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Zambian private sector credit's response to changes in monetary policy

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Abstract

The aim of the study is to document 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. The empirical approach uses monthly time series data on private credit, average lending rate and GDP covering the period 2001M1 to 2015M12.Using a VECM approach, results indicate that positive changes in monetary policy leading to higher lending rates have a negative impact on private sector credit in the long-run. Further, the results show that in the short-run, credit is primarily driven by its own dynamics with a lag of months and GDP with a lag of six months. Since a rise in the policy rate leads to a rise in the interbank rate and ultimately the bank lending rate, the implications for monetary policy variations are that, a rise in the policy rate will lead to a fall in credit in the long run and vice versa.

JEL classification: E5
Key words: Private sector; credit; monetary policy

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Contents

1. Introduction

Available literature has shown that monetary policy changes have important implications for aggregate demand, and thus on both output and prices. Further, this literature identifies a number of ways in which policy actions get transmitted to the real economy (Ireland, 2008; Mishkin, 1996). In particular, this literature identifies the following transmission channels of monetary policy: exchange rate channel; asset price channel; interest rate channel; credit channel; and, expectations channel.

In applied monetary policy analysis, it is conventional wisdom that the channels through which monetary policy operates need to be clearly understood and analysed before one can formulate and later on implement monetary policy. Researchers and policy-makers alike have engaged in studying the transmission mechanisms through which changes in monetary policy brought about by the monetary authorities are transmitted to real sector variables.

An exploration of literature further indicates that monetary policy transmission mechanism is a well-researched area of monetary economics and Zambia is not exempted. For example, Chileshe et al. (2014), Zgambo and Chileshe (2014), Mutoti (2006) and Simatele (2004) examines the effects of monetary policy on real sector variables and makes only inferences to channels of monetary policy transmission. However, recent studies such as those by Chileshe (2016) and Simpasa et al. (2014) have devoted efforts to exploring channels of monetary policy transmission. For example, Chileshe (2016) examined the relative importance of the different channels of the monetary policy transmission in Zambia using vector autoregressive methods and found that exchange rate and credit channels are the most effective channels. In another similar study, Simpasa et al. (2014) undertakes a comprehensive study of the bank lending channel in Zambia using panel data methods. Results from Simpasa et al. (2014) indicate that the transmission of monetary policy changes through the bank lending channel is stronger through large and moderate medium sized banks while it is virtually non-existent in smaller banks.

Although, studies by Chileshe (2016) and Simpasa et al (2014) study the credit channel of monetary policy transmission in Zambia, they do not tackle the issue of the nature of private sector credit in the short and long-term visa-vie the monetary policy conditions. Hence, in this study, we take the debate further and aim at providing evidence of the intrinsic characteristics of the credit channel in Zambia. The insights gained are particularly relevant to monetary policy implementation in Zambia. The understanding gained helps to establish effects of a given monetary policy on private sector credit and ultimately the economy. This is the key point of departure from what has been done so far on the credit channel transmission in Zambia. Therefore, the paper builds rather than detract from the already existing empirical literature on the intrinsic features of the credit channel transmission in Zambia. Thus, the main objective of this study is to investigate the long-run and short-run effects of changes in monetary policy on private sector credit.

Using monthly data of three variables namely, GDP, private sector credit and average lending rate, a VECM approach provides evidence that there is a negative long run relationship between private sector credit and the lending rate (proxy for monetary policy) suggesting

that the nature of the credit channel is such that private sector credit declines in the long-run following tightening monetary conditions, thus also validating the credit channel in Zambia. Furthermore, the results suggest that in the short-run credit is driven by its own dynamics with a lag of 3 months and economic activity with a lag of 6 months.

The rest of the paper is structured as follows; section II presents literature review. Section III outlines the Theoretical framework; section IV presents the Empirical model and estimation strategy while Section; Section V concludes.

2. Literature Review

Majority of the existing literature focused on modeling credit demand on aggregate level. In these models, for example, most studies use a set of explanatory variables, which usually include GDP per capita or real GDP, real or nominal interest rate and the inflation rate (Calza et al., 2001, 2003; Brzoza-Brzezina, 2005; Boissay, Calvo-Gonzalez and Kozluk, 2006 and Kiss, Nagy and Vonnak, 2006). It was further observed that most empirical research devoted to the determination of credit frequently employs cointegration techniques to estimate mainly demand relationships (e.g. Hofmann, 2001; Calza et al., 2003). Schadler et al. (2004) estimated a vector error correction model (VECM) on quarterly euro area data for 1991-2002. The VECM of the demand for credit included three variables: the credit-to-GDP ratio, a proxy for the cost of credit (long-run real interest rate on government bonds) and per capita income.

Several other studies based on aggregate data have searched for empirical evidence for the bank lending channel of monetary policy, taking into account both demand and supply side of credit developments. For instance, Hulsewig et al. (2001) investigated the relevance of bank lending channel in the transmission of monetary policy in Germany on basis of aggregate bank loan data. With a VECM analysis, they identified supply and demand relationships in the German loan market by imposing restrictions on the long term cointegration vector to reveal the systematic impact of monetary policy actions. They concluded that the bank lending channel in Germany is effective through both loan demand and loan supply. The study found that banks base their loan supply on their credit margin that is affected by monetary policy actions and their capital position, while loan demand by firms and households is related to the private part of real output and the loan interest rate. From the short–run dynamics of the VECM they concluded that in case aggregate bank loans deviate from equilibrium the return to it is not prompted solely by the adjustment of loans themselves, but also by the adjustment in the interest rates.

Calza et al. (2001) estimated credit demand on aggregate level in the euro area. Using the Johansen methodology, the study identified one cointegrating relationship linking real loans, GDP and interest rates. This relationship implied that in the long-run, real loans are positively related to real GDP and negatively to real short-term and long-term interest rates. Both the signs and the magnitude of the coefficients suggested that the cointegrating vector described a long-run demand equation. The short-run dynamics of the demand for euro area real loans were subsequently modeled by means of a Vector Error Correction Model (VECM).

In another study by Kakes (2000), the role of bank lending in the monetary transmission process in the Netherlands was investigated. The Johansen approach and a vector error correction model (VECM) analysis was used to identify supply and demand relationships in the credit market for the Netherlands, thereby testing the validity of the bank lending channel in that country. He found that the market for bank credit is demand-determined rather than supply determined. These results were found to be consistent with earlier findings that banks hold a buffer stock of securities which they use to offset monetary shocks.

Within the region, a study by Ludi et al. (2006) examined the bank-lending channel of the credit channel of monetary policy in South Africa by making use of structural vector autoregressions (SVAR's). Using the Johansen cointegration procedure to test for a demand or supply driven bank-lending channel, found a cointegrating equation which by imposing restrictions such that the cointegrating equation is normalised with respect to loans, reflected a loan equation. The resulting estimated coefficients pointed towards demand driven, rather than supply driven, bank lending. The pass-through effects of a change in the repurchase (repo) rate on bank deposits and loans and output, were tested using impulse response functions and variance decomposition analysis from a parsimonious vector error correction model (PVECM).

In Zambia, we note a study by Simpasa et al. (2014) based on panel data regressions which explored the effect of monetary policy on lending behaviour of commercial banks in Zambia. Interacting bank specific factors with indicators of monetary policy, they found evidence of bank lending channel operating mainly through large banks. The effect of monetary policy on medium sized banks was found to be moderate while it was found to be effectively non-existent for smaller banks. Particularly, the findings suggested that the ability of monetary policy to generate large distributional effects also depends on whether or not it impacts the reserves of large sized banks. Further, their findings showed that monetary policy anchored on price signals is more potent than that based on quantity aggregates.

3. Methodology

3.1.Theoretical Framework

The founding assumptions are as postulated by Krylova (2002), who asserted that the crucial argument of the credit view is the distinct role played by financial assets and liabilities. It is assumed that firstly, internal funds, bank loans and other sources of financing are imperfect substitutes for firms. Secondly, a heterogeneous structure of borrowers leads to different reactions among them to changes in credit conditions. Thirdly, a wedge between external and internal financing can occur due to imperfect information or costly enforcement of contracts. And finally, the growth of interest rates influences firms with weaker balance sheets stronger.

Based on above assumptions, the bank lending channel assumes that bank credit remains the dominant source of financing for small and medium-sized firms, whereas large firms can directly access the credit market issuing corporate securities like stocks and bonds.

This paper adopts and modifies the theoretical approach by Ludi et al (2006) who using a VAR model and South African data, tested whether the transmission through bank lending channel is demand driven or supply driven and found that credit was demand driven. The authors' theoretical argument was that if bank loans are demand-driven, tightening monetary policy reduces bank loans due to rising costs of funds, and thus through the money multiplier, reduce bank deposits. Lower bank loans imply lower private consumption expenditure and investment, and thus lower output. In the Zambian case therefore, this argument is modified as follows:

$$\uparrow BoZ\ Rate \rightarrow \uparrow Lending\ rate \rightarrow \downarrow Bank\ Loans \rightarrow \downarrow Bank\ deposits \rightarrow \downarrow I, \downarrow C \rightarrow \downarrow Y$$

Furthermore, that if however, bank loans are supply driven, tightening monetary policy lowers credit limits due to higher possible bank earnings, thereby increasing bank loans, which increases bank deposits, increasing private investment and consumption ultimately raising output.

$$\uparrow BoZ\ Rate \rightarrow \uparrow Lending\ rate \rightarrow \uparrow Bank\ Loans \rightarrow \uparrow Bank\ deposits \rightarrow \uparrow I, \uparrow C \rightarrow \uparrow Y$$

This argument is conditioned on the assumption that banks seek to maximize the difference between interest rates on loans, bonds and interest rate on deposits received.

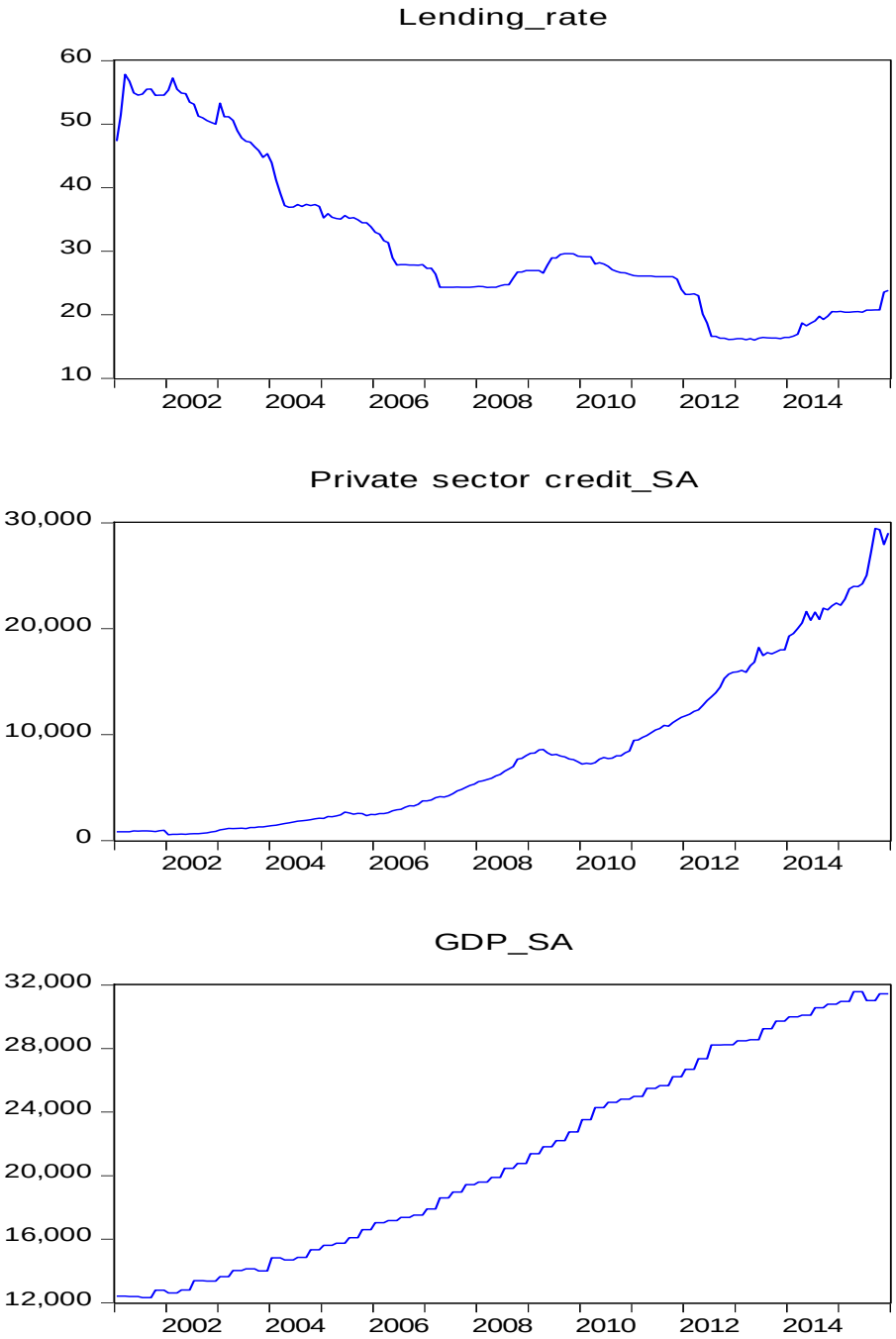
3.2.Data and Variable Description

The study uses monthly data from January 2001 (2001M1) to December 2015 (2015M12). The monthly data on GDP is unavailable and therefore generated in Eviews by decomposing annual Real GDP, the monthly average lending rate (lending rate) and private sector credit are extracted from the BoZ fortnightly statistics tables. Private sector credit and GDP are seasonally adjusted in order to remove seasonal fluctuations in the series during the year. With an exception of the lending rate, GDP and private sector credit have been transformed into natural logarithms. The variables and data sources used are discussed in Table 1 below and presented figure 1.

Table 1: Data description

Data series	description and transformation	Source
Private Sector credit	monthly commercial Banks' loans and advances, natural logarithms	Bank of Zambia, Monetary Survey
Average lending rate	nominal average lending interest rate, daily data taken as average over a month period	Bank of Zambia, Fortnightly statistics
GDP	real GDP, transformed using Eviews function, natural logarithms	Central Statistical Office

Figure 1: Lending rate, Private credit and GDP series

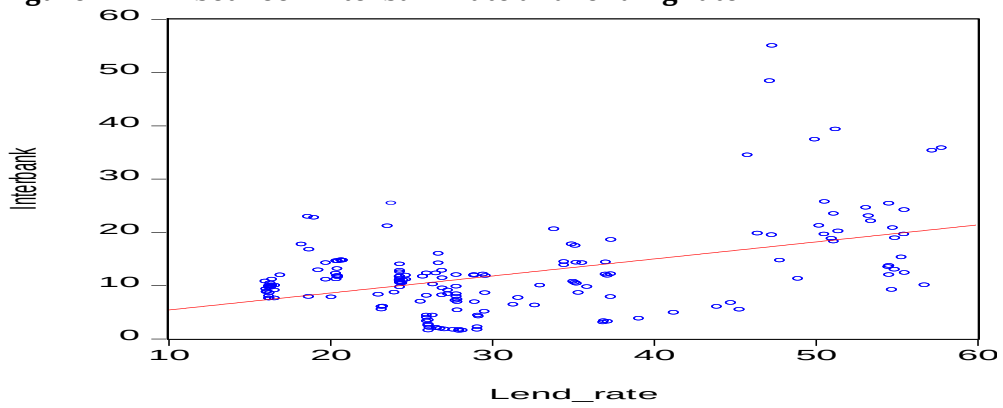


Source: Bank of Zambia

While we would have preferred to use the actual BoZ policy rate in studying the run-run and long-run interaction between monetary policy and credit, the policy rate series is only available for the period starting April 2012 when the new monetary policy framework that signal price was implemented. As such, for a monetary policy instrument proxy, we will use the lending rate. Preliminary observations have guided the decision of variables, for example, the researcher observed strong positive relationship (correlation) between the

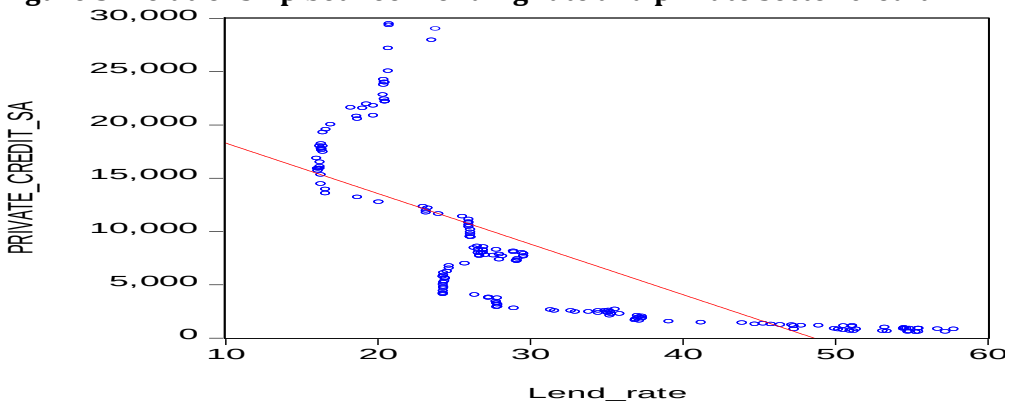
BoZ intermediate target, the interbank rate, and the lending rate established by regression (See regression line in figure 2 below).

Figure 2: Link between interbank rate and lending rate



Furthermore, in accordance with theoretical constructs, we expect a negative relationship between the lending and private sector credit. That is, high cost of money is associated with declining credit to private sector. This is on assumption that private sector firms are profit maximisers looking to achieve the largest gap possible between revenue and costs. In figure 3 below, we present a scatter plot with a superimposed regression line. Clearly, we observe an inverse relationship between private sector credit and commercial banks' lending rate.

Figure 3: Relationship between lending rate and private sector credit



3.3.Unit Root and Lag Selection

The time series properties are documented in Table 2, which reports the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for the levels and first differences of the variables. Using the ADF and PP unit root tests, we tested for unit roots in the time series and found that all data series were non-stationary in levels. However, all data became stationary in first differences. Literature shows that, in the presence of non-stationary variables it is likely that cointegration among variables may exist. In this view, a Johansen test of cointegration was performed which revealed that there was one cointegrating vector (Table 4). Literature further shows that if there is evidence of

cointegration in data, it is consistent to estimate a VAR in levels or a Vector Error Correction Model (VECM) (Geda et al., 2006). In this study, the VECM was estimated.

Table 2: Augmented Dick Fuller (ADF) and the Phillips-Perron (PP) unit root tests

		Level		First difference	
		t-statistic	prob.	t-statistic	prob.
GDP	ADF	-3.878413	0.9740	-3.87841	0.0178
	PP	-2.877544	0.9965	-2.87764	0.0000
lending rate	ADF	-2.877544	0.6662	-2.87773	0
	PP	-2.877544	0.667	-2.87764	0
Private sector credit	ADF	-2.877823	1	-2.87802	0.0262
	PP	-2.877544	1	-2.87764	0

Source: Computations by the Authors

3.4.Empirical Strategy

Formally, suppose x_t is a vector of n variables, which can be expressed as:

$x_t = \sum_{i=1}^{\rho} A_i x_{t-1} + \varepsilon_t$ where $\varepsilon_t \sim iid(0, \omega)$ ...1

The VECM representation of x_t is

$\Delta x_t = \pi x_{t-1} + \sum_{i-1}^{\rho-1} \pi_i \Delta x_{t-i} + \varepsilon_t$ ...2

Where $\pi = -[1 - \sum_{i=1}^{\rho} A_i]$ and $\pi_i = -\sum_{j=j+1}^{\rho} A_j$ ...3

π is the cointegrating space of the VECM and represented by $\pi = \alpha.\beta'.\alpha$ is the loading matrix of the dimension $n \times r$, and β is the matrix of the cointegrating vectors of the dimension $n \times r$.

Since we found seven lags to be optimal for the VAR, a VECM with six lags was estimated. The VECM also took account of the short-run variations in the cointegrating relationships.

Furthermore, given that we found rank $(\pi) = 1$, equation 2 can now be rewritten in matrix form as;

$$\Delta x_t = \sum_{i=1}^{\rho-1} \pi_i \Delta x_{t-i} + \alpha\beta' x_{t-1} + \varepsilon_t \quad \ldots 4$$

Where the single cointegrating vector is $\beta = (1, \beta_2, \beta_3)'$ and the speed of adjustment parameters are given by $\alpha = (\alpha_1 \alpha_2 \alpha_3)'$.

3.5.Model

Put in another way the Johansen (1988) cointegration test was conducted to estimate a long-run relationship and hence a credit equation. Johansen (1988) allows one to estimate multiple long run relationships between a set of non-stationary variables, via cointegrating vectors, as well as any short run dynamics in these variables thereby providing a statistical framework, which allows analysing long–term relationships between non-stationary time series in a dynamic specification.

In addition, the lag-selection tests were performed to select the appropriate lag length of the VAR. Lag length selection criteria results presented in table 3 below suggests different lag lengths for the model. Since our sample is relatively small, according to Liew (2004), AIC and FPE may be employed to choose the optimal lag length in the VAR because they produce the least probability of under estimation among all criteria. Hence, a stable VAR[2] model with seven lags and subsequently a VECM with six lag was estimated.

Table 3: Lag-selection for the VAR model with credit, BoZ policy rate, average lending rate and GDP

Lag	LogL	LR	FPE	AIC	SC	HQ
1	1388.766	NA	2.16e-11	-16.04379	-15.87909*	-15.97697
2	1403.207	27.87562	2.03e-11	-16.10706	-15.77767	-15.97342
3	1421.139	33.98731	1.83e-11	-16.21092	-15.71684	-16.01046
4	1438.448	32.20247	1.66e-11	-16.30754	-15.64876	-16.04025*
5	1444.149	10.40755	1.73e-11	-16.26917	-15.44570	-15.93507
6	1456.699	22.47370	1.66e-11	-16.31046	-15.32229	-15.90953
7	1477.856	37.14797*	1.44e-11*	-16.45182*	-15.29896	-15.98407
8	1486.328	14.57854	1.45e-11	-16.44567	-15.12811	-15.91110

Source: Computations by the Authors

Table 4 shows the results of both the trace and the maximum eigenvalue tests. It was found that, there was one cointegrating vector to be applied under the model with a linear trend in the data, intercept (no trend) in the cointegrating equations (CE) and in the VAR. Tests below show a single cointegrating equation, therefore, rank $(\pi) = 1$ and πx_{t-1} in equation 2 below is therefore, the error correction term.

[2] No root lies outside the unit cycle

Table 4: Johansen Cointegration test

Test	Statistic	P-value	No. CE's
Trace	13.07633	0.1119	1
Maximum Eigenvalue	7.094060	0.4780	1

The estimated VECM with long-run and short-run relationship between private sector credit, commercial banks' lending rate and GDP is presented below;

Short-run equation

$$\Delta lcre = \underset{(0.82506)}{0.0079} + \underset{(2.309)\ **}{0.19009}\Delta lcre_{t-3} + \underset{(2.27896)\ **}{0.006}\Delta lgdp_{t-6} - \underset{(-2.867)\ ***}{0.1044} ecm_{t-1}$$

Long-run equation

$$ecm_{t-1} = lcre_{t-1} + \underset{(2.85152)\ ***}{1.815718} lending\ rate_{t-1} - \underset{(-12.3411)\ ***}{3.059367} lgdp_{t-1} + 21.27856$$

$R^2 = 0.23$; Serial correlation LM-statistic = 19.02 (0.26); Normality test J-B test = 15.17 (0.19); White's heteroskedasticity test X^2 = 141.68 (0.08). ***, **, * = 1%, 5% and 10% significance level, respectively.

In order to estimate the long-run credit equation, restrictions were imposed such that the cointegrating equation was normalised with respect to credit, so as to reflect a credit equation'i.e. $B(1,1)$ is set equal to 1. Furthermore, given that the error correction function was set up in the following order, EC(C,1) 1 6 LOG(PRIVATE_CREDIT_SA) LENDING_RATE LOG(GDP), by setting $B(1,3) = 0$, the coefficient on GDP equal to zero in the long-run equation (the cointegrating equation), we captured the link between monetary policy and credit, hence credit channel of the monetary policy transmission mechanism. The resulting equation enables us to analyse the transmission from the monetary policy to credit. Put differently, by normalizations and restrictions on the cointegrating coefficients, it is possible to interpret the cointegrating equation below as a credit demand equation (t-values in brackets).

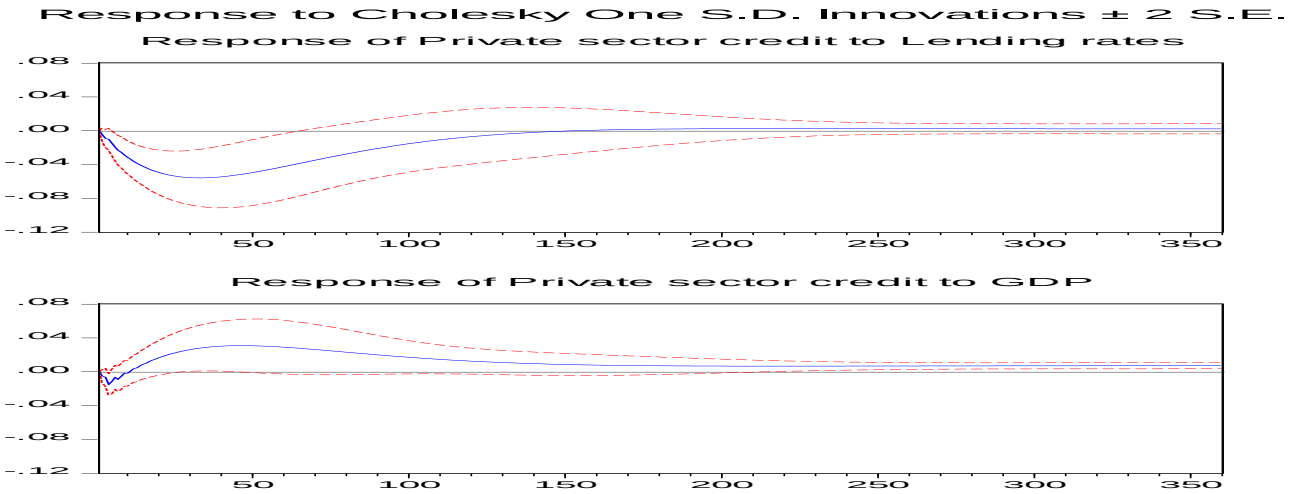
$$CREDIT_t = \underset{(6.62896)\ ***}{-7.208287} * Lending\ rate_t + 10.72327 \qquad \ldots 5$$

From the credit equation above, it is clear that commercial banks' credit to the private sector inversely relates with the monetary policy conditions in the long-run. This in essence implies that when the policy rate increases, credit to private sector by banks declines. This result is consistent with Simpasa et al. (2014) finding that price signals matter the most in the transmission of monetary policy.

Figure 5 below graphically show the response of private sector credit response to commercial banks' lending rate and economic activity. A positive one standard deviation shock to the lending rate leads to a fall in advancement of credit to the private sector before

the shock dies out in the market. We also observed that a one standard deviation shock to output leads to rise in credit demand but with a lag.

Figure 5: Response functions of private sector credit to commercial banks' lending rate and GDP from a VAR



From the short-run dynamics of the VECM, we observed that in case aggregate credit level deviate from equilibrium, the return to it is prompted by the adjustment of credit itself with a lag of 3 months and GDP with a lag of 6 months.

4. Conclusion

The main objective of this study was to investigate the short-run and long-run effects of changes in monetary policy on private sector credit. To do so, the study undertook an econometric investigation using VARs in conjunction with the Johansen procedure to determine the existence of a stable long run relationship between credit and the monetary policy. A VECM was estimated and by restricting the coefficient on GDP in the cointegrating equation, we established that credit is negatively related to monetary policy conditions in the long-run. This implied that an increase in the monetary policy rate which leads rising market lending rates tend to contract credit to the private sector. The implications for monetary policy variations are that, a rise in the policy rate leads to a fall in credit in the long run and vice versa.

In terms of short-run dynamics, we observed that in case aggregate credit level deviate from equilibrium the return to it is prompted solely by the adjustment of credit itself with a lag of 3 months and GDP with a lag of 6 months. The findings indicate that contractionary or expansionary policy will decrease or increase private sector credit growth in the long-run. In addition, this result provides additional evidence that validates the credit channel of the monetary policy transmission in Zambia.

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