The Relative Importance of the Channels of Monetary Policy Transmission in a Developing Country: The Case of Zambia

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Abstract
This study sought to examine relative importance of the different channels of the monetary transmission mechanism in Zambia. Vector Autoregressive Methods are used to examine the strength of each channel of monetary policy, namely interest rate, Exchange rate, credit and asset price channels. Results indicate that the exchange rate and credit are effective channels of monetary policy transmission in Zambia. Further, the study shows that although the interest channel is working it is weak while the equity or asset price channel is not important. From a policy perspective, these results imply that Central Bank is required to continuously monitor developments in the credit and conditions in foreign exchange markets in order to design effective monetary policies. In addition, concerted efforts are needed towards enhancing the asset/equity price channel in Zambia to make monetary policy to be more effective.

Keywords: Monetary Policy;, Transmission Channel, Central Bank, Zambia, VAR.
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1.0 Introduction

In the last two decades, an increased number of Central Banks have moved away from traditional monetary policy frameworks such as Monetary Aggregate Targeting (MAT) to Inflation Targeting (IT), Zambia included.This movement has been motivated by a number of reasons: chief among them is the weakening relationship between monetary aggregates and inflation, a key ingredient of MAT. For an IT 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). Information on the effective channels of monetary policy is important for a number of reasons. First, such information is important to policy makers in choosing an anchor for monetary policy. Second, a thorough understanding of monetary policy channels is necessary if policy is going to have the desired results (Tahir, 2012). Third, a good understanding of the channels of monetary policy working in a particular country provides information about the type of reforms which are needed before implementing IT framework.

Despite the importance of knowledge on channels of monetary policy transmission, all studies so far on Zambia have paid little attention to this topic (Chileshe *et al.*, 2014; Zgambo and Chileshe, 2014;Simatele, 2004; and Mutoti, 2006). All these studies focus on the effect of monetary policy on real sector variables of inflation and economic activity while providing some general inferences regarding which channels of monetary policy are working or not. Specifically, they do not identify the channels of monetary policy transmission which are effective. However, there is a lot of literature from the developed and emerging economies on channels of monetary policy transmission (Tahir, 2012; etc). It is against this background that the objective of this study is to *investigate the relative importance channels of monetary policy which are working in Zambia*. It answers the following research questions: Is the interest channel effective in Zambia? Is the exchange rate channel effective? Is the credit channel working? Is the asset/equity working in Zambia?

The study utilised a Vector Auto Regression (VAR) approach in which a channel variable is introduced endogenously and exogenously and then impulse response functions from the two models are compared. Results indicate that the exchange rate and credit are effective channels of monetary policy transmission in Zambia. Further, the study shows that although the interest channel is working it is weak while the equity channel is not working.

The rest of the paper is organised as follows. Section 2 provides empirical and theoretical literature while section 3 provides the methodology used in the study. Section 4 provides the main empirical results and section 5 concludes and gives policy recommendation.

2.0 Review of Literature

2.1 Theoretical Literature

Monetary policy affects real variables through changes in money aggregate or some form of interest rate (Ozdogan, 2009). Monetary policy changes are transmitted to real sector variables via the channels of monetary policy. Traditional theory identifies three channels namely; the interest rate, the exchange rate, and the asset/equity channel. However, recent works have added two more channels, the Credit and Expectations channels (Mishkin., 1996; 14).

2.1.1 Interest Rate Channel

According to the traditional interest channel, an increase in the money supply leads to a decrease in the real interest rate due to the Keynesian assumption of sticky prices. A fall in real interest rates induces an increase investment and consumer spending resulting in increased aggregate demand and economic activities (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. The rational expectation hypothesis of the term structure states that the long-term interest rate is an average of expected future short-term interest rates, suggesting that lower real short-

term interest rate leads to a fall in the real long-term interest rate. The Interest rate channel is often 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 proposes that as a result of these informational asymmetries, two channels of monetary transmission arise: those that operate through the effects on bank lending as well those that affect the firms' and households balance sheets. 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 bank 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 makes 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. As Mishkin (1996), Tahir, (2012) and Bernanke and Gertler (1995) emphasis that banks have a comparative advantage in assessing the balance sheets of borrowers and hence help in mitigating adverse selection as well as moral hazard. Under the balance sheet channel, there are several ways through which monetary policy affect the balance sheets of economic agents and hence the occurrence of moral hazard and adverse selection. Specifically, expansionary monetary policy enhances net worth of firms through increase in stock prices, reduction in the interest cost as well as increased sales. Enhancement in the net worth reduces the possibility of moral hazard and adverse selection thereby improving chances of these economic agents to access loans. Easier access to loans increases borrowing leading to increased consumer spending and investment, and consequently economic activity. It is important to emphasise 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 of monetary policy 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. On the demand side, expansionary monetary policy, leads to a fall in interest rates relative to the foreign inducing capital outflows leading to a depreciation of the local currency makes exports cheaper resulting in increased net exports and consequently aggregate demand and output (Mishkin (1996, 2001)). On the supply, expansionary monetary policy which depreciates the local currency raises the domestic price of imported goods, which leads to inflation pressures through the exchange rate pass-through (Butkiewiecz and Ozdogan, 2009).

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 Ando-Modigliani (1963) life cycle theory of consumption. The Tobin's Q measures the ratio of the stock market value of a firm to the replacement cost of physical capital. The Tobin's Q works as follows, expansionary monetary policy increases the demand for equities (either by the Keynesian or 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 Ando-Modigliani life cycle model of consumption monetary policy changes affect the economic agents' long-term wealth and therefore, alter their consumption pattern. The basic premise of Ando-Modigliani theory is that consumers smooth out their consumption over time and this consumption depends on lifetime resources and not only current consumption (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 output.

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 national stock market. This is confirmed by Butkiewicz and Ozgdogan (2009) who notes that the asset price channel in developing and emerging markets is weak and more unpredictable compared to developed economies due to shallower and uncompetitive markets as well as highly unstable macroeconomic environments.

2.1.5 The Expectations Channel

Since the early years of modern macroeconomics, expectations have been acknowledged to influence the behaviour of economic agents. For example, Keynes (1936) in his General Theory comments "…the behaviour of each individual firm in deciding its daily output will be determined by its short-term expectations — expectations as to the cost of output on various possible scales and expectations as to the sale-proceeds of this output; though, in the case of additions to capital equipment and even of sales to distributors, these short-term expectations will largely depend on the long-term (or medium-term) expectations of other parties". Economists generally agree that expectations are important in influencing economic activity, but they differ on how these expectations 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.

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. Empirically, 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 be used to influence expectations of future inflation and thus influence 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 behaviour 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

Although empirical studies on effects of monetary policy have been going on for decades, studies focussing on the channels of monetary policy transmission only started emerging in the 1990s. A majority of these studies are from developed world (Bernanke and Blinder, 1992; Ramey, 1993; De Fiore, 1998; Bernanke and Gertler, 1995; Berkelmans, 2005; Morsink and Bayoumi, 2001;Camerero and Ordonez, 1999; Bernanke and Kuttner, 2004; Christiano *et al.*, (1999,2001); Bjøbland and Havolsen, 2010; and DA'mico and Farka, 2011) and a few from emerging and developing (Tahir, 2012;) while very little from the sub-Saharan Africa (SSA) and Zambia in particular (Lungu, 2012;). This is despite countries in the SSA region using monetary policy as one of its macroeconomic stabilisation tools.

Studies in developed economies indicate that all the channels of monetary policy are working. In the USA, studies have found that the interest rate, credit and asset price channels are working (Bernanke and Blinder, 1992; Ramey, 1993; Christiano et al., (1999, 2001); Bernanke and Gertler, 1995; and, Bernanke and Kuttner, 2004). Specifically, Bernanke and Blinder (1992) finds that the credit and interest rate channels are working while Ramey (1993) finds that the money channel is more important than the credit or interest channels.In addition, Bernanke and Gertler (1995) finds evidence for the interest channel while Bernanke and Kuttner (2004) finds evidence for the interest rate and asset price channels. DA'mico and Farka(2011) study on the USA finds results similar to those by Bernanke and Kuttner (2004). Studies by Christino *et al.* (1999) and Christiano *et al.* (2001) finds evidence of the interest rate and the asset rate channels, respectively. On the other hand, studies on the channels of monetary policy in advanced small open economies have shown that in addition to channels in the USA they also find evidence for the exchange rate channel. A study by Camerero and Ordonez (1999) on Spain finds that the interest and exchange rate channels are working while Bjonland and Halvosen (2010) find similar results on six OECD countries (Australia, UK, Norway, Canada, Australia, and Sweden). Finally, Berkelmans (2005) study on Australia finds evidence of the exchange rate and credit channels while De Fiore (1998) obtains similar results on Israel.

Results of empirical studies in developing and emerging economies has shown that the dominant channels of transmission are the credit and exchange rate channels with very little evidence on asset price and interest rate channels. Specifically, all studies reviewed on emerging and developing economies found the exchange rate channel to be the dominant route of transmission (Cevik and Teksov, 2012; Tahir, 2012; Dabla-Norris and Floerkermeir, 2006; Butkiewcz and Ozdogan, 2009). Other channels of transmission from literature are credit channel (Sun, 2006; Afandi, 2005; Dabla-Norris and Floerkermeir, 2006; Kassim and Majid, 2008) and interest rate channel (Sun, 2006) and the asset price channel (Cevik and Teksov, 2012; Sun, 2006).

Just like studies on emerging markets, in Sub-Saharan Africa (SSA) studies have shown that the dominant channels are the exchange rate and credit channels. Studies on Nigeria by Isiohoro (2012); Ngalawa and Viegi (2011) on Malawi found evidence of the exchange rate channel while Boughrara (2008) on Morocco and Tunisia found bank lending channel. Furthermore, studies by Ngalawa and Viegi (2011) on Malawi and Lungu (2012) on southern African countries also found evidence of the bank lending channel.

Studies reviewed on Zambia, all conclude show support for existence of a stronger exchange rate channel compared to other channels of monetary policy. A study by Simatele (2004) investigated the effects of financial reforms on monetary policy transmission using a VAR model and found that the exchange rate channel is stronger than the bank lending channel while the interest rate channel is non-existent. Mutoti (2006) and Bova (2009) used a co-integrated sVAR and found evidence of the exchange rate channel. Funda (2012) investigates the effectiveness of the interest rate channel and concluded that it is a weaker channel of transmission. Chileshe *et al.* (2014) used the VAR with quarterly data and found that the interest rate channel is week while the exchange rate channel is

stronger. Although studies reviewed on Zambia make inferences about channels of monetary policy transmission, it is not their primary focus.

3.0 Methodology

3.1 Empirical Methods

Since the pioneering work of Sims (1980), the Vector Auto Regressive (VAR) model has been used as a standard tool for analysing monetary policy transmission (Davoodi *et al.* 2013; Cheng, 2006). This study uses a finite order VAR which is "a multivariate model in which each endogenous variable is regressed on its own lags and the lags of all other variables in the system; the number of lags determines the order of the VAR" (Kakes, 2000; 36). In addition, since Zambia is an open economy, it is affected by external factors which are exogenous implying the economy is best represented by a VAR model with exogenous external variables. In this regard, the baseline VAR model of the Zambian economy can be described by;

$$AY_t = B(L)Y_{t-1} + C(L)X_t + \varepsilon_t;\ \varepsilon_t \sim iid\ (0, \Lambda) \ldots\ldots\ldots\ldots 1$$

In equation 1, Y_t represents an $nx1$ vector of endogenous variables while X_t is an $mx1$ vector of exogenous variables, and ε_t is an $nx1$ vector of structural disturbances with a zero mean and constant variance, Λ. In this specification, *A* is an nxn matrix of contemporaneous coefficients of the interaction of variables in $Y_t$while *B* is the matrix of lagged coefficients on interactions in Y_t.

However, since the structural model given in (1) cannot be estimated directly due to inadequate information, the existence of the inverse of the matrix *A*, A^{-1}allows us to have a reduced-form of the structural model, which can be specified as follows (Cheng, 2006):

$$Y_t = A^{-1}B(L)Y_{t-1} + A^{-1}C(L)X_t + A^{-1}u_t;\ u_t \sim iid\ (0, \Sigma) \ldots\ldots 2$$

Or

$$Y_t = D(L)Y_{t-1} + \delta X_t + \mu_t;\ \mu_t \sim iid\ (0, \Sigma) \ldots\ldots\ldots 3$$

Where: $D(L) = A^{-1}B(L);\ \delta = A^{-1}C(L);\ \mu = A^{-1}\varepsilon_t$

Given that *A* is a matrix of contemporaneous coefficients in the structural model and *B(L)* is matrix of lagged coefficients in the model, we can define *G(L*) as the matrix of both contemporaneous and lagged coefficients as follows:

$$G(L) = A + B(L) \ldots\ldots\ldots\ldots\ldots 4$$

Following Cheng (2006) and using equation (3), structural and reduced-form equations can be related by:

$$D(L) = -A^{-1}B(L) \text{and } \delta = -A^{-1}C(L) \ldots\ldots\ldots\ldots 5$$

And the disturbance terms through:

$$\mu_t = A^{-1}\varepsilon_t \text{ Or } \varepsilon_t = A\mu_t,$$

This imply that,

$$\Sigma = A^{-1}\Lambda A^{-1} \ldots\ldots\ldots\ldots\ldots 6$$

In the baseline model, the endogenous variables are output (Real GDP), Consumer Price Index (CPI), Broad Money (M2), and Short Term Interest rate (BoZ Policy Rate) while the exogenous variables are the copper price (Cupr), Oil Price (Oilpr), and the Federal Funds Rate (FFR).

$$Y_t = [RealGDP, CPI, M2, TBrate] \quad \text{.....7 and } X_t = [Cupr, Oilpr, FFR] \quad \text{.....8}$$

The ordering determines the level of exogeneity of the variables, so that the most exogenous variables are ordered first as given in equation 7. Real GDP is ordered first on the assumption that real economic activity responds sluggishly to policy and other economic shocks; Consumer price index (CPI) comes second in the ordering on the assumption that prices have no immediate effects on output but respond quickly to changes in aggregate demand. Broad money is ordered after CPI to indicate that money stock has no contemporaneous effect on prices while the Treasury bill rate (which may represent a monetary policy shock) is ordered after broad money to indicate that it has no immediate effect on the money stock.

To evaluate the relative importance of each channel, the baseline model is re-estimated by adding the channel variables endogenously and exogenously. This is done because estimating a VAR model with all the channels variables make it difficult to assess the strength of each channel while at the same time it reduces the power of tests to be performed. VAR models allow a researcher to assess the strength of each channel by blocking off the effect of a particular channel by exogenizing the variable representing it (Ozdogan, 2009). Hence, the VAR model allows a researcher to compare the results from an endogenous and the exogenous model to assess the effectiveness of a particular channel. Specifically, the endogenous model is an extended version of the baseline model which includes the channels variables as one of the endogenous variables while the exogenous model is the baseline model which includes the channel variable as an exogenous variable.

In the extended endogeneous Vector Auto-Regressive with exogeneous (VARX) model, the vector of endogenous variables, Y_t, now looks as follows:

$$Y_t = [RealGDP, CPI, M2, TBrate, CHANNEL] \quad \text{.....9}$$

While the vector of the exogenous variables,X_t, remains the same. On the other hand, the extended exogenous VARX model, the vector of endogenous variables remains as in the baseline VAR while the exogenous vector changes,Y_t, changes to

$$X_t = [Cupr, Oilpr, FFR, CHANNEL] \quad \text{.....10}$$

After estimating the baseline, endogenous, and exogenous models the impulse response functions (IRFs) are computed. First, the IRFs of the baseline and the extended model are compared. Secondly, the extended exogenous VARX model is estimated and IRFs are obtained. Then the IRFs of the extended exogenous and endogenous models are compared to check for any diffrences and or check if the channel works or not. This approach is applied to each of the four major channels of monetary policy transmission; interest rate, exchange rate, asset price channel, and credit channels.

Finally, to check the robustness of the results, a test is done to check whether the monetary transmission channels work endogenously or exogenously. Several statistical tests can be used to undertake this test among them likelihood ratio test, the Wald Test, and the Langragian Multiplier test. In this study, the Likelihood Ratio Test is employed. The Likelihood Ratio Test is used in comparing the goodness of fit of two models; the 'full' model vs the 'simpler' model (Favero, 2001; Greene, 2012). The restricted model must be obtainable by restricting the parameters of the full model. In this study, the simpler or restricted model is the extended VARX model treating the channel as working exogeneously while the full model treats the channel working endogeneously. Specifically, the null hypothesis tested in this study states that the channel works exogenously over the alternative hypothesis that it works endogenously for each channel. The test statistic is given by;

$$LRT = -2\ln\left[\frac{L_{resticted}(\theta)}{L_{unrestricted}(\theta)}\right] \ldots\ldots 11$$

The LRT is assymptotically chi-square with degrees of freedom equal to the difference in the number of parameters in the two models. If the computed LRT is greater the critical value obtained from the Chi-square table we do not reject the null hypothesis, otherwise we do. Hence, if we reject the null hypothesis in our study we conclude that indeed the channel of monetary policy transmission being tested works.

As is now standard in time series analysis, unit root tests are performed using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and KPSS tests. The ADF and PP tests are done under the null hypothesis of unit root while the KPSS is carried out under the null-hypothesis of no unit root (Geda et al., 2011). Unit root tests are done because literature reveal that if variables are non-stationary then it is possible that there could be co-integrating relationships among the variables which have to be taken care of to avoid spurious results.

3.2 Data

This study utilises monthly data covering the period January 1993 to June 2015. Data on financial variables is obtained from from Bank of Zambia, while real GDP and CPI is from Central Statistical Office, the all share index from Lusaka Stock Exchange and commodity prices from World Bank, while the Federal Funds Rate is obtained from the FED.

Since GDP variably is only available on an annual basis quartely and monthly series were obtained by way of interpolation. In the analysis, the output or GDP data generated by the Denton interpolation method (see Baum and Renka, 2001). The Index of Industrial Production (IIP) is used as the related series. Over the sample period, the IIP series is available on a quarterly frequency. The interpolation, is therefore done, with this series to a quarterly output series and then a simple linear interpolation method is used to obtain a monthly series.

4.0 Results

4.1 Set up Tests

Table 1 below present results of unit root tests. Results from ADF and PP tests indicate that all variables have unit roots with an exception of the interbank, 3-month TB rate, federal funds rate and oil price. However, the KPSS shows that all variables are integrated of order one, I(1). Hence, it can be safely be concluded that the series used in this study are integrated of order one, I(1). Literature reveal that, in the presence of non-stationary variables it is highly likely that there is co-integration among variables. In this regard, a Johansen co-integration test is performed which reveal that there is co-integration (see table A in appendix). Available literature reveals that if there is evidence of co-integration in data, it is consistent to estimate a VAR in levels or a Vector Error Correction Model (VECM) (Geda et al., 2011). In this study, the VAR in levels is estimated following in Sims (1992).
In addition, the lag-selection tests are performed to select the appropriate lag length of the VAR. Lag length selection criteria results are presented in Tables 2 below suggests different lag lengths for model. However, the principle of parsimony in the selection of the lag length is used, which entails that if two or more models explain the same phenomena but have different lag lengths; choose the model with lower lags in order not to lose information when higher lags are included and to preserve the degrees of freedom (Zgambo and Chileshe, 2014). Hence, the model with one lag length is selected based on the Schwartz-Information Criterion.

Table 1: Stationarity Tests

	ADF			PP			KPSS		
	Levels	**1st Difference**	**I(d)**	**Levels**	**1st Difference**	**I(d)**	**Levels**	**1st Difference**	**I(d)**
Interbank Rate	-3.16**	-26.94***	I(0)	4.78***	-39.72***	I(0)	1.37***	0.27	I(1)
3-month TB Rate	-4.69***	-12.77***	I(0)	-3.85**	-12.76***	I(0)	0.14*	0.02	I(1)
ALR	-1.48	-6.47***	I(1)	-1.53	-6.38***	I(1)	0.84***	0.20	I(1)
Real GDP	-1.48	-10.58***	I(1)	-3.19	-16.53***	I(1)	0.29***	0.11	I(1)
M1	-1.78	-4.53***	I(1)	-3.14	-17.68***	I(1)	0.21**	0.18	I(1)
Credit	-1.70	-7.98***	I(1)	-1.81	-7.97***	I(1)	0.15**	0.06	I(1)
LUSE Index	-2.35	-5.38***	I(1)	-1.77	-5.37***	I(1)	0.13*	0.08	I(1)
CPI	-2.18	-5.12***	I(1)	6.28***	-5.35***	I(0)	0.31***	0.11	I(1)
Copper Prices	-2.33	-6.93***	I(1)	-1.94	-6.78***	I(1)	0.18**	0.10	I(1)
Oil Prices	-3.41*	-7.45***	I(0)	-2.03	-6.73***	I(1)	0.15**	0.08	I(1)
Federal Funds Rate	-3.33*	-4.12***	I(0)	-2.43	-4.26***	I(1)	0.09	0.04	I(0)
Exchange Rate	-2.38	-7.20***	I(1)	-1.98	-5.62***	I(1)	0.25***	0.11	I(1)

Source: Computations by the Author.

*,**,*** means statistically significant at 10%, 5% and 1% respectively.

Table 2: Lag-selection for the model with 3-month TB rate as the policy rate

Lag	LogL	LR	FPE	AIC	SC	HQ
0	243.5857	NA	1.46e-08	-6.693696	-6.171459	-6.486770
1	521.5388	490.5055	6.59e-12	-14.39820	-13.35373*	-13.98435
2	547.6431	42.99535	4.95e-12	-14.69539	-13.12867	-14.07461
3	572.7349	38.37561	3.87e-12	-14.96279	-12.87384	-14.13508*
4	592.2297	27.52218*	3.62e-12	-15.06558	-12.45439	-14.03095
5	609.6176	22.50197	3.67e-12	-15.10640	-11.97298	-13.86484
6	626.5589	19.93097	3.87e-12	-15.13409	-11.47843	-13.68560
7	649.1024	23.86952	3.58e-12	-15.32654	-11.14864	-13.67113
8	676.7905	26.05940	2.97e-12*	-15.67031*	-10.97017	-13.80797

Source: Computations by the Author

4.2 Evaluating the Channels of Monetary Policy Transmission in Zambia

In this section, empirical evidence on the effectiveness of each channel of monetary policy in Zambia is presented. The study focuses on four channels, namely interest rate; exchange rate, credit and equity price Channel.

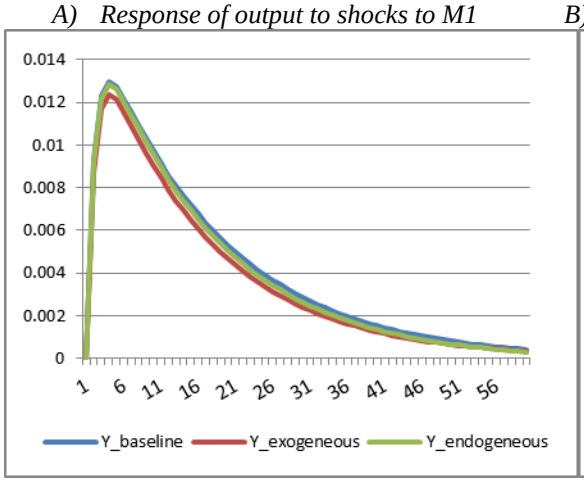
Interest Rate Channel

Figures 1 and 2 below shows the impulse response functions for the VARs. . Specifically, figure 1 shows the impulse response of the output and consumer price index to a one standard deviation shock to M1 and 3-month rate for the all models (i.e. Baseline, Exogenous and Endogenous model) while figure 2 shows the response of the other variables when the average lending rate is added as an endogenous variable.

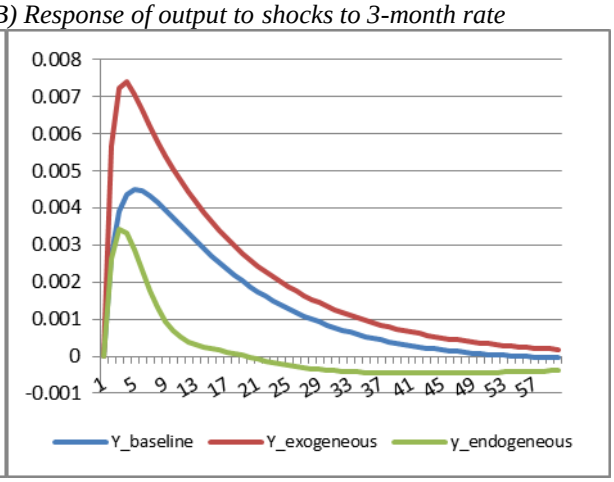
The impulse response of output to a one standard deviation shock to M1 [(given in chart A) of figure 1 below] is similar for all the models. This reveals that the effect of shock to M1 on economic activity is similar to that of the baseline when the average lending rate is added endogenously or exogenously. Specifically, output rises in the first three months following a one standard deviation shock to M1 then it starts dying out. Although the response is similar it is important to note that the response of output to an M1 shock is higher for the baseline than for the exogenous and endogenous implying that including the average lending rates reduces the response of output. However, panel B) shows that the response of output to a one standard deviation shock to the 3-TB month rate is significantly different among the three models. Although the results show that there is an output puzzle the response of output to a one standard deviation shock to 3-month rate is lower for the endogenous model, and then followed by the exogenous and lastly the baseline. These results imply that including the average lending rate exogenously or endogenously help to improve the results of the model.

Panel C) shows that the impulse response of the price level to a one standard deviation shock to M1 in the exogenous model is very similar to that of the baseline model whereas when the average lending rate is added as an endogenous variable the response of prices is lower. On the other hand, inclusion of the average lending rate as an exogenous and endogenous variable improves the response of the prices to a one standard deviation shock to 3-month rates. Specifically, one standard deviation shock to the 3-month rate initially increases prices (price puzzle) while for the exogenous and endogenous models prices start falling almost immediately. These results indicate that adding the lending rate helps to solve the price puzzle. Similar results are obtained when the interbank is used as the policy rate.

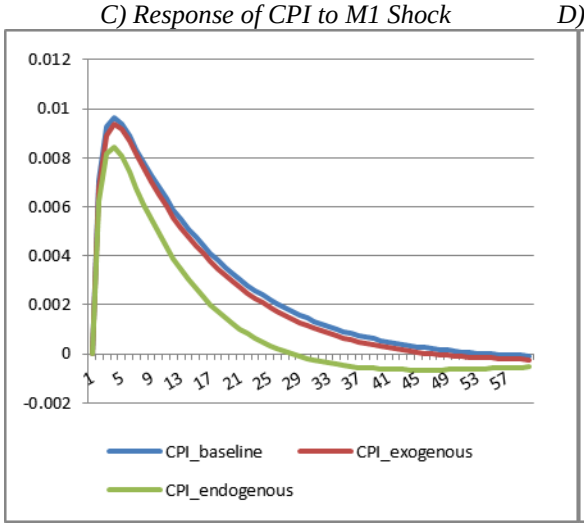
A) Response of output to shocks to M1



B) Response of output to shocks to 3-month rate



C) Response of CPI to M1 Shock



D) Response of CPI to 3-month rate

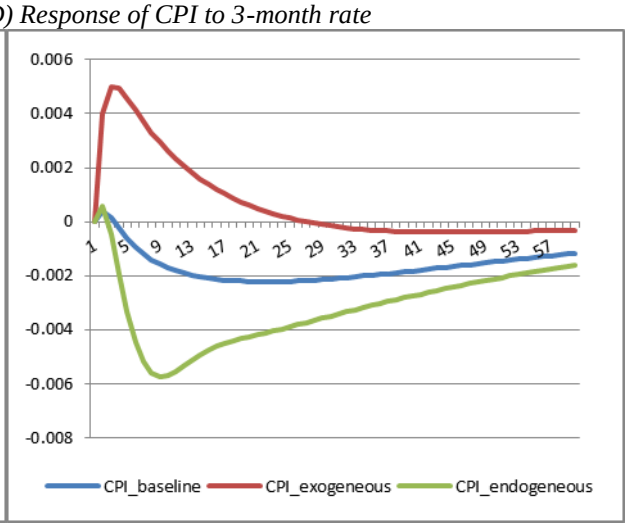


Figure 1: Response of Output and CPI to shocks to financial variables (M1 and TB-91-Day rate)-interest Channel

Source: Computations by the Author

To decipher how lending rates affect real sector variables we also present results from the endogenous model in figure 2 below. The results indicate that a one standard deviation shock to the 3-month rate significantly increases average lending and then the effects die out slowly. Furthermore, a one standard deviation shock to the average lending rate leads to a fall in the price level and output though not significantly.

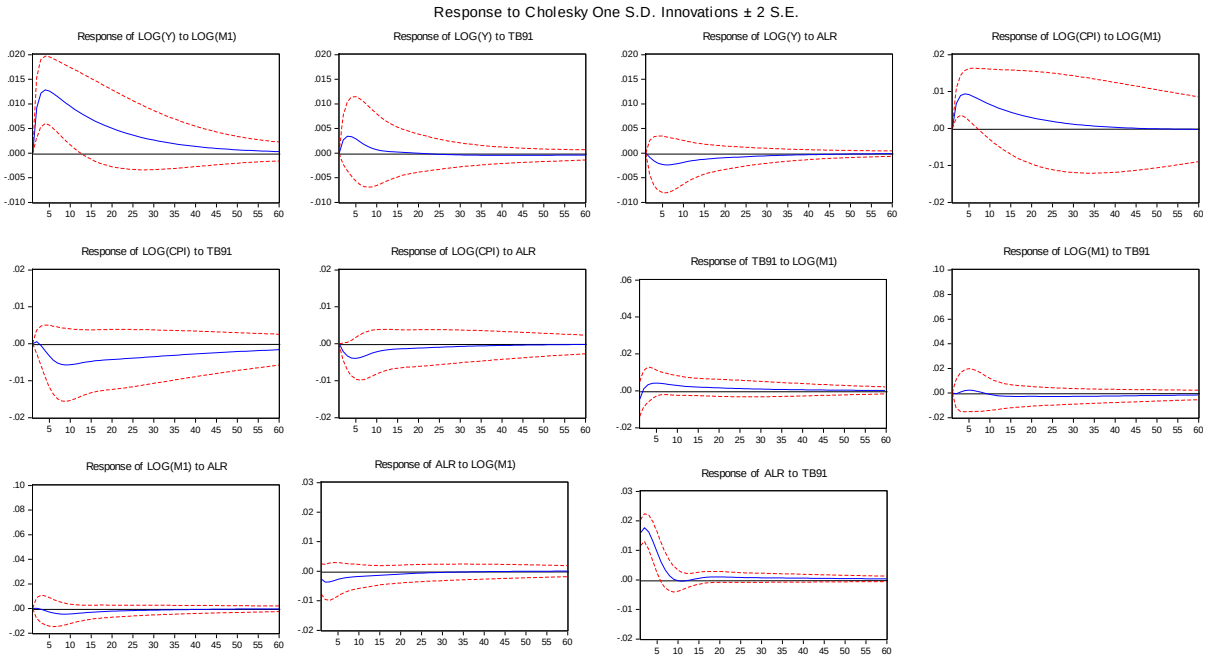


Figure 2: Impulse response functions with average lending rate added as an endogenous variable

Source: Computations by the Author

Table 3 below presents the variance decompositions of the output and consumer prices in which the average lending rate is added as an endogenous variable. The results show that at the three year horizon the 3-month TB rate and the average lending contribute a total of less than 3 percent of the variability in output with much of it being explained by M1(34.40%) and own shocks (62.33%). Furthermore, at the three year horizon average lending rate accounts for 5.38% while the 3-month TB rate account for only (1.10%).

The results obtained on the interest rate channel in this study are similar to those obtained by others (Simatele, 2004; Mutoti, 2006; Chileshe et al,2014) on Zambia as well as other emerging economies (Ozdogan, 2009). Although the results in this section indicate that the interest rate channel may be working, it is very weak in Zambia. These results are expected for data from a developing country for two reasons. First, the proportion of the population with access to formal financial services is small rendering the effect of changes in monetary policy on the economy limited. For example, in Zambia the proportion of adults with access to formal financial services is 24.8% while only 22.3% have access to credit facilities (Finscope, 2015). Secondly, the banking system in most of these countries is highly concentrated making the transmission of monetary policy shocks limited (Mishra *et al.*, 2010)

Table 3: The variance decomposition of output and prices in the endogenous average lending rate model

Variance Decomposition of LOG(Y):

Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	ALR
1	0.04	100.00	0.00	0.00	0.00	0.00
6	0.06	76.56	0.19	21.36	1.32	0.57
12	0.07	68.21	0.16	29.51	1.14	0.97
18	0.07	65.29	0.24	32.37	1.04	1.07
24	0.07	63.78	0.46	33.64	1.00	1.12
30	0.07	62.89	0.77	34.20	0.99	1.15
36	0.07	62.33	1.11	34.40	1.01	1.16

Variance Decomposition of LOG(CPI):

Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	ALR
1	0.02	4.93	95.07	0.00	0.00	0.00
6	0.06	9.73	74.92	12.23	1.98	1.15
12	0.07	11.97	70.41	11.90	1.77	3.96
18	0.09	14.53	69.02	10.28	1.46	4.72
24	0.10	16.80	67.91	8.95	1.29	5.04
30	0.10	18.57	67.00	8.02	1.18	5.24
36	0.11	19.92	66.25	7.38	1.10	5.35

Cholesky Ordering: LOG(Y) LOG(CPI) LOG(M1) TB91 ALR

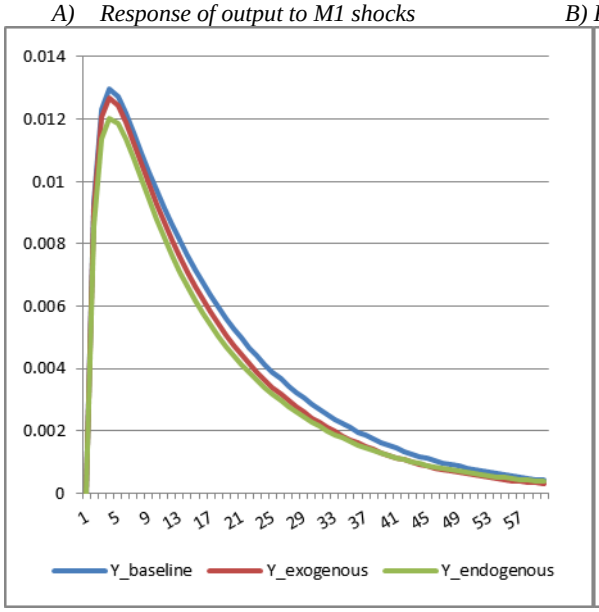
Source: Computations by the author

Exchange Rate Channel

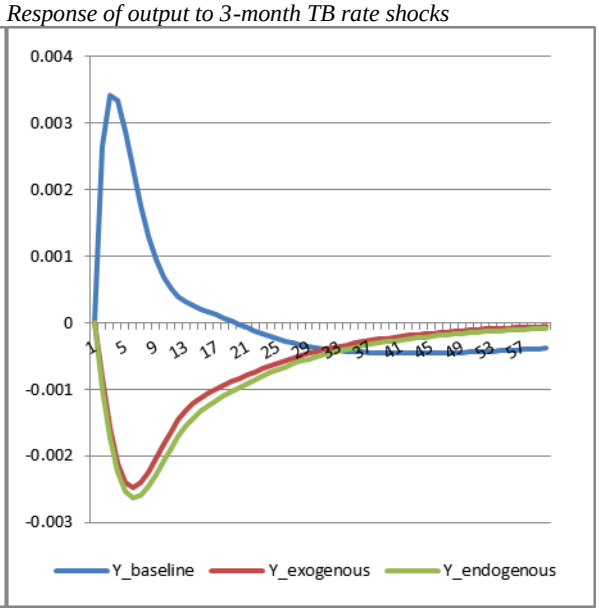
Figure 3 below presents the response of output and consumer prices to shocks to financial variables of M1 and 3-month TB rate. Panels A) and B) shows the impulse response of output to a one standard deviation shock in M1 and 3-month TB rate for all the models respectively. Panel A) shows that the response of output to a one standard deviation shock to M1 is similar for all models. However, it is important to note that the response of output is lower in the endogenous model as well as the exogenous model compared to the baseline. Our results could imply that expansionary monetary policy in Zambia have limited impact on economic activity due the import dependent nature of the economy.

Expansionary monetary policy causes the exchange rate to depreciate thereby increasing the cost of intermediate goods (inputs) which consequently hampers the response of output. Panel B) shows that the response of output to a one standard deviation shock to the 3-month TB rate for the exogenous and endogenous models significantly differs from those of the baseline model. Specifically, adding the exchange rate to our baseline model helps to solve the "output puzzle" we experienced in the baseline model. A closer look at the chart also shows that the effect of a shock to 3-month rate is higher for the endogenous model compared to the exogenous model. The difference in the response of the output to shocks to 3-month TB rate shows in the baseline and the other models could imply that the exchange rate channel is strong. In addition, the results could also imply that exchange rate channel is working endogenously.

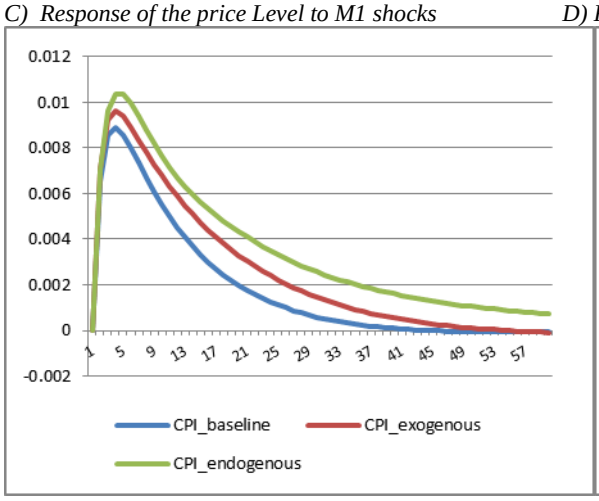
A) Response of output to M1 shocks



B) Response of output to 3-month TB rate shocks



C) Response of the price Level to M1 shocks



D) Response of the Price Level to 3-month TB shocks

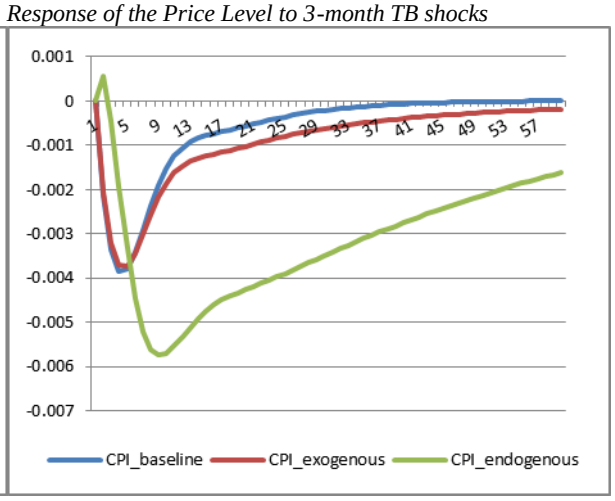


Figure 3: Response of Output and CPI to shocks to financial variables (M1 and TB-91-Day rate)-Exchange rate channel
Source: Computations by the Author

Panel C) shows that the response of consumer prices to a one standard deviation shock to M1 is larger for the endogenous and exogenous models compared to the baseline. Further, the response of the consumer prices to a shock is higher for the endogenous model compared to the exogenous model implying that the exchange rate channel is working endogenously. Panel D) shows that the impulse response of the consumer prices to a one standard deviation shock to 3-month rate is similar for the exogenous and baseline models while significantly different for the endogenous model. In the baseline and exogenous models, a one standard deviation shock leads to a fall in the price level bottoming out at 4 months then starting to revert back to equilibrium but after 9 months the effects are stronger under the exogenous model. On the other hand under the endogenous model a similar shock will lead to a fall in consumer prices bottoming out after 9 months and reverting back to equilibrium slowly.

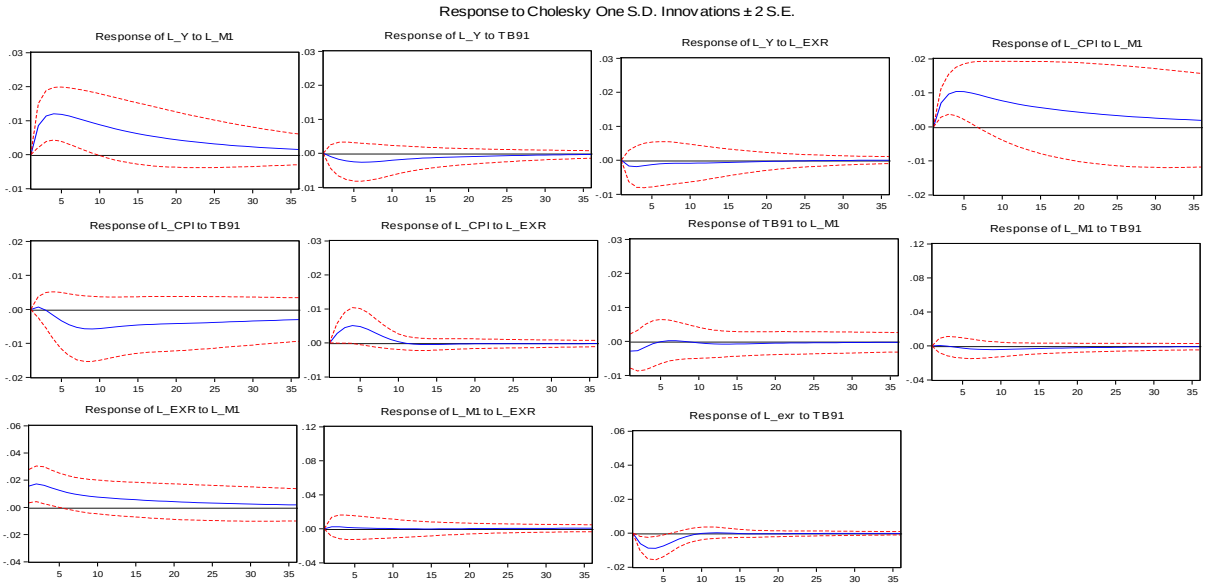


Figure 4: Impulse response functions with exchange rate added as an endogenous variable

Source: Computations by Author

To further examine the pass-through of the exchange rate to prices, impulse response functions presented in figure 4 above also provide the response of prices and output to exchange rate shocks. The results in 4 shows that output falls following a positive one standard deviation shock to the exchange rate though the responses are not significantly. Further, a one standard deviation shock to the exchange rate significantly increases consumer prices in line with expectations.

Table 4 presents the variance decomposition of output and the price level. The results reveal that at the three year horizon the exchange rate contributes more than 13% in the variability in output. Further, the exchange rate contributes approximately 14.2% variability in the price level at the three year horizon.

Results clearly, indicate that there is strong exchange channel in Zambia as expected. These results are similar to many studies on the effects of monetary policy done in developing economies especially those with floating exchange rate and a liberalised capital account (Dabla-Norris and Floerkemeier, 2006;Butkiewcz and Ozdogan , 2008; Chileshe *et al.*, 2014; Zgambo and Chileshe, 2014; Cheng, 2006). These results are expected because literature indicates that Zambia is ranked as a highly liberalised economy with a flexible exchange rate which makes the channel stronger. The *IMF 2013 De Facto Classification of Exchange Rate* categorises, Zambia as having a floating regime with no pre-determined path for the exchange rate. Furthermore, according to calculations by Chinn and Ito (1997,2013), Zambia's Index of Financial Openness has risen from 1.79 in 1997 to 2.44 in 2011 which indicate a high degree of financial openness/integration, thus, there is a high level of capital mobility. This means strong financial openness and thus, a high level of capital mobility. Furthermore, the significant effect of the exchange rate on prices but insignificant on output is expected. These results imply that the direct effect of depreciation is higher in an import dependent small open in which the majority of consumer goods are imported. Further, the effect on output maybe little in that the majority of production in Zambia depend on the importation of intermediate goods. Hence it is expected that depreciation would lead to an increase in the cost of production which in turn hurts economic activity.

Table 4: The variance decomposition of output and prices in the endogenous Exchange model

Variance Decomposition of LOG(Y):

Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(EXCHANGE)
1	0.04	100.00	0.00	0.00	0.00	0.00
6	0.06	74.59	0.09	17.21	1.71	6.39
12	0.07	64.15	1.07	23.28	3.18	8.31
18	0.07	59.79	1.10	26.27	2.56	10.27
24	0.07	57.25	1.17	26.65	3.66	11.27
30	0.07	55.45	1.27	27.34	3.68	12.27
36	0.07	53.00	1.38	28.69	3.67	13.27

Variance Decomposition of LOG(CPI):

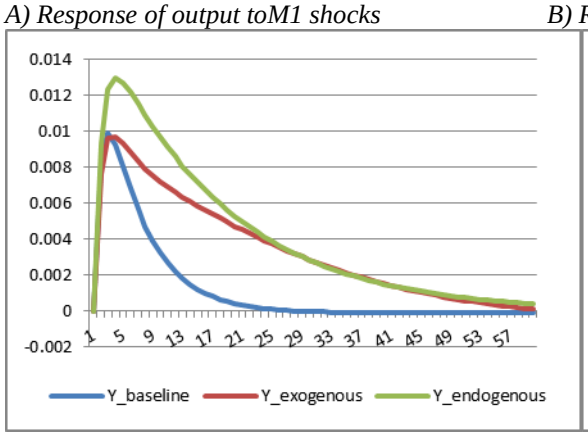
Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(EXCHANGE)
1	0.02	5.48	94.52	0.00	0.00	0.00
6	0.05	6.29	68.94	16.21	0.07	8.49
12	0.07	8.25	63.08	18.22	0.49	9.95
18	0.08	9.65	60.72	17.68	0.86	11.09
24	0.09	10.81	59.06	16.85	1.14	12.15
30	0.09	11.75	57.63	16.11	1.34	13.18
36	0.10	12.48	56.32	15.52	1.49	14.19

Cholesky Ordering: LOG(Y) LOG(CPI) LOG(M1) TB91 LOG(EXCHANGE)

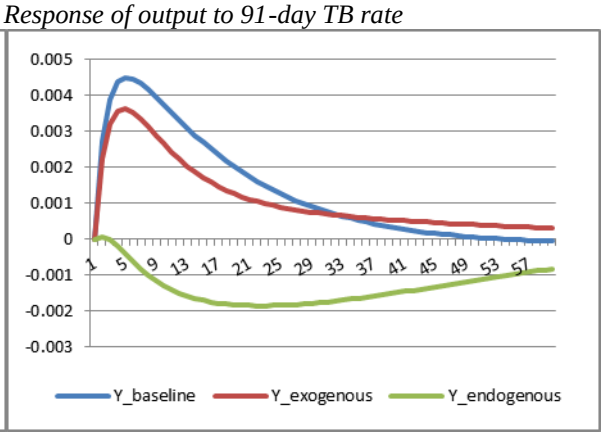
Credit Channel

Figure 5 presents the impulse response of output and the price level to a one standard deviation shock to financial variables (M1 and Interest Rates). The results of the impulse response of output to a one positive standard deviation shock to M1 are shown in panel A) of figure 5. The results show that the response of output is similar for the baseline and exogenous models in the first two months but thereafter it returns slowly to equilibrium for the exogenous model. On the other hand, adding private loans endogenously make output to respond much higher peaking after three months then falling slowly to equilibrium. In Panel B) adding private loans exogenously to the baseline model does not remove the "output puzzle" observed in the baseline model. However, once the private loans are added endogenously to the baseline model the "output puzzle" disappears as a one standard deviation shock to output leads to fall in output peaking after 21 months then starting to die out slowly. These results imply two things: firstly, it implies that the credit channel is operating endogenously; secondly, that the credit channel is working in Zambia.

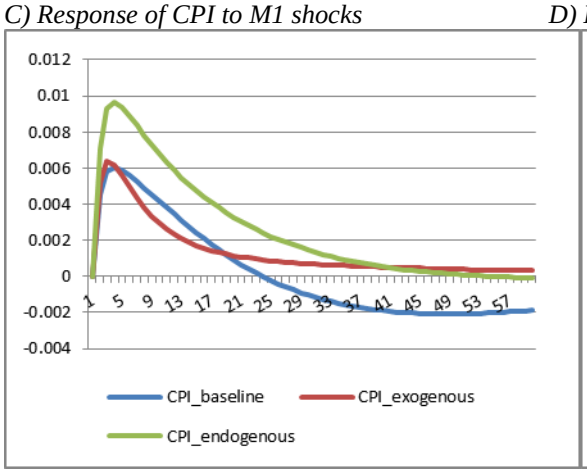
A) Response of output toM1 shocks



B) Response of output to 91-day TB rate



C) Response of CPI to M1 shocks



D) Response of CPI to 91-day TB rate

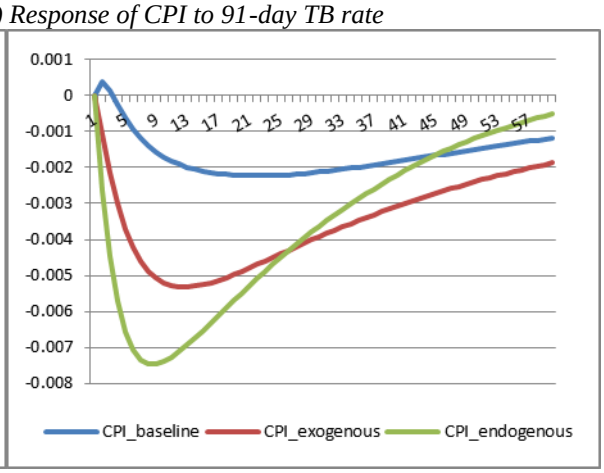


Figure 5: Response of Output and CPI to shocks to financial variables (M1 and TB-91-Day rate)-Credit Channel

Source: Computations by the authors

Panel C) shows that the response consumer prices to a positive one standard deviation shock to M1 is similar for the baseline and exogenous models but different from that of the endogenous model. Specifically, following a positive shock to M1 consumer prices rises in both the exogenous and baseline models reaching a peak after 2 months and then starting to return to equilibrium while the endogenous model a positive shock leads to a larger increase in the price level peaking after three months. These results show that the impulse response of prices is enhanced when the private loans are added endogenously to the baseline model. Furthermore, these results show that there is an effective credit channel of monetary policy transmission. Panel D) provides the impulse response of the price level to changes in the 3-month TB rate. Panel D) shows that prices fall following a positive one standard deviation (monetary policy tightening) in the cases but the fall is greatest for the endogenous model followed by the exogenous model while it is least in the baseline. Again this shows that adding private loans to the baseline model enhances the impact of monetary policy on prices indicating that the credit channel is important in Zambia's monetary policy transmission process.

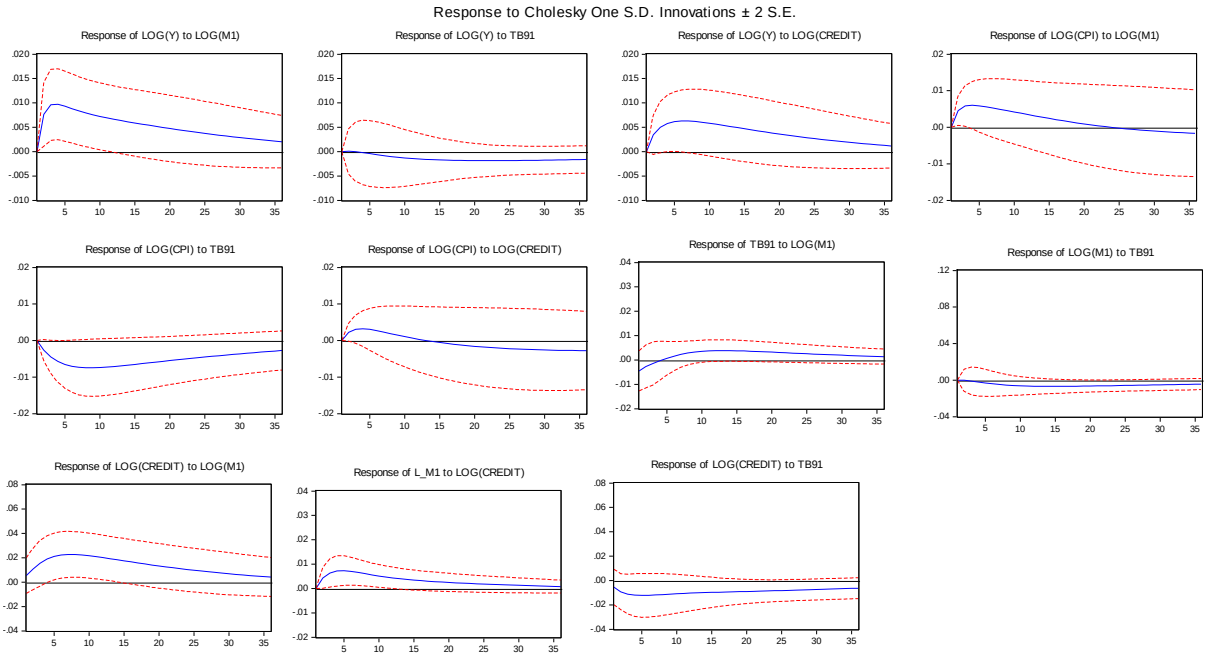


Figure 6: Impulse response functions with bank loans added as an endogenous variable
Source: Computations by the authors

Further, to study the credit channel figure 6 above presents the impulse response which includes the response of credit to shocks to M1 and 3-month rate as well as the response of prices and output. First figure 6 shows that private sector credit significantly responds to shocks to M1. Specifically, private sector credit increases for seven months following a one standard deviation shock to M1 and then starts stabilising. Secondly, it shows that following a one positive standard deviation shock to 3-month rates private credit falls for about four months and the stabilises. Further, a positive one standard deviation shock to private credit leads to a significant increase in output peaking after 8 months then starting to stabilise. In addition a similar shock leads to a significant increase in prices peaking after 4 months. These results again show that the credit channel is an important channel of monetary policy transmission in Zambia similar to results by Simatele (2004) but at variant with those by Lungu (2007).

Variance decompositions of the variations in output and price level under the endogenous model are provided in table 5. The results in table 6 reveal that at the three year horizon shocks to credit account for over 13% of the variations in output while at the same horizon it accounts over 11% in the variations of the price level compared to own shocks of 53.9% and 56.2% respectively.

As indicated above, evidence presented clearly shows that the credit channel in Zambia is working similar to results obtained by Simatele (2004) but at variant with Lungu (2007) on Zambia and Ezema (2009) on Nigeria. These results could be due to the increase in the sample size which has not been tested before by any other study. In addition, there has been an increase in the number of Small Medium Enterprises (SMEs) which are bank dependent and hence it is expected to enhance the credit channel. Furthermore, the introduction of salary backed loans has also made many households to become exposed to bank credit thereby enhancing the credit channel.

Table 5: The variance decomposition of output and prices in the endogenous credit model

Variance Decomposition of LOG(Y):

Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(CREDIT)
1	0.03	100.00	0.00	0.00	0.00	0.00
6	0.05	75.45	3.04	15.79	0.02	5.70
12	0.06	64.22	3.52	21.62	0.28	10.37
18	0.06	59.30	3.25	24.30	0.69	12.45
24	0.06	56.60	3.10	25.80	1.14	13.35
30	0.07	54.96	3.24	26.56	1.57	13.68
36	0.07	53.92	3.60	26.84	1.92	13.72

Variance Decomposition of LOG(CPI):

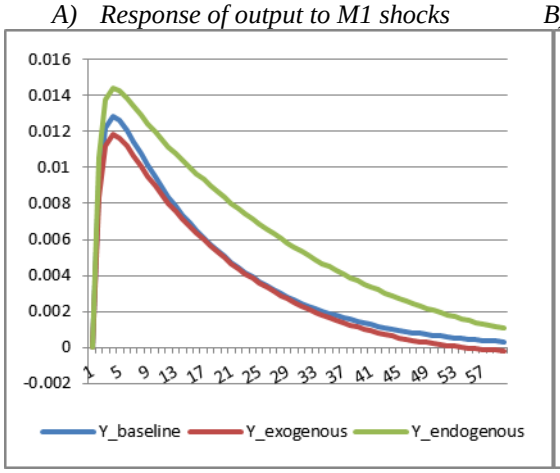
Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(CREDIT)
1	0.02	0.99	99.01	0.00	0.00	0.00
6	0.05	13.84	70.29	7.06	1.90	6.90
12	0.06	18.40	62.38	6.51	1.31	11.40
18	0.08	21.48	59.91	5.22	1.00	12.40
24	0.08	23.92	58.44	4.27	1.08	12.30
30	0.09	25.76	57.24	3.75	1.36	11.89
36	0.10	27.10	56.19	3.54	1.72	11.45

Cholesky Ordering: LOG(Y) LOG(CPI) LOG(M1) TB91 LOG(CREDIT)

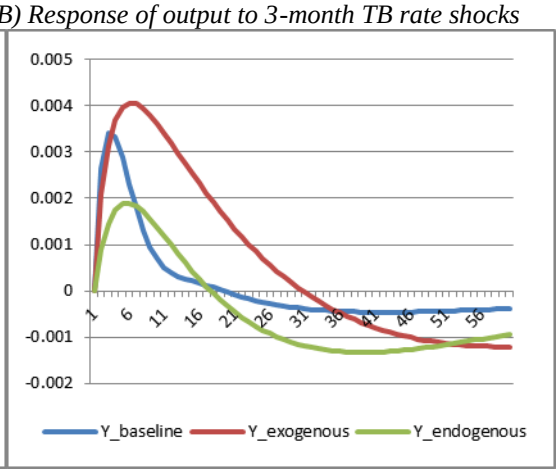
The Equity Price Channel

Figure 7 presents the impulse response functions from the exogenous, endogenous and the baseline VAR with the 3-month TB rate as the policy rate to a one standard deviation to M1 and 3-month rate. Panel A) of figure 7 shows that following positive one standard deviation shock to M1 (loose monetary Policy) the response of output in the exogenous model is very similar to the baseline while it is different for the endogenous model. Specifically, the results show that following a positive one standard deviation shock to M1 output increases in both the baseline and endogenous models peaking after 3 months and then start returning to equilibrium. On the other hand (in panel B), a similar shock to M1 increases output by a larger quantum in the endogenous model. A one standard deviation shock to the 3-month TB rate in the endogenous and exogenous models produces an "output Puzzle". Specifically, output rises following monetary policy tightening in the baseline, exogenous and endogenous models though the in the case of the endogenous model the puzzle reduces. This clearly shows that the asset price channel is weak in Zambia as the introduction of the asset price variable does not remove the puzzle in the model.

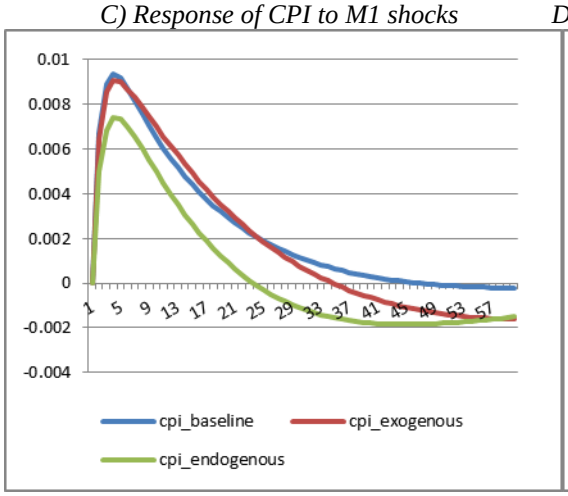
A) Response of output to M1 shocks



B) Response of output to 3-month TB rate shocks



C) Response of CPI to M1 shocks



D) Response of CPI to 3-month TB rate shocks

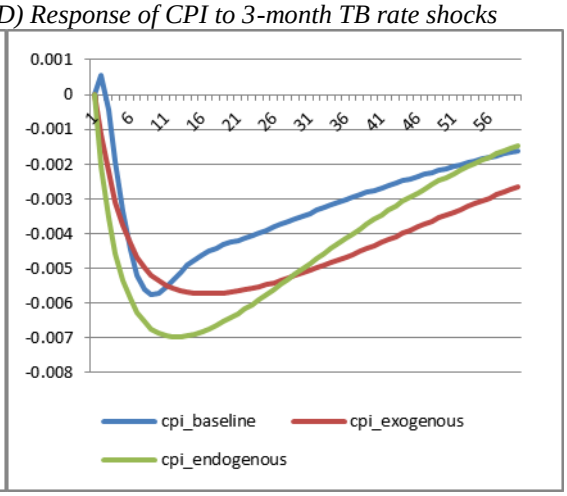


Figure 7: Response of Output and CPI to shocks to financial variables (M1 and TB-91-Day rate)-Equity Channel
Source: Computations for Authors

Panel C) and D) of figure 7, give results of the impulse response functions of consumer prices to a positive one standard deviation shock to M1 and 3-month TB rate, respectively. In panel C) shows that the response of the prices to a one standard deviation shock to M1 for the baseline and exogenous models are similar whereas adding the Lusaka index reduces the response of price level to monetary policy shock. In panel D) the response of the price level to a positive one standard deviation shock for the exogenous and endogenous models is different from the baseline but the response of prices to a shock is greater for the endogenous. These results suggest that the asset price channel works endogenously in Zambia.

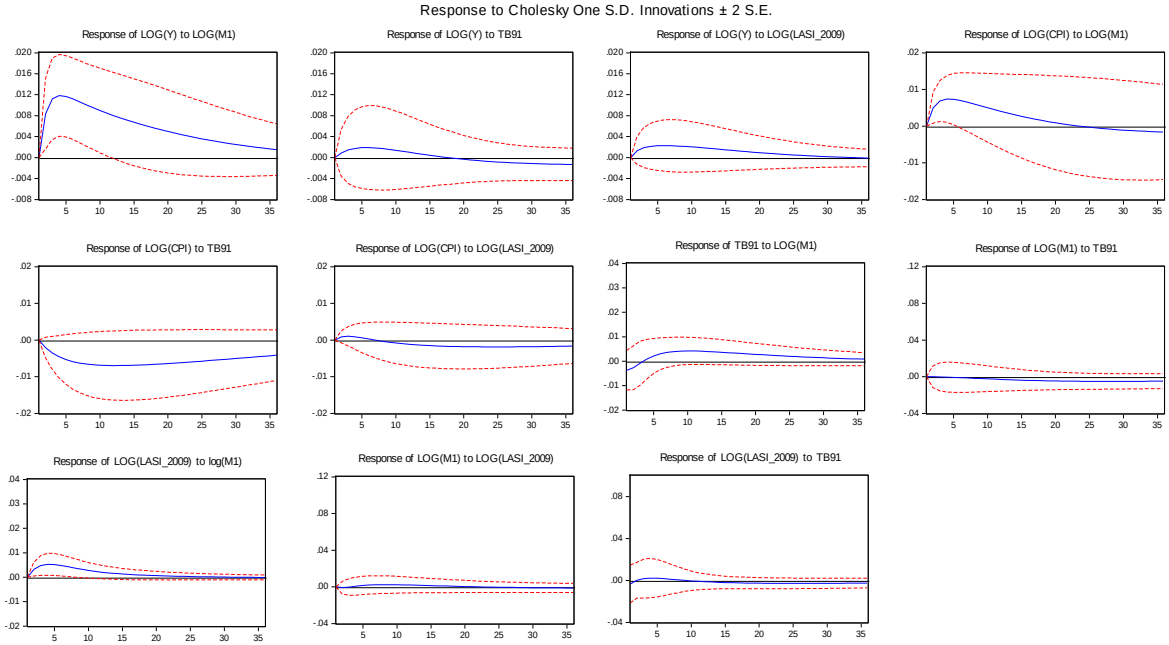


Figure 8: Impulse response functions with Lusaka All Share Index added as an endogenous variable

Source: Computations by Authors

Figure 8 shows the impulse response functions for the endogenous model. It shows that a one standard deviation shock to M1(loose monetary) significantly leads to an increase in the stock index while a one standard deviation shock to the 3-month TB rate has no significant effect on the index. Furthermore, a positive one standard deviation shock to the stock index leads to a rise the level of economic activities and prices but these results are not significant.

The Variance decomposition of output and the price level for the endogenous model are given in table 6 below. The results show that at the three year horizon the stock index explain only 1.32 percent variability in output and less than 1% in the case of the price level. Results clearly show that monetary policy does not get transmitted through asset price channel, specifically the equity or stock price channel. Specifically, a shock to M1 has a significant effect on asset prices while a shock to the 3-month TB rate has no significant effect on asset prices. Furthermore, shocks to asset prices have no effect on both prices and output. These results could be attributed to low participation of majority Zambians in the Stock market. Further trade in equities on the stock exchange is very low while the number of listed companies is just about 18 with a majority of limited liability companies not listed on the exchange.

Table 7: The variance decomposition of output and prices in the endogenous asset price model

Variance Decomposition of LOG(Y):						
Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(LASI_2009)
1	0.03	100.00	0.00	0.00	0.00	0.00
6	0.06	78.57	0.91	19.43	0.43	0.66
12	0.06	69.48	0.78	27.94	0.65	1.15
18	0.07	65.61	0.98	31.45	0.62	1.33
24	0.07	63.39	1.66	32.96	0.64	1.36
30	0.07	61.94	2.58	33.38	0.76	1.34
36	0.07	60.95	3.53	33.26	0.94	1.32

Variance Decomposition of LOG(CPI):						
Period	S.E.	LOG(Y)	LOG(CPI)	LOG(M1)	TB91	LOG(LASI_2009)
1	0.02	1.73	98.27	0.00	0.00	0.00
6	0.05	8.09	77.21	10.13	4.44	0.13
12	0.07	13.11	68.97	9.21	8.57	0.15
18	0.08	16.62	65.18	7.19	10.66	0.34
24	0.09	19.32	62.54	5.87	11.74	0.54
30	0.09	21.31	60.51	5.17	12.29	0.71
36	0.10	22.73	58.98	4.87	12.57	0.84

Cholesky Ordering: LOG(Y) LOG(CPI) LOG(M1) TB91 LOG(LASI_2009)

The Likelihood Ratio Test

In addition to the analysis performed above, we also conducted likelihood ratio tests as a robustness measure. Firstly, a likelihood ratio test to test whether each channel operates exogenously or endogenously is conducted. Secondly, the same test is done to examine whether each of the channels is not working (baseline) against the alternative that they are working (exogenously or endogenously). The results for these tests are reported in table 7 below. We reject the null hypothesis at 1% that the channels (interest rate, exchange rate, credit, and asset price channel) work exogenously and therefore conclude that they are all endogenous. These results confirm our analysis from the impulse response functions which showed that generally all channels are working endogenously. Further, we reject the null hypothesis that the channels do not work (baseline) at 5% in favour of the alternative that they are working endogenously. However, the significance of the interest rate channel and the asset channel are only significant at 5% and 10% respectively indicating that these are weaker channels of monetary policy transmission in Zambia.

Table 7: The Likelihood ratio Test results

Hypothesis	Interest Rate Channel	Exchange Rate Channel	Credit Channel	Asset Price Channel
$H_0: Exogenous\ Vs\ H_1: Endogenous$	28.03(0.001)***	234.70(0.000)***	190.87(0.000)***	13.86(0.000)**
$H_0: Baseline\ Vs\ H_1: Endogenous$	13.26(0.0276)**	250.97(0.000)***	141.12(0.000)***	7.53(0.063)*

Source: Computations by the author

5.0 Conclusions and Policy Recommendations

This study set out to investigate the relative importance of channels of monetary policy transmission in Zambia. It attempted to answer the following questions: Is the interest rate channel working in Zambia? Is the Exchange Rate Channel working? Is the Credit Channel working? And is the equity Channel working? Using VAR methods, this study draws the following conclusions: first, the interest rate channel is working but a weak channel of monetary policy transmission in Zambia similar to findings by author studies on Zambia (Chileshe *et al.*, 2014; Zgambo and Chileshe, 2014; Simatele, 2004) and other developing countries (Tahir, 2012; Dabla-Norris and Floerkemeier, 2006). Further, results seem to suggest a relatively stronger interest rate channel compared to previous studies on Zambia. This could be attributed to numerous economic and financial reforms that have been undertaken by the authorities since the early 1990s. Secondly, the exchange rate channel is the strongest channel of transmission in Zambia similar to studies done in developing economies especially those with floating exchange rate and a liberalised capital account (Dabla-Norris and Floerkemeier, 2006;Butkiewcz and Ozdogan , 2008; Chileshe *et al.*, 2014; Zgambo and Chileshe, 2014; Cheng, 2006). Third, the credit is working in Zambia but these results are at variant with those obtained by other on Zambia (Lungu, 2007) and other SSA countries (Ezema, 2009). Finally, the asset price channel seems not to be working.

Given the foregoing conclusions, this study suggests the following policy recommendations for monetary policy authorities in Zambia:

i) *There is need for the central banks, Bank of Zambia in this particular case, to continue closely monitoring developments in bank credit and conditions in the foreign exchange market.* This is because the results show that credit and exchange rate channels are important mechanisms through which monetary policy is transmitted in Zambia. Specifically, shocks to both exchange rate and bank credit have important effects on real variables which would imply that changes in these variables could mean that the central bank would need to change its monetary policy stance.

ii) *Finally, it is recommended that there are concerted efforts needed towards enhancing the asset/equity channel.* The central bank and other players such as the Securities and Exchange Commission (SEC) in the financial market should devise strategies aimed encouraging more economic agents to participate in the equities market. Currently, there are very few players who are currently participating on the Lusaka Stock Exchange (LUSE). For example there are only 19 (nineteen) companies that are registered on LUSE while the volume of trade still remain very low.

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