate channel of monetary policy transmission in Zambia.

All the step-by-step coefficients of interest in the transmission process are statistically significant, implying that investment and consumption are critical for the transmission of monetary policy in Zambia. However, the coefficients for the eventual effect of monetary policy on inflation computed under both the interest rate and credit channels are modest, possibly indicating that other components of aggregate demand such as Government expenditure and net exports could play a more significant role, a subject which future research can look at.

These findings underscore the need for reforms to enhance the efficacy of financial markets as a conduit for the transmission of monetary policy. This is crucial in strengthening the interest rate channel which is a bedrock of the inflation targeting regime. The results enable policy makers to identify the stages of the transmission process at which their actions are more impactful and where they are less prominent.

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Appendix

Traditional Interest Rate Channel

System: INTEREST_RATE_CHANNEL
Estimation Method: Three-Stage Least Squares
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.127249	0.244032	0.521441	0.6036
C(3)	1.036922	0.294789	3.517509	0.0007
C(4)	0.049206	0.066275	0.742458	0.4601
C(16)	0.390390	0.233783	1.669886	0.0990
C(18)	0.064670	0.066315	0.975193	0.3325
C(19)	-0.008739	0.021874	-0.399507	0.6906
C(20)	-0.022498	0.011749	-1.914912	0.0592
C(23)	1.242767	0.633112	1.962950	0.0533
C(25)	-0.160970	0.306746	-0.524768	0.6013
C(10)	0.022240	0.004088	5.440962	0.0000
C(11)	0.006514	0.003547	1.836586	0.0701
C(13)	0.098535	0.050440	1.953511	0.0544
C(15)	0.179706	0.076750	2.341455	0.0218
Determinant residual covariance		3.89E-07		

Equation: DALR = C(1) + C(3)*DDPSR + C(4)*D_BOND_YIELD_RATE +
C(16)*DMPR(-2) + C(18)*RGDP_GR

Equation: DLOG_GFCF = C(19) + C(20)*DALR + C(23)*DLOG_CPI + C(25)
*DLOG_PSC

Equation: DLOG_CPI = C(10) + C(11)*DALR + C(13)*D_LOG_EXCH +
C(15)*DLOG_GFCF

Traditional Bank Lending Channel

System: BANK_LENDING_CHANNEL
Estimation Method: Three-Stage Least Squares
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.021428	0.016688	1.284018	0.2027
C(3)	0.009342	0.016719	0.558786	0.5778
C(4)	0.317298	0.151303	2.097099	0.0390
C(16)	-0.033958	0.014102	-2.407978	0.0183
C(18)	-0.003059	0.005761	-0.531067	0.5968
C(19)	-0.040375	0.026782	-1.507529	0.1355
C(20)	-0.007474	0.017116	-0.436644	0.6635
C(23)	1.812629	0.792666	2.286750	0.0248
C(25)	0.611983	0.329212	1.858932	0.0666
C(10)	0.023416	0.004767	4.912152	0.0000
C(11)	0.009090	0.005171	1.757894	0.0825
C(13)	-0.063697	0.079200	-0.804249	0.4236
C(15)	0.239433	0.100509	2.382209	0.0195
Determinant residual covariance		9.35E-10		

Equation: DLOG_PSC = C(1) + C(3)*DDPSR + C(4)*D_LOG_EXCH + C(16)
*DMPR(-2) + C(18)*RGDP_GR

Equation: DLOG_GFCF = C(19) + C(20)*DALR + C(23)*DLOG_CPI + C(25)
*DLOG_PSC

Equation: DLOG_CPI = C(10) + C(11)*DALR + C(13)*D_LOG_EXCH +
C(15)*DLOG_GFCF

Interest Rate Channel Revisited

System: INTEREST_RATE_CHANNEL_REVISITED
Estimation Method: Three-Stage Least Squares
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.265228	0.243258	1.090317	0.2786
C(3)	0.861054	0.260069	3.310864	0.0014
C(4)	0.103265	0.069182	1.492667	0.1392
C(16)	0.381791	0.223262	1.710059	0.0909
C(18)	-0.010044	0.064803	-0.155000	0.8772
C(19)	-0.017016	0.023677	-0.718672	0.4743
C(20)	-0.033876	0.016644	-2.035390	0.0449
C(23)	1.679422	0.780331	2.152193	0.0342
C(26)	0.178011	0.221503	0.803649	0.4238
C(10)	0.020745	0.003758	5.519686	0.0000
C(11)	0.008325	0.003764	2.211426	0.0297
C(13)	0.077516	0.052133	1.486873	0.1407
C(15)	0.130841	0.055348	2.363992	0.0203

Determinant residual covariance	6.33E-07

Equation: DALR = C(1) + C(3)*DDPSR + C(4)*D_BOND_YIELD_RATE +
C(16)*DMPR(-2) + C(18)*RGDP_GR

Equation: DLOG_RETSALES = C(19) + C(20)*DALR + C(23)*DLOG_CPI +
C(26)*D_LOG_EXCH

Equation: DLOG_CPI = C(10) + C(11)*DALR + C(13)*D_LOG_EXCH +
C(15)*DLOG_RETSALES

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