RESEARCH AND FINANCIAL SECTOR DEVELOPMENT DEPARTMENT

P O Box 2882, Windhoek, Namibia

Tel: +264-61-283 5111

Fax: +264-61-283 5231

E-mail: research@bon.com.na

AN EVALUATION OF THE MONETARY POLICY TRANSMISSION MECHANISM IN NAMIBIA

Daisy Mbazima-Lando[1], *Bank of Namibia; e-mail: daisy.mbazima-lando@bon.com.na*

Victoria Manuel[2], *Bank of Namibia; e-mail: victoria.manuel@bon.com.na*

Erwin Naimhwaka, *Bank of Namibia; e-mail: erwin.naimhwaka@bon.com.na*

Florette Nakusera, *Bank of Namibia; e-mail: florette.nakusera@bon.com.na*

BON Working Paper: WP1- 2021

[1] Corresponding Author

[2] Corresponding Author

Published by the Research and Financial Sector Development Department of the Bank of Namibia

Enquiries related to this publication should be directed to:
The Chief Economist and Head of the Research and Financial Sector Development Department
P O Box 2882
WINDHOEK
NAMIBIA

Tel: +264 61 283 5111
Fax: +264 61 2835231
e-mail: research@bon.com.na

https://www.bon.com.na

Abstract

This paper evaluates the monetary policy transmission mechanism and draws implications on the effectiveness of monetary policy in Namibia. The paper uses the Structural Vector Autoregressive (SVAR) methodology on quarterly data from 2002Q1 to 2020Q4 to empirically test the effectiveness of monetary policy through the key channels of the monetary policy transmission mechanism. These are the interest rate, credit, asset price and exchange rate channels. The findings indicate that the interest rate and credit channels emerge as the most effective channels of the monetary policy transmission mechanism to achieve the ultimate goals of price stability and sustainable economic growth. Furthermore, the effect of a policy rate change by the monetary authorities on inflation and real GDP occurs immediately from the first quarter with the effects lasting into the twelfth quarter. This translates into a monetary policy transmission mechanism of between 3 to 36 months and implies that the effects of monetary policy decisions occur much faster in the short-term and last longer in the long-term than the theoretical expectations of 12 to 24 months. The key policy finding points to reaffirm that despite Namibia being in a fixed exchange rate regime, the monetary policy decisions enacted by the monetary authorities, given some level of discretion, have an effective impact on the aggregate economy.

Contents

1. Introduction

The monetary policy transmission comprises of four channels through which a change in the policy rate impacts the real economy. The monetary policy transmission mechanism is a channel through which changes in the central bank's official policy rate transmits to the real economy and inflation, affect the commercial bank lending rates, and transmit through key channels such as the interest rate, credit, exchange rate and market expectations. Generally, the transmission process influences the demand and supply of goods and the setting of wages and ultimately domestic and import prices in the economy (Mbazima-Lando and Manuel, 2020). However, in the case of Namibia and as member of the Common Monetary Area (CMA) with a fixed exchange rate regime, a change in the repo will not significantly affect import prices as a small market player that is often a price taker in the global economy.

The monetary policy transmission mechanism is unlikely to change unless a country is faced with significant internal and external shocks that change the structure of its economy. As it is unlikely that a country will frequently change its monetary policy framework and thereby its exchange rate regime (both of which are not exclusively mutually dependent) which would then dictate the effectiveness of any one of the channels, it can be argued that transmission channels can remain relatively unchanged over the long-term. Significant changes to the structure of an economy may prompt the monetary authority to adjust its monetary policy framework and ensure the efficient working of the transmission mechanism. The schematic working of the monetary transmission mechanism is therefore broadly universal to most central banks. The main differences in the permeability of the channels may arise from the type of exchange rate regime pursued as this determines which channels are more effective than others in different countries.

Namibia's monetary policy framework is premised on the fixed exchange rate regime to the South African Rand. Namibia's monetary policy framework is dictated by the peg of the Namibia dollar to the South African Rand. As South Africa adopted an inflation targeting monetary policy framework with a predetermined inflation target range of 3-6 percent, Namibia by de facto, through the peg aims to achieve this price stability. Differences in the effectiveness of the channels of transmission might be characterised by country specific factors such as the level of financial sector development.

An effective monetary policy transmission mechanism serves as an important monetary policy toolkit for central banks. An effective transmission mechanism ensures that policy decisions are effectively transmitted to the real economy and contribute towards sustainable economic growth. However, the transmission mechanism is theoretically and practically known to operate with a lag of between 18 to 24 months due to the dynamic nature of the financial sector, legal structures (Smal and de Jager, 2001) and economic conditions. In this regard, country specific characteristics become important in determining the lag length and magnitude of responses.

The rest of the paper is structured as follows. The rest of Section 1 contextualises Namibia's monetary policy objective and addresses the research question, after which Section 2 presents the research objective. Thereafter, a review of the Common Monetary Area (CMA) and its implications for Namibia is done in Section 3 after which Namibia's Monetary Policy Framework is discussed. Section 4 reviews the theoretical literature that underpins various channels of the monetary policy transmission mechanism and the empirical literature is discussed thereafter. Section 5 analyses the methodology of the paper while section 6 analyses the empirical results. The paper ends with a conclusion and policy recommendations in Section 7, while the list of references and the annex are presented in Section 8 and 9 respectively.

1.1 Namibia's Monetary Policy Objective

The main objective of monetary policy in Namibia is to ensure price stability in the interest of sustainable growth and development of the economy. Namibia's monetary policy has been underpinned by the fixed currency peg to the South African Rand. Maintenance of the fixed currency peg ensures that the ultimate goal of price stability is achieved by importing stable inflation from the anchor country, South Africa. In recent years, South Africa's monetary authority has increasingly emphasised the importance of steering inflation towards the 4½ percent midpoint of the target range of 3-to-6 percent per annum (Bank of Namibia).

The need to maintain adequate foreign exchange reserves is central to monetary policy in Namibia. In terms of the bilateral monetary agreement between Namibia and South Africa, it is required that Namibia's currency in circulation is backed by international reserves to a minimum ratio of one to one. In order to maintain the one-to-one fixed currency peg, Namibia is required to keep a minimum international reserves equivalent to the amount of Namibia Dollar notes and coins in circulation. To this end, the Bank of Namibia has consistently

maintained foreign exchange reserves at levels far higher than the minimum level required (Bank of Namibia).

Namibia's monetary policy uses the Repo rate to influence changes in the supply of credit and money through commercial bank lending rates. Due to this practice, the interest rate channel of the monetary policy transmission plays an important role as it is linked to other macro-economic variables. Changes in nominal interest rates are expected to influence real rates and eventually the cost of holding money. Namibia's monetary policy transmission mechanism therefore runs from the repo rate to market lending rates, with the aim of ensuring price stability in the interest of sustainable growth and development (Bank of Namibia, 2020).

This paper arises from two objectives with the first being the need for custodianship as the monetary policy advisor to Government on the workings of the monetary policy transmission. The last working paper by the Bank of Namibia was done by Uanguta and Ikhide in 2002 and despite other academics and researchers having written about one and / or the other channels of transmission, the current paper aims to validate and / or reaffirm the general findings. Secondly, although no significant changes are anticipated, the analysis on the transmission mechanism in the current Monetary Policy Framework would benefit from an update given recent findings.

2. Research Objective

This paper, therefore, evaluates Namibia's monetary policy transmission mechanism. Empirical work on the monetary policy transmission mechanism in Namibia include Sheefeni (2012, 2013, 2017 and 2020), Kamati (2014) and Uanguta and Ikhide (2002). The conclusion from most of these studies seem to suggest that interest rate and credit channel are the most effective channels of monetary transmission, with one study suggesting that the porosity asset price could be equally important and should be investigated further. In addition, however, there appears to be conflicting conclusions with regard to the effective period of monetary transmission from the time of a policy shock. In this regard, the objective of the paper is to evaluate and validate the workings of the monetary policy transmission mechanism in Namibia. The paper empirically tested the four key transmission channels, after which monetary policy recommendations are provided based on the findings. The paper will also form the basis to update the analysis on the transmission mechanism in Namibia's Monetary Policy Framework in 2022.

3. The Common Monetary Area and Implications for Monetary Policy in Namibia

Namibia's membership to the Common Monetary Area (CMA) underpins the Monetary Policy Framework. With this view, monetary matters between South Africa, Namibia, Lesotho and Eswatini (previously Swaziland) are regulated by an agreement between the governments of the four countries, usually referred to as the Common Monetary Area Agreement or CMA Agreement. It in fact technically consists of several agreements. The initial agreements date back to 1974. A Multilateral Agreement is in force between all four countries and is complemented by a Bilateral Agreement between South Africa and each of the other three countries, tailored to the specifics of each country. The full set of agreements are legal documents that set out the modalities of how, among others, the Common Monetary Area (CMA) is governed, while taking note of each country's sovereignty within the jurisdiction of the CMA. Fifteen Articles exist in both agreements and not only set out relevant definitions but also provide for national currencies and legal tender of the Rand in the ELN countries, transfer of funds, access to CMA money and capital markets and compensation payments, to mention a few. While Namibia became a de facto member of the CMA upon independence in 1990, it formally joined the monetary union in 1992 (CMA Multilateral Agreement,1993).

Within the context of the CMA agreement, Namibia's monetary policy although submissive to the peg can still deviate to a certain degree from that of South Africa. If interest rates between Namibia and South Africa diverge greatly and significant capital outflows emerge, Namibia will likely affect a policy interest rate adjustment in order to safeguard the fixed currency peg. These powers and characteristics make it possible for the Bank of Namibia to maintain a Repo rate somewhat different from the Repo rate of the South African Reserve Bank (SARB), when warranted, and allow it some discretion in controlling the domestic short-term interest rates, money supply, credit extension, aggregate demand and ultimately, domestically induced inflation (Bank of Namibia, 2020).

3.1 Namibia's Monetary Policy Framework

Namibia's monetary policy framework is therefore underpinned by the fixed currency peg to the South African Rand which governs the conduct of its monetary policy and where the monetary authority uses the repo rate to influence macroeconomic policy. Namibia's monetary policy transmission mechanism therefore runs from the repo rate to market lending rates, with the aim of ensuring price stability in the interest of sustainable growth and development. Maintenance of the fixed peg, which is the intermediate target, ensures that the goal of price stability is achieved by importing stable inflation from the anchor

country. Under a fixed exchange rate arrangement, a country cannot operate monetary policy independently from the anchor country. As such, Namibia has limited monetary policy independence due to the fixed exchange rate arrangement, however, with some discretion (Bank of Namibia, 2020).

4. Literature Review on the Monetary Policy Transmission Mechanism

4.1 Theoretical Literature

Four main channels of the transmission mechanism have consistently been emphasised in the literature. Literature on the monetary transmission mechanism has traditionally been quite consistent with reference being made to four key channels, the interest rate, asset price, credit and exchange rate channels. They all work to establish how a policy rate change by a central bank transmits to the aggregate economy and influences inflation and output.

The four channels are theoretically linked. According to Mishkin (1995,1996), the transmission mechanism of monetary policy highlights the importance of monetary policy as a powerful tool in influencing the aggregate economy, *"the outcomes which may at times be unexpected or result in unwanted consequences".* As a result, he emphasises the *"need for monetary authorities to have an accurate assessment of the timing and the effect of their policies on the aggregate economy by thoroughly understanding the monetary policy transmission mechanism".*

The transmission mechanism theory is based on the Keynesian monetary theory. The Keynesian monetary theory postulates that a monetary policy stance taken by a central bank to influence the money supply is transmitted to the real economy and positively impacts autonomous investment and output through the multiplier effect. The result has been a schematic illustration on which most of the transmission mechanisms pursued by central banks have been adapted and tailored to their monetary policy frameworks.

This paper also adopts for illustration purposes, the monetary transmission mechanism based on the work of Mishkin (1995,1996) as cited in Smal and de Jager's (2001) paper.

4.1.1 Interest rate channel

This channel is premised on the Keynesian monetary theory and looks at how monetary policy is transmitted to the real economy. In his 1995 and 1996 papers Mishkin reflects on the work of Taylor (1995) where the interest rate channel of monetary transmission emerged to be relatively strong in comparison to other channels due to the effect that a policy change had on consumer spending and investment. Although the validity of this channel should be left to empirical evidence, it can be assumed to be of importance to those economies that use interest rates as their main monetary policy tool, which in today's context would be most of the low and middle-income developing countries.

In the case of Namibia, changes in the repo rate tend to influence the pricing of retail financial products. Almost immediately after the official rate is changed, commercial banks accordingly adjust their lending rates, but this may not necessarily be by the same margin of the policy rate change. Theoretically, firms and individuals respond to a change in commercial bank lending rates by altering their spending and investment decisions. This spurs a resultant response on consumer spending (C), investment (I) and real output (Y) (Smal and de Jager, 2001). The interest rate channel therefore influences domestic demand, and such changes filter through to domestic inflation and output (Bank of Namibia, Monetary Policy Framework, 2020). Thus, there is an inverse relationship between the repo rate and investment, consumption and output. A change in the repo rate affects the investment, consumption, and output as demonstrated with Mishkin's simple framework of the interest rate transmission channel as cited and tailored by Smal and de Jager (2001) below:

↑ Repo rate → ↑ interest rates→ (↓ I, ↓C) →↓Y

4.1.2 Asset price channel

The asset price channel emerged as a monetarist contribution to the literature after some perceived shortcomings with the Keynesian view on interest rates. In this regard, the argument was that the Keynesians' key indicators for an asset price measure were only the interest rate, be it short-term or long-term, and the exchange rate. Economists such as Tobin (1969) through his q theory and Modigliani's life-cycle hypothesis (1971) as cited in Mishkin (1995,1996) argued that monetary policy and hence the transmission mechanism required an assessment of how the relative prices of other assets and real wealth were

transmitted considering an evolving business cycle and hence transmission mechanism respectively. In this regard, according to Tobin's (1969) q theory, where q is defined as the ratio of the market value of firms divided by the replacement cost of capital, monetary policy affected the economy through its effect on the valuation of equities. If q was high, investment spending would increase as the market price of firms relative to their market value was also higher and investment spending would increase and vice versa. In terms of the monetary transmission, an increase in interest rates results in decreased consumer spending and the public will divert any savings to investing on the stock market by acquiring equity. The influx of such demand drives down equity prices. A similar conclusion is derived from the Keynesian view where contractionary monetary policy makes bond prices more appealing relative to equities and this results in a decline in equity prices (Mishkin 1995,1996).

Theoretically, changes in interest rates among other factors have an impact on bond and equity prices as they can impact the return on investment for both households and firms with the latter's profitability affected through fluctuations in share price valuations (Bank of Namibia, 2020).

In the case of Namibia, this channel primarily works through the real estate and the trading in bonds and equities. For instance, when the central bank tightens its monetary policy, it will result in the rise of mortgage lending rates by the commercial banks. The rise in interest rates also tends to reduce the value of assets, and lower wealth leads to decreased spending. This resulting lower spending will ultimately filter through to domestic inflation and output (Bank of Namibia, 2020).

Mishkin (1995) viewed the asset price channel as one of the most potent for monetary policy and below is the transmission for households as cited in Smal and de Jager (2001):

↑Repo rate →↓equity prices, land, housing→ ↓C→↓ I ↓ Y

However, given the above transmission mechanism, the structure of the Namibian financial sector has historically meant that the impact might be somewhat muted or qualified for Namibia. This is attributed to a relatively small and less developed financial sector where most of the investments in locally listed equity are dominated by institutional investors and some strategic investors. In this regard, the markets tend to be quite illiquid as there continues to be a relatively short supply of domestic assets for this investor segment. Due to this shortcoming, locally listed equity prices may not always respond to

changes in interest rates as per theoretical expectation. In the case of bonds, the changes in prices are more consistent as they are not only affected by factors such as market sentiment, risk appetite and market yields of comparable investment products, but also inflation expectations. Therefore, central banks use interest rates to control inflation and thereby manage inflation expectations which will have some impact on bond prices. Given Namibia's membership of the CMA and the interlinkage that exists in the bond market of both countries, just as changes in the South African Repo rate will have an impact on South African bond prices, the benchmarking of Namibian bonds to their South African counterparts ensures that their valuation is likely to change ahead of any local repo rate adjustment (Bank of Namibia, 2020).

4.1.3 Credit channel

This channel is also based on monetarist foundations, and it addresses the issue of asymmetric information in the financial sector and works through two sub-channels, namely bank lending and the balance sheet of households and firms.

With the bank lending channel, the assumption is that not all borrowers will have access to credit markets unless they borrow from the commercial banks. Therefore, when interest rates are low, commercial bank reserves, deposits and loans will increase. The increase in loans will translate into a rise in investment and consumer spending which will eventually increase the level of output. The transmission is depicted below according to Smal and de Jager (2001):

↓Repo rate → ↑commercial bank deposits → ↑ commercial bank loans ↑ I→↑C ↑Y

According to Mishkin (1995), the impact of monetary policy will be greater for those consumers dependent on bank loans such as households and small firms as large firms will have access to credit via the stock and bond markets without necessary going to the banks. However, the potency of this channel may be compromised if changes in regulatory frameworks allow banks to raise funds via other means or due to the impact of financial innovation.

The balance sheet channel also arises from asymmetric information in credit markets as inferred by Bernanke and Gertler (1995). The concept is discussed by Mishkin (1995) as referenced in Smal and de Jager (2001) where expansionary monetary policy is viewed to raise the net worth of households and firms as more money becomes available for these segments with potential losses from adverse selection lowered on the part of commercial banks. The adverse selection problem is therefore lowered with higher net worth and raised with lower net worth. Similarly, the moral hazard problem which arises from lower net worth is exacerbated as households and businesses may be enticed to engage in risky investment projects, while it is lowered with a higher net worth of these two market players.

The schematic transmission is depicted below:

↓Repo rate → ↑price expectations → ↑ cash flow →↓adverse selection, ↓moral hazard →↑bank lending→↑ I ↑C ↑Y

4.1.4 Exchange rate channel

This channel assesses how a policy rate change by the central bank transmits to the exchange rate and hence, affects output. Theoretically, the schematic transmission mechanism would be such that if interest rates are lowered (raised), the nominal exchange rate will appreciate (depreciate), and this will decrease (increase) export earnings and increase (decrease) imports and the effect on output will be positive. Below is the transmission mechanism adapted to compliment the discussions above.

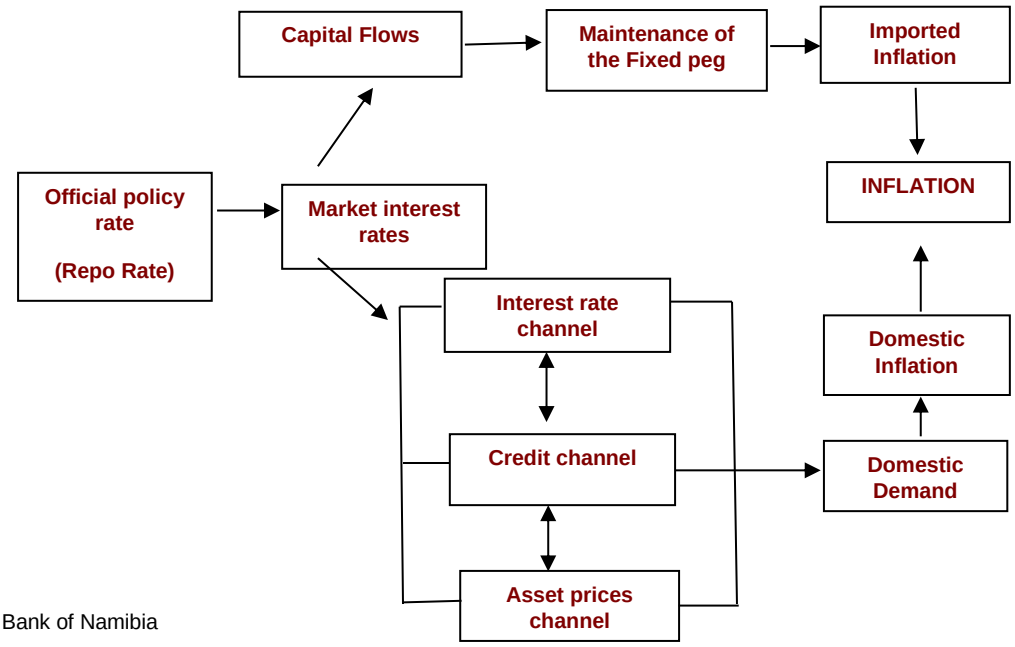
Scenario 1: ↓Repo rate → ↓interest rates → ↑nominal exchange rate ↓export earnings, ↑imports→ ↓Y

Scenario 2: ↑Repo rate → ↑interest rates → ↓ nominal exchange rate ↑Export earnings, ↓imports → ↑Y

The exchange rate channel is more relevant for countries pursuing flexible as opposed to fixed exchange rate regimes. Countries that pursue flexible exchange rate regimes have the characteristic of full monetary policy independence, which is required to intervene, when necessary, by the monetary authority in the event of any negative internal or external shocks. Given Namibia's CMA membership and the prevailing fixed exchange

rate regime, the effectiveness of the exchange rate channel is therefore non-existent due to the characteristic of incomplete monetary independence to intervene by the monetary authority previously discussed in the paper.

4.2 Namibia's Monetary Policy Transmission Mechanism Schema

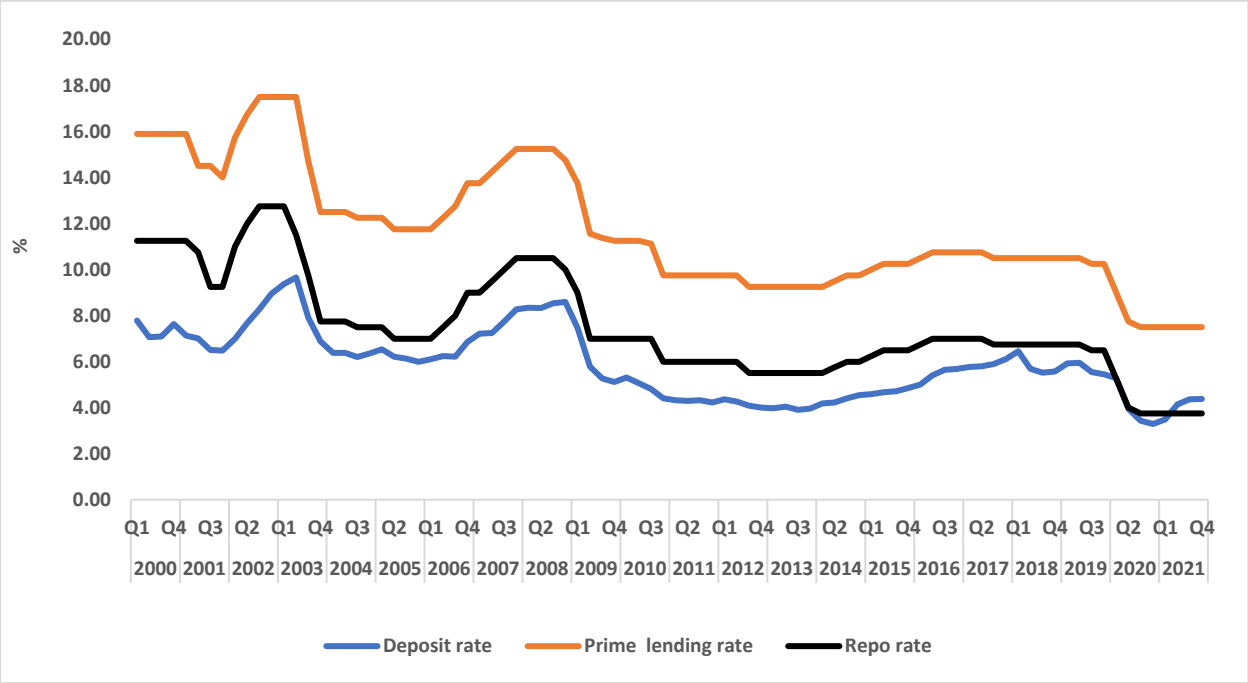


Source: Bank of Namibia

The above monetary policy transmission mechanism schema summarises all the key channels discussed above in the context of Namibia and her exchange rate regime. Some minor amendments for ease of reference have been made in this paper to include the credit channel, the bank rate channel has been renamed to "interest rate channel", market rates to "market interest rates" and official rate to "official policy rate".

4.2.1 Channels in the Monetary Policy Transmission Mechanism of Namibia

Chart 1: Nominal interest rates



Source: Bank of Namibia

The above chart shows the movements of nominal interest rates in Namibia overtime. The movement in the repo rate is closely aligned with the deposit and prime lending rates overtime. However, there is a larger spread between the deposit rate and prime lending rate than there is between the latter and the repo rate. Furthermore, there is clearly a narrowing of the deposit rate and repo rate over time. These developments are in line with the general adjustment mechanism of market rates in Namibia.

4.2 Empirical Literature

Empirical literature on the monetary policy transmission mechanism is often based on findings in Emerging Market and Developing Economies (EMDEs). This is primarily due to the divergent country characteristics by which economies are known such as the level of financial sector development and exchange rate regime among others. Indications from the review are that both the interest rate and credit channels are important for the transmission mechanism in most LICs while the interest rate channel might be relatively more important for the EMDEs due to the contemporary monetary framework pursued such as inflation targeting and their level of economic and financial development. Namibia's empirical evidence thus far points to the confirmation of the literature reviewed for a sample of African countries, regional trading blocs and monetary unions as presented below.

Sheefeni's (2017) paper found that the interest rate and credit channels remained important in Namibia's transmission mechanism. Analysing all the four key channels of the transmission mechanism, Sheefeni (2017) used quarterly data for the period 2000 Q1 to 2016 Q4 and applied the Bayesian Vector Autoregression (BVAR) technique where the impulse response functions and forecast error variance decomposition were derived.

The results by Sheefeni (2017) suggest that monetary policy in Namibia affects output in medium term, but not in the long term. The impulse response functions assessed the impact of monetary policy on output and inflation and indicated that a rise in the interest rate, i.e., positive shock, resulted in output declining up to eight quarters ahead but without persistence. This implied that monetary policy affected output in the medium term but not long term. Furthermore, the effect of a positive interest rate shock negatively affected inflation over the same observed period.

A positive exchange rate shock (appreciation) on output and inflation resulted in an initial increase in output, followed by a non-persistent decline after three quarters with the effects totally wearing out after six quarters. Inflation rose with the effects wearing out after five quarters. Sheefeni (2017) attributes Namibia's strong import dependency for the empirical results that showed a rise in output and inflation.

Results of a positive shock to credit led to a decline in both output and inflation with the effects wearing out after four quarters in both instances. This finding was attributed to the working of monetary policy transmission mechanism which operates with a lag, as commonly recorded in literature for most developing countries.

Shocks to housing prices resulted in a decline in output with the effects wearing out after seven quarters while inflation rose with the persistence wearing out after five quarters with the responses being of a lesser magnitude.

The overall findings suggested that the interest rate and credit channels remained important for the transmission mechanism even though the impact of monetary policy was short-lived.

Sheefeni and Ocran's (2012) earlier work on the interest rate channel of the transmission mechanism found that it was effective. Built on the premise that restrictive monetary policy raises both short-term and long-term rates, the paper specifically analysed the interest rate channel to determine how monetary policy shocks were transmitted to the real economy. Using quarterly data for the period 1993Q1 to 2009Q4, a Structural Vector Autoregression (SVAR) methodology was applied from which the impulse response functions and variance decompositions were derived. The estimation results showed that monetary policy was effectively transmitted in the short run and long run and had a significant impact on output and inflation. In this regard, the interest rate channel was effective in Namibia.

Sheefeni and Ocran (2013) found strong evidence of the monetary policy transmission mechanism through the credit channel in Namibia. With the aim of investigating the significance of the credit channel in Namibia, Sheefeni and Ocran (2013) use quarterly data for from 1993Q1 to 2011Q4. The authors used the SVAR technique from which they derived the impulse response and variance decompositions to analyse the transmission mechanism. The empirical evidence suggested the presence of a significant bank lending channel through which monetary policy ultimately influences output and inflation. In this regard, two main outcomes were unraveled, the first showed that the response of inflation to an increase in the repo rate was indicative of a price puzzle. The price puzzle is premised on the theoretical expectation that a surprise increase in the short-term interest rate will efficiently lower inflation almost immediately (Dueker, 2006). However, most empirical evidence, including the results of the authors, proved otherwise, with inflation, often immediately rising well beyond the perceived lag of the transmission mechanism. Secondly, the response of the bank lending channel was not immediate but rather effective two quarters after a policy change. According to the authors, this was in line with international empirical evidence on the subject matter.

Kamati (2014) finds that domestic monetary policy shocks to key monetary economic aggregates in Namibia had an impact in the short run and long run. In chapter two of his PhD thesis, Kamati (2014) investigates the effectiveness of monetary policy in Namibia. Using quarterly data from 1991Q1 to 2012Q3, a Structural Vector Autoregression (SVAR) estimation technique was applied with structural impulse response functions and cumulative response functions derived to show how output, inflation and private sector credit responded to structural

monetary and credit shocks in the short run and long run respectively. Capturing monetary policy shocks by an unsystematic component of changes in the repo rate showed that in the short run, real GDP, inflation, and private sector credit declined significantly in response to these shocks. In this regard, a sharp decline was observed for more than three quarters after the first impact on real GDP. Furthermore, the structural impulse response functions showed that real GDP and inflation increased to one standard deviation in response to the private credit shock. In the long run, the cumulative impulse response functions showed that inflation declined and remained below the initial level while responses for the other variables were statistically insignificant.

South African monetary policy shocks negatively affected private sector credit in Namibia. It was further established that a South African monetary policy shock negatively impacted Namibia's private sector credit while the impact on real GDP was barely statistically significant in the short run. With regards to the monetary policy transmission mechanism, results from the structural forecast error variance decompositions showed that the responsiveness of the interest rate channel was relatively much stronger than that of the credit channel given the variations of output attributed to an interest rate shock. This implied that interest rate shocks accounted for a large variation in output compared to the variation attributed to the private sector credit shock. It was then concluded that domestic monetary policy using the repo rate was effective with the central bank encouraged to pursue independent monetary policy actions to achieve price stability (Kamati, 2014).

Uanguta and Ikhide's (2002) paper found evidence of an operational interest rate and bank lending channel. With the aim of analysing the two main channels of the transmission mechanism, they applied two methodologies namely, the Cumulative forecast error and a Vector Autoregressive model (VAR) using monthly data from 1990 to 1999. The results, despite lacking an assessment of the magnitude of response to the monetary policy, revealed that a rise in the repo rate led to a rise in the lending rates which depressed private investment, output and employment in the short run. With regards to the impact on credit, tight monetary policy was anticipated to affect the households and firms' investment behaviour from otherwise optimal levels.

In summary, empirical evidence on Namibia suggests that the interest rate channel and bank lending channel remain the key channels of the monetary policy transmission mechanism with some advocation to investigate the relevance of the asset price channel.

Khoabane (2020) evaluated Lesotho's monetary policy transmission mechanism and found a weak transmission through the interest rate, credit, and exchange rate channels. As one of the CMA economies, Khoabane (2020) investigated the effect of South Africa's monetary policy decisions on Lesotho's interest rates and the monetary policy transmission mechanism. A Vector Autoregression (VAR) model was used on quarterly data from 2007Q1 to 2017Q4. However, due to data constraints, only three channels were assessed, and the findings indicated that despite a strong transmission mechanism of South African monetary policy decisions to Lesotho's short-term interest rate, the transmission to output and inflation through tested channels was found to be statistically insignificant and hence ineffective.

Sander and Kleimeier (2006) found that the bank lending channel of the CMA economies was effective with a fast and complete pass-through. The authors investigated the interest rate pass-through to the bank lending channel and deposit rates in the CMA economies to answer three questions. The first being, how the monetary transmission mechanism works; secondly, the dependency of national monetary policy on the anchor economy; and finally, how similar the responses to monetary policy impulses were across the CMA economies. Monthly data from 1991 to 2005 and an interest rate pass-through methodology was used which allowed for long run cointegration relationships with asymmetric and threshold adjustment. This allowed for the assessment of the speed and completeness of monetary policy transmission. The methodology rested on the market structure of the banking sector, information asymmetries and competition. The results showed that the bank lending channel of the CMA was homogeneous with a fast and complete pass-through. Furthermore, the adjustment of deposit rates was heterogeneous with divergent degrees of interest rate stickiness and asymmetric adjustment in some countries. Namibia's exhibited pronounced stickiness with the deposit rates indicating some degree of market imperfection. CMA policy makers were alerted to the potential existence of imperfect competition in the banking sector which may have accounted for the remaining differences of the CMA transmission mechanism.

Ouchchikh (2017) found evidence of the monetary policy transmission mechanism through the interest rate and credit channels. Seeking to investigate the transmission mechanism in Morocco, which is in a fixed exchange rate regime, the author used monthly data from 1992 to 2011 and the structural vector autoregression model (SVAR) to examine the transmission of a positive monetary policy shock to the real economy. The findings suggested that monetary policy shocks were transmitted to the real economy primarily through the interest rate and credit channels while the asset price and exchange rate channel were ineffective.

Awana (2021) found that the credit channel was only effective in the long run for the Central African Economic and Monetary Community (CEMAC). The author assessed the relevance of the credit channel via the risk-taking channel from where monetary policy is assumed to act on the supply of credit by taking into consideration, the risk-averse behaviour of banks. Persistently low interest rates entice banks to increase their supply of credit to risky borrowers and by doing so inadvertently assume more risk on their credit portfolio. The author uses annual data from 2000 to 2016, in a modified fourth-generation Dynamic Stochastic General Equilibrium (DSGE) model which analyses the dynamics of credit propagation with financial frictions. In this regard, banks are assumed to factor in expected inflation in their credit policy and empirically, expected inflation in the interest differential that corresponds to the term structure of nominal interest rates. The slope of the yield curve is therefore seen to portray the dynamics of the supply of credit and hence the transmission mechanism of monetary policy on bank credit. The results showed that the credit channel was relevant in the long term for the CEMAC economies and that its short-term relevance was dependent on the internal and external governance of creditor and shareholder banks.

Empirically testing the exchange rate channel remains important to confirm or dispute the theoretical and empirical literature for fixed exchange rate regimes. Assessing the exchange rate channel for countries in fixed exchange rate regimes might seem counterintuitive given the theoretical underpinnings and empirical evidence; however, it remains necessary to validate or dispute it. As Kamati (2014) infers from a theoretical point of view, since the effects of monetary policy are often transmitted via the import of goods and services from the anchor country, any domestic monetary policy decisions that might have had a bearing on the exchange rate are rendered void by virtue of the peg regime. This is often the basis of insignificant empirical results frequently cited in the literature.

Smal and de Jager (2001) assessed the main channels of the monetary policy transmission mechanism in South Africa and confirmed the existence of the interest rate channel. South Africa adopted an inflation targeting framework in February 2000 implying that the central bank has a precise inflation target of 3 to 6 percent making the relevance of an effective interest rate channel important. In this regard, to assess the transmission mechanism, a small macro-econometric model was developed to simulate the potential impact of a change in monetary policy on the real economy through the key channels. The simulation included two scenarios, one where the repurchase rate was shocked by an increase of 100 basis points from its baseline scenario during the first year of a three-year simulation period to graphically illustrate the change and time lag of the response. The alternative scenarios reflected a one percentage increase in the repurchase rate and a one percentage increase in the repurchase rate with a Taylor-type monetary policy reaction function added to the model.

The results confirmed the functioning and existence of the interest rate channel and indicated the existence of rather long-time lags between a change in the interest rate and its impact on the real economy and inflation of about four to six quarters.

In spite of economists usually referring to a lag of three to six quarters (12 to 24 months), empirical results such as those of South Africa dictated otherwise. According to Smal and de Jager (2001), the magnitude and time lags of the transmission mechanism depend on domestic and external factors such as the perceptions of the economy, business and consumer sentiment, the state of the global economy, the extent to which the interest rate adjustment was anticipated, and the functioning of the financial market.

Kelikume (2014) found an effective monetary policy transmission mechanism through the interest rate channel in Nigeria. The author set out to establish the effectiveness of the interest rate channel in Nigeria using a cointegration error correction methodology with quarterly data from 1996Q1 to 2013Q3. An increase in interest rates reduced output over the long run via its effect on investment and consumption. The short run result, however, showed a marginal increase in output which contrasted with theory.

Salihu *et a*l (2020) found that the interest rate and credit channels were effective in the monetary policy transmission mechanism of the Economic Community of West African States (ECOWAS). The paper sought to evaluate the effectiveness of the transmission mechanism among ten ECOWAS member states using quarterly data for the period 2005Q1 to 2017Q4. A Panel Structural Vector Autoregression model (PSVAR) was applied to test three channels and the results showed that only the interest rate and credit channels were effective despite a weak outcome for the effect of monetary policy on output. A weak transmission of the exchange rate channel was also established, and this was attributed to the indirect effect through which monetary policy is transmitted into the real economy, i.e., initially through the earlier two channels mentioned.

Brandao-Marques et al (2020) find that the interest rate channel was effective in a sample of forty Emerging Market and Developing Economies. In assessing how the 40[3] EMDE monetary policy rates were transmitted to output and inflation, the authors accounted for several financial sector development indicators such as whether they were inflation targeting or not, differences in liquidity and structure of the interbank money markets as being important for an effective interest rate channel. With regards to the bank lending channel, attributes such as market segmentation, lack of access to financing, dollarisation and the

[3] Botswana and South Africa were part of the sample.

presence of state banks was seen to hamper its effectiveness. Using monthly data for the period 1995 to 2017, Jordà's (2005) local projection method, applying country fixed effects and a Taylor rule to identify monetary policy shocks, the results confirmed an effective interest rate channel once the exchange rate was explicitly accounted for. Furthermore, it was established that having a modern monetary policy framework such as Inflation targeting, central bank independence and transparency mattered more for the transmission mechanism than financial development. The bank lending channel was found to be more important in less developed countries where households and firms relied heavily on banks for credit.

5. Methodology

To empirically assess Namibia's monetary policy transmission mechanism, the study applied the Structural Vector Autoregressive (SVAR) methodology. This methodology is similar to that applied by Uanguta and Ikhide (2002), Sheefeni and Ocran (2012), Kamati (2014), and Sheefeni (2020), to assess Namibia's monetary transmission mechanism in the past. According to Stock and Watson (2001) as cited in Kamati (2014), an SVAR model is defined 'as a system of κ-equations and κ-variables of stationary linear relation, where current variables are explained by contemporaneous terms, their own lags and the lags of remaining variables. In addition, an SVAR model is a multivariate, linear representation of a vector of observables on its own lags and (possibly) other variables as a trend or a constant. It allows for the identification of economic assumptions to isolate estimates of policy and private agents' behaviour and its effects on the economy, while keeping the model free of the many additional restrictive assumptions needed to give every parameter a behavioural interpretation. The model was first introduced by Sims (1980), and it is the most widely used model to empirically analyse monetary policy transmission mechanisms (Fernández-Villaverde and Rubio-Ramirez, 2008).

In this paper, the description of SVAR model followed and closely resembles the description by Kamati (2014), Drama (2017) and Sheefeni (2020) in deriving the SVAR model. In this regard, the Namibian monetary transmission mechanism using the SVAR model is described by a dynamic system whose structural form equation is expressed as follows:

$$A_0 Y_t = \Phi + A_1^* Y_{t-1} + A_2^* Y_{t-2} + A_p^* Y_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

- A_0 is an invertible (nxn) matrix of parameters, that explains the contemporaneous relations among the variables (i = 0,1, 2...p),

- Y_t is a column vector $(nx1)$ of endogenous vector variables at time t ($y_{t-1,}y_{t-2,}y_{t-n)}$,
- A_t^* (for i=1, 2…p) are matrices of structural coefficients on the lagged variables,
- Φ is a vector of constants
- while ε_t is $(nx1)$ is multivariate white noise error process

The endogenous vector in equation 1 has the following properties:

$E(\varepsilon_t\varepsilon_\tau) = \sum t = \tau \ \ or\ E(\varepsilon_t) = 0$ otherwise.

The SVAR framework above assumes that the structural innovation ε_t are orthogonal while the variance-covariance matrix is constant and diagonal, and the structural disturbances are uncorrelated. In addition, the contemporaneous matrix A_0 in equation 1 above is normalised across the main diagonal so that each equation in the SVAR system has a designated dependent variable.

Equation 1 is expressed in its reduced forms as follows.

$Y_t = A_0^{-1}A_1^*\,Y_{t-1} + A_0^{-1}A_2^*\,Y_{t-2} + \ldots + A_0^{-1}A_p^*\,Y_{t-p} + A_0^{-1}\varepsilon_t$……..(2)

$Y_t = \beta_1\,Y_{t-1} + \beta_2 Y_{t-2} + \cdots + \beta_3 Y_{t-p} + \delta_t$……..(3)

Where $\beta = A_0^{-1}A_i^*$, (i = 0,1, 2,…p) and $\delta_t = A_0^{-1}\varepsilon_t$ is the innovation linking to the reduced form with zero mean and constant variance. The structural innovation in equation 2 is linked to the reduced form in equation 3. Hence, equation 3 can further be re-written as follows.

$E(\delta_t\delta_t^1) = A_0^{-1}(\varepsilon_t\varepsilon_t^1)A_0^{-1\prime}$ =……..(4)

$\Omega = A_0^{-1}\sum(A_0^{-1})'$ ……..*(5)*

Hereafter, the contemporaneous and the variance-covariance matrix can be identified; this allows the maximisation of the likelihood function conditional on the parameter estimates of the obtained VAR.

The study estimated four SVAR models representing various channel of monetary policy transmission. The ordering of the variables in the models is based on assumption that shocks on monetary policy target variables will be transmitted to the variables in the model in the same order:

Interest rate channel; $repo = (\ lnpsce \rightarrow inflation \rightarrow lnGDP)$
Credit channel; $lnpsce = (repo \rightarrow \ \ inflation \rightarrow, lnGDP)$
Exchange rate channel; $lnreer = (lnpsce \rightarrow, repo \rightarrow \ \ inflation \rightarrow \ lnGDP)$
Asset price channel; $lnhpi \ = (lnpsce \ \rightarrow repo \rightarrow \ inflation \rightarrow lnGDP)$

Where, *psce* stands for private sector credit extended and *hpi* stands for the housing price index.

The impulse response and variance decomposition were used to assess the transmission of monetary policy shocks. The advantages of using a SVAR model is that it allows the use of impulse response functions, variance decompositions and historical decompositions which can be important when analysing the effects of the policy shocks on other macroeconomic variables. The use of impulse response is key in assessing the transmission mechanism of monetary policy to the rest of the economy. This is because it describes the contemporaneous relationships between the analysed variables in the model, by making use of the orthogonal impulse response where the correlation between the errors is obtained from the (lower) Cholesky decomposition of the error covariance matrix. This enables the analysis of the simultaneous effects of a shock to the general economy (Gerlach and Smets,1995). Moreover, "an SVAR model only requires a minimum of restrictions in order to disentangle movements in endogenous variables such as output, prices and interest rates into the parts due to underlying shocks, such as shifts in aggregate supply and demand schedules and changes in the stance of monetary policy" (Gerlach and Smets, 1995). The use of variance decomposition additionally assesses the effects of monetary policy shocks on other variables in the model. This technique determines how much of the forecast error variance for the variables in a system, is explained by innovations to each explanatory variable, over a series of time horizons, (Stock and Watson, 2001 as cited in Sheefeni, 2020).

The study was mindful of some of the limitations associated with SVAR methodology. Despite its usefulness to analyse the dynamics of a model by subjecting it to an unexpected shock and it being the most preferred method for policy simulations, the study was mindful of some of the limitations associated with SVAR methodology. These include the argument that 'due to the low dimension of typical SVAR models, the assumption that the underlying shocks are orthogonal is likely to be fairly restrictive' (Jan, 2001).

5.1. Variables and Data description

This study used quarterly time-series data with time period spanning from 2002Q1 to 2020Q4. Data were sourced within the Bank and Namibia and Namibia Statistics Agency. The variables included a policy indicator variable (repo rate), a variable representing the intermediate monetary policy target variable (Private sector credit extension), as well as variables representing the key macroeconomic objectives of the monetary policy in Namibia (inflation and real GDP). In addition, the study included an exchange rate variable (REER) and asset price variable represented by the House price index (HPI) in order to validate and test additional transmission channels of monetary policy to the rest of the economy.
These variables are as follows:

The policy shock variable, Namibia's main policy tool:

- Repo rate

Namibia's intermediate monetary policy target:

- Private sector credit extension (PSCE)

Monetary policy key macroeconomic goals:

- Inflation
- Real GDP

PSCE, real GDP, REER and HPI were transformed into logarithms, while the repo rate and inflation were used in their original form**.**

Prior to the estimation of the four SVAR models', stationarity and lag tests were carried out. It is always important to test for stationarity of data to be used in order to establish the characteristics of the data being analysed. In this regard, the study used the Augmented Dicky-Fuller test for data stationarity in order to determine the order of integration. This step was followed by the lag length criteria test, which determines the appropriate number of lags to be applied in the models.

6. Results

Unit root test

Table 1: Augmented Dickey-Fuller unit root test

Variable	ADF (intercept) Levels		ADF (Intercept)1st Difference		Order of integration
Repo	-1.567931	0.4957	-7.037484	0.0000	I (1)
Inflation	-2.200164	0.2075	-9.152443	0.0000	I (1)
PSCE	-0.295580	0.9210	-3.755141	0.0044	I (1)
GDP	-1.761225	0.3980	-3.000156	0.0379	I (1)
HPI	0.905198	0.9953	-11.64779	0.0000	I (1)
REER	-1.720742	0.4182	-9.088373	0.0000	I (1)
Repo SA	-1.816120	0.0662	-4.603871	0.0003	I (1)

The unit root tests show that all variables were stationary after taking their first differences. The study used the Augmented Dicky-Fuller (ADF) test to examine whether variables had unit roots or not. The results of the unit root test presented in Table 1 show that the null hypothesis of unit root was rejected in levels and failed to reject after first differences. This conclude that all variables are integrated of the order I (1), they are only stationary after taking first their differences. The results of integration conform to the Vector Auto-Regression methodology, which requires variables to be of I (1). Based on the unit root results, all variables were differenced while running the SVAR model.

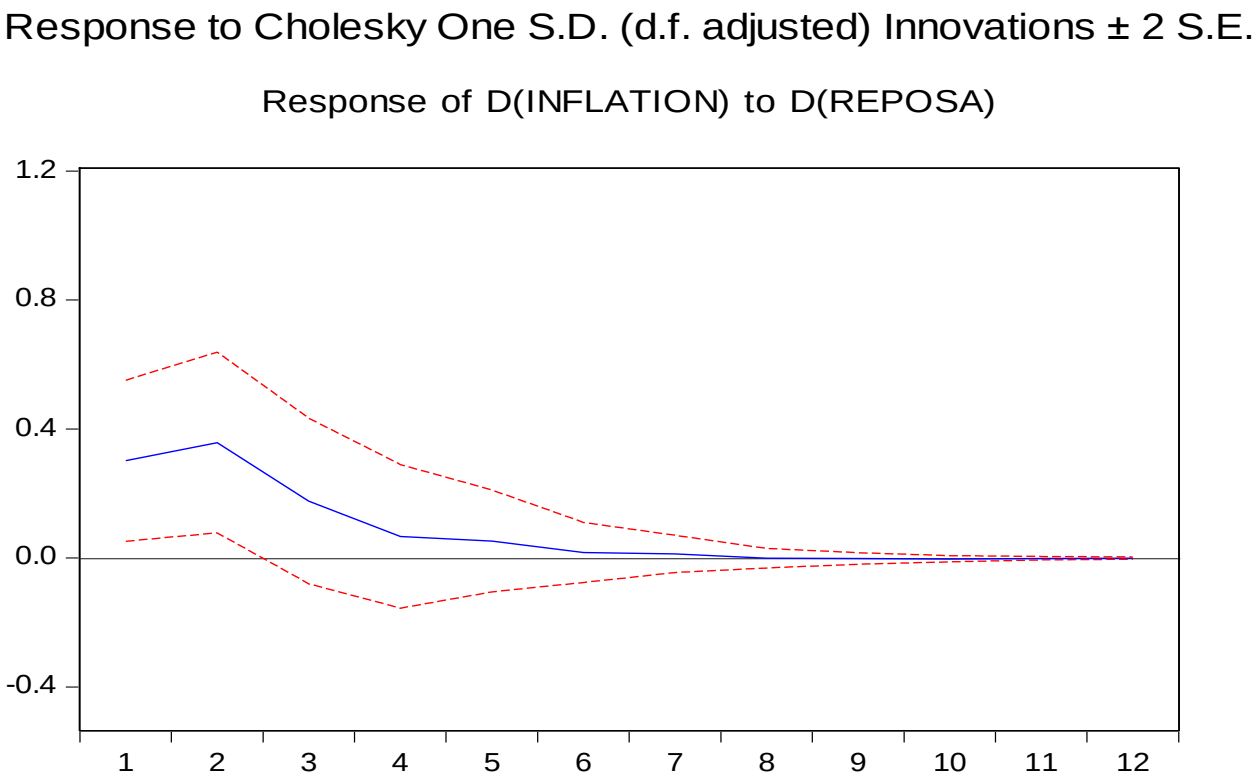
Table 2: Lag Length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	184.7903	NA	2.26e-10	-5.182328	-4.988058	-5.105255
1	262.7800	140.1554	6.73e-11	-6.399421	-5.039530*	-5.859907*
2	287.0138	39.33591	9.68e-11	-6.058370	-3.532858	-5.056415
3	308.9435	31.78216	1.55e-10	-5.650535	-1.959402	-4.186139
4	356.6494	60.84230	1.24e-10	-5.989836	-1.133083	-4.063000
5	421.6025	71.54256*	6.60e-11*	-6.829057	-0.806683	-4.439780
6	460.7035	36.26765	8.45e-11	-6.918943*	0.269052	-4.067225

The study used lag of one as recommended by SC and HQ and all models were stable and no autocorrelation was detected. Table 2 above shows the lag length selection criteria by various tests such as sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike Information Criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). The majority of the tests including FPE, AIC and FPE recommended to use the lag of five, however, due to limited observations and the fear of losing economic meaning of the study, using lags of five maybe seen to distort the expected underlying macroeconomic mechanism. Based on these, the study made use of the lag length four, which mid-point between the recommended criteria. (The residual diagnostic results are summarised in table 4-6 in the annex. The results revealed that models have no autocorrelation, residuals are normally distributed and does not suffer from heteroscedasticity. The SVAR model was found to be stable as depicted by the inverse root of AR characteristic Polynomial in figure 4 of the annex, which shows that no roots lie out of the unit circle.

6.1. Monetary Policy Transmission Mechanism through various channels

Figure 1: The Effect of SA's positive Repo rate policy shock on Namibia's Inflation[4].



Namibia being under a fixed exchange regime with South Africa (SA), it was expected that the Bank of Namibia's monetary policy will closely be linked to the South African Reserve Bank (SARB). In this case, a VAR model consisting of SA's Repo rate, and Namibia's inflation was used to analyse the effect of a positive SA monetary policy shock on Namibia's inflation (Figure 1). The impulse response function results indicate a positive response in Namibia's rate of inflation for the first two quarters after which it declines up to quarter six and becomes insignificant thereafter for the remaining quarters. These results are consistent with that of Kamati (2014). In addition, the variance decomposition shows that about 8 percent to 17 percent of variations in the rate of inflation in Namibia are explained by changes in SA's repo rate over a period of 12 quarters. This is much higher than the 1 percent to 8 percent variations explained by Namibia's repo rate and confirms the expectations that Namibia's inflation is largely explained by import prices from SA.

[4] Variables with D, means the variables were differenced.

6.1.1. Interest rate Channel

Figure 2: Impulse Response of a positive Repo rate policy shock on PSCE, Inflation and Output

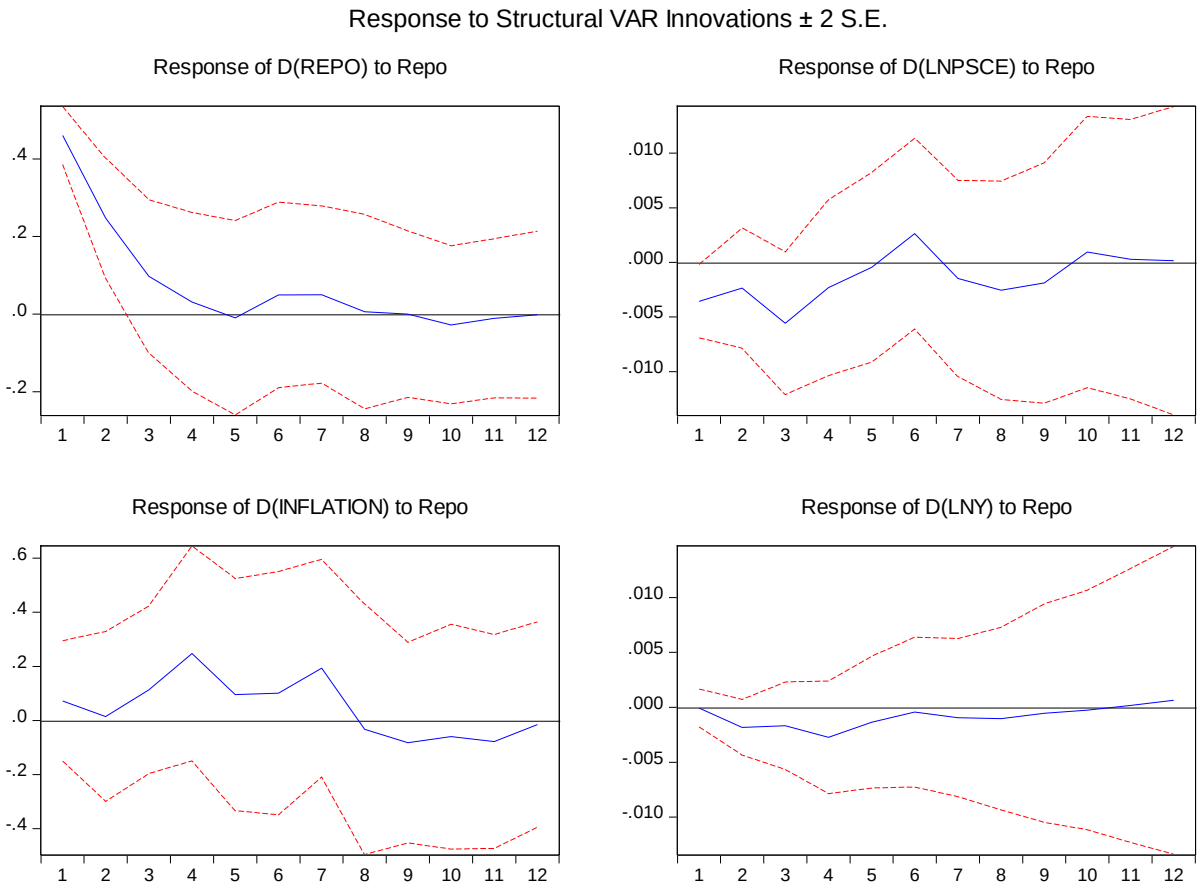


Figure 1 displays the output results of the impulse response functions of a positive policy shock of the Repo rate (contractionary monetary policy) on private sector credit, inflation and real output. The impulse response functions results suggest that a positive shock to the policy rate (repo rate), results in a decline in private domestic credit extension starting in the third quarter and proceeding to the fourth quarter after which it sharply increases from then to the sixth quarter and then sharply declines again up to the tenth quarter and after which it briefly rises and steadily declines at a slower pace ,becomes almost static after the tenth quarter and turns positive in the 12th quarter. Inflation responds negatively after the policy shock for the first two quarters and starts increasing from the third quarter after which it declines and remains steady between the 4th and 5th quarter. It picks up in the sixth quarter and declines sharply in seventh quarter, and the effect becomes negative thereafter. A positive shock in the repo rate results in a significant and immediate decline in real GDP.

The negative effect is larger in the earlier periods, from quarters one to about six quarters and becomes smaller thereafter from quarter seven. The effect on real GDP is almost insignificant and non-responsive by quarter 10. This shows that domestic credit responds to contractionary monetary policy by the third quarter while inflation reacts negatively immediately in the first two quarters, fluctuates in between, and declines more consistently from the sixth quarter onwards. Real GDP also responds immediately and more consistently for the first six quarters after which the effect becomes smaller. domestic credit responds to contractionary monetary policy by the third quarter while real GDP responds immediately from quarter one but becomes more visibly around quarter three and four. Inflation first reacts negatively in the first and second quarter before it starts declining in third quarter.

The effect of the policy shock response is more noticeable on real GDP and domestic credit compared to inflation. These results confirm that using repo rate to control domestic credit and GDP growth is effective in Namibia. The results of a positive repo rate shock to real GDP are consistent with the findings of Uanguta and Ikhide (2002), Sheefeni (2012), Kamati (2014) and Sheefeni (2020). While the finding on the inflation is similar to Ikhide and Uanguta (2002) and Sheefeni (2020) but contrary with Sheefeni (2012) and Kamati (2014) who found that prices respond positively to shocks in repo rate in the first two quarters and then followed by an immediate decline in the three quarters before convergence towards the initial level. According to Kamati (2014), this positive response of inflation to contractionary monetary policy is commonly cited in literature as the price-puzzle. Investigating the price puzzle anomaly in the case of Namibia is beyond the scope of the current paper but a step towards further future research.

In conclusion, the effectiveness of monetary policy in Namibia through interest rate channel is evident as the results confirm that it does immediately transmit to real GDP from quarter one and will last up until quarter 12. In addition, the effectiveness of the transmission to credit, occurs from the third quarter and lasts well into quarter 12. However, the effectiveness of monetary policy in the case of inflation only occurs in the second quarter, stays low and steady between the fifth and sixth quarter after which it turns negative from the eighth quarter and thereafter.

6.1.2. Credit Channel

Figure 3: Impulse Response of a positive private sector credit shock on Inflation, the interest rate and output

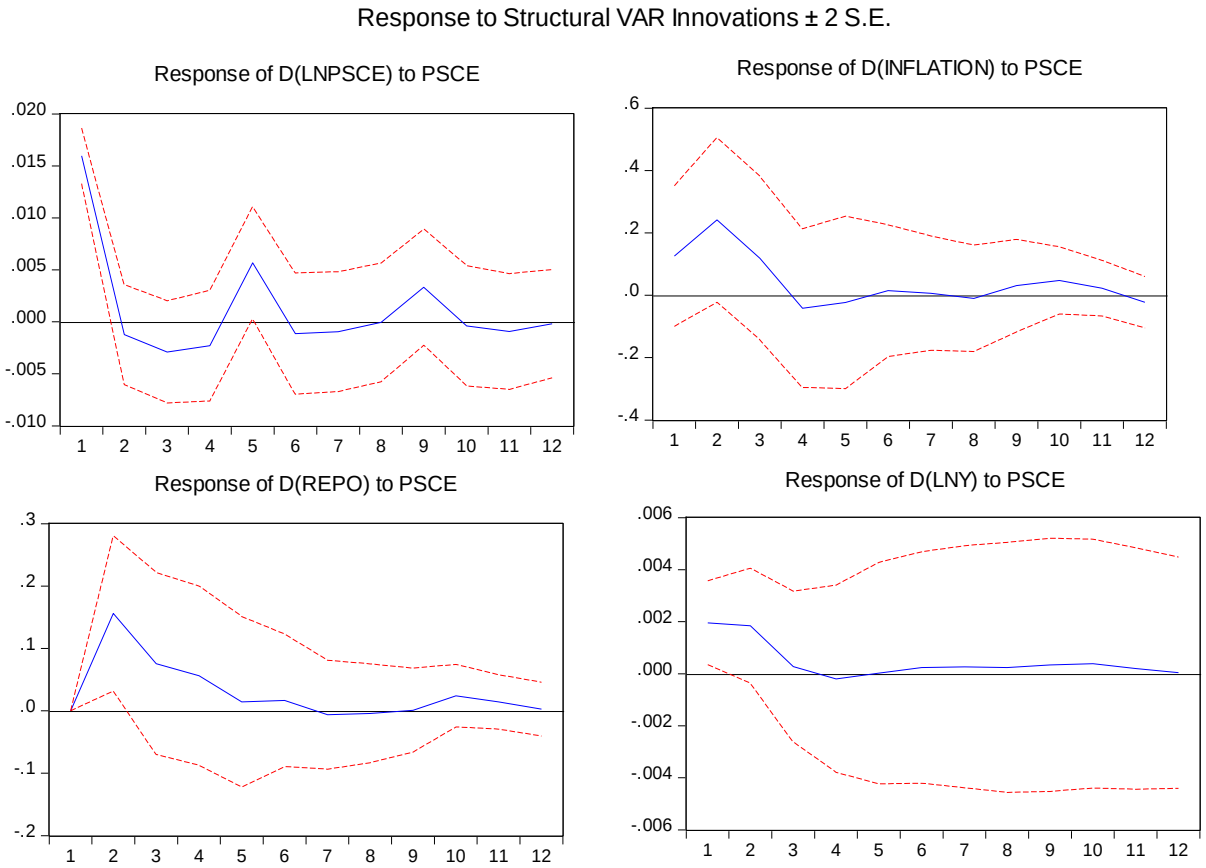


Figure 3 displays the impulse response of a positive policy shock of private sector credit, on inflation, real GDP, and the interest rate. The results demonstrate that a positive shock on domestic private sector credit extended in Namibia, results in an increase in inflation from the first and second quarters after the shock. The effect of the shock on inflation is greater (i.e. increases significantly) in quarter two and starts declining sharply afterwards, but becomes almost insignificant from quarter 6 onwards. The shock to private sector credit in this paper occurs at a faster rate than in Kamati (2014) who concluded that shocks to private credit increase the rate of inflation from quarter one to the third quarter. In addition, the real GDP immediately responds positively to positive shock on domestic credit between quarter one and quarter two after which it gradually starts declining until it becomes insignificant around the 5th quarter. These results are consistent with both Uanguta and Ikhide (2002) as well as Kamati (2014), who also established that shocks to domestic credit result in an increase in real GDP.

Similar to findings of Kamati (2014), interest rate (repo rate) reacts positively to increase in domestic credit in quarter one and two and becomes more pronounced in quarter two and three, thereafter it gradually declines until it becomes insignificant from quarter seven.

The credit channel emerges as another effective channel of the monetary policy transmission mechanism. This is demonstrated by its ability of transmitting to the key macroeconomic variables, i.e., inflation, real GDP and Repo rate. The effect on all these variables starts immediately from the first quarter and becomes more evident around quarter three and four.

6.1.3. Exchange rate channel

Figure 4: Impulse Response of a positive exchange rate shock on inflation, private sector credit extended and output

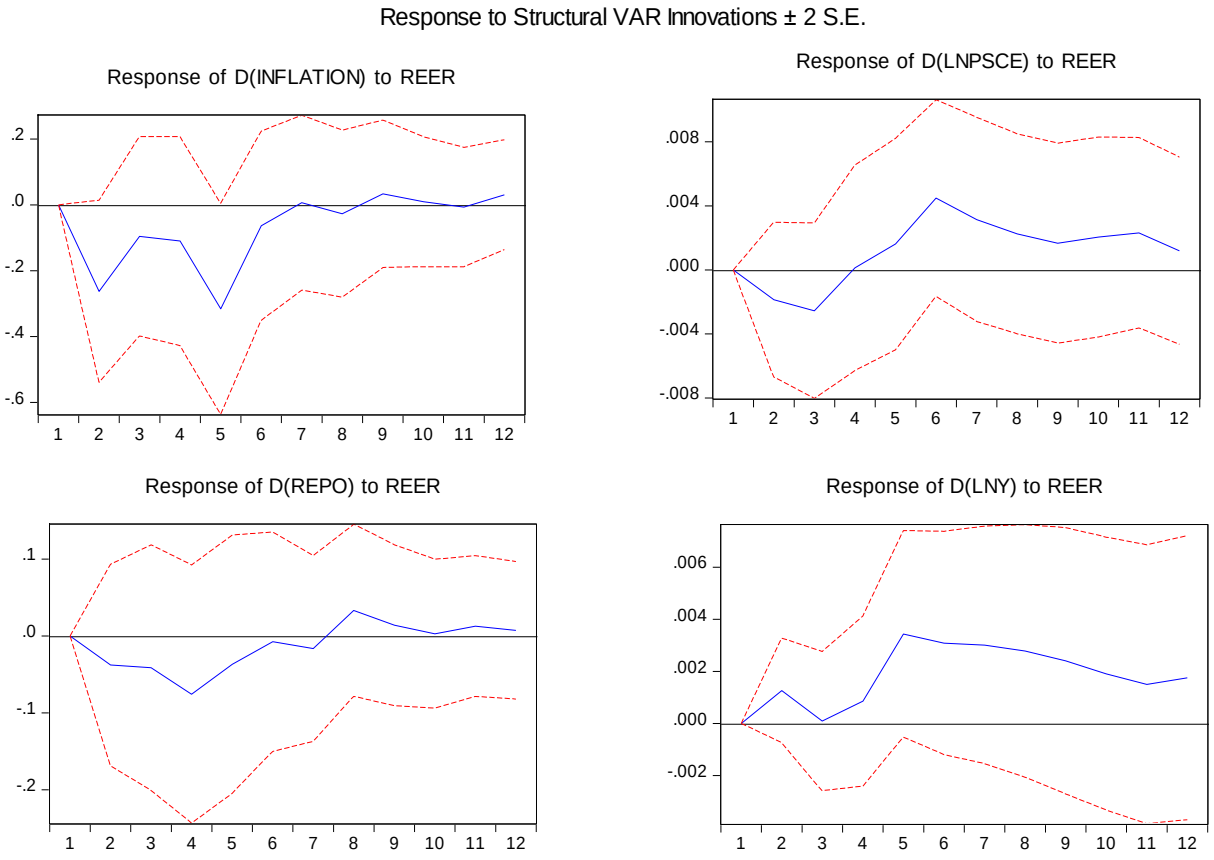


Figure 4 displays the output results of the impulse response functions of a positive shock on the real effective exchange rate, inflation, the domestic credit, and real output. The results show that a positive shock on real exchange rate or appreciation of Namibia dollar, results in an immediate decline in the rate of inflation and the interest rate from quarter one with a gradual pick up from quarter five and seven respectively to positive levels slightly above base levels. Domestic credit also responds negatively to policy shock on real effective exchange rate from quarter two to four and then positively from quarter five and remains positive for the remaining quarters. Real GDP reacts positively to unexpected appreciation in real exchange rate, and the effect remains significant from quarter one up to quarter 12. The direct impact of this finding is theoretically inconsistent unless an assumption is indirectly made via the impact of cheaper imports. Although the channel showed its ability to transmit to inflation, private sector credit extended and real GDP, the effectiveness of monetary policy under the exchange rate channel is compromised due to the fixed exchange rate arrangement and hence invalid in this regard.

6.1.4. Asset Price channel

Figure 5: Impulse Response of a positive asset price shock on inflation, the interest rate and output

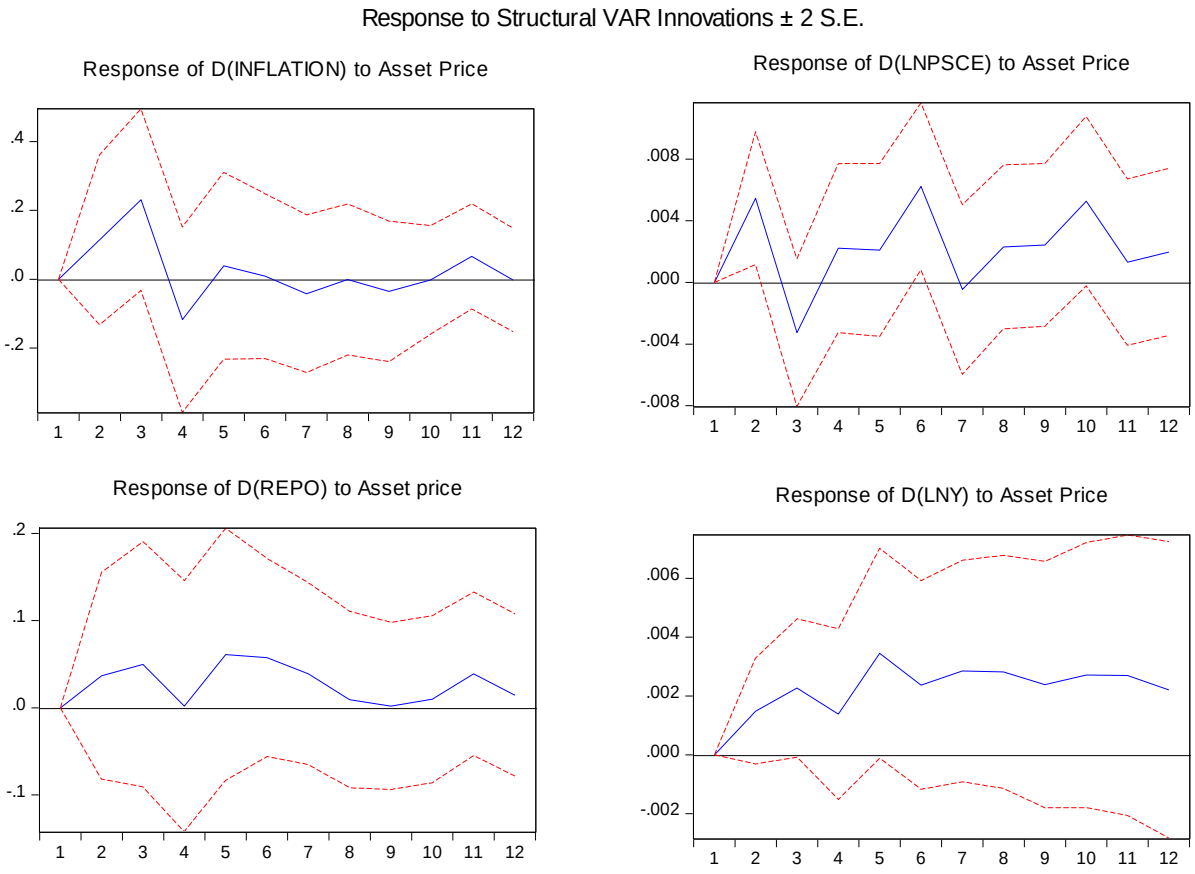


Figure 5 displays the output results of the impulse response functions of a shock on asset prices on inflation, the interest rate and real output. Both PSCE and the Repo rate display an immediate positive reaction to a positive shock on asset prices from quarter one, which are proxied by the House price index. The positive effect on PSCE is more evident in quarter two followed by negative responses in quarter three, before increasing and remaining above zero in for the remaining quarters. Inflation on the other hand, responds positively to positive shocks in asset price in quarter one and two, before declining in quarter three, thereafter, inflation starts fluctuating around zero. Similarly, real GDP responds positively to a positive shock in the house price index from quarter 1 and throughout the entire period. Comparing the transmission of the repo rate and credit rate on real GDP and inflation, this channel is the least effective mainly on its effect on inflation in the medium term as the reactions become insignificant earlier than the other two channels while the effect on credit and the repo rate is similar.

Comparing all four monetary policy transmission channels it can be determined that interest rate and credit channels are the most effective channels of transmission to achieve key objectives of monetary policy, i.e., price stability and GDP growth. The asset price channel is the least effective in terms of its impact on inflation in the medium term, while the exchange rate channel is invalid for Namibia, and as per expectation due to the fixed peg arrangement. The monetary policy transmission to inflation and GDP takes place from the first quarter to quarter 12 translating into 3 to 36 months. Hence, the effects are much faster in the short-term and last a little longer in the long-term than the theoretical expectations of 12 to 24 months respectively.

6.2. Variance Decomposition Analysis

The variance decomposition results of all variables are presented in Table 3 in the annex. The variance decomposition assessed the effects of monetary policy shocks on variables in the VAR model and indicate the level of influence of each variable to variations in the other variables.

- **Changes in the Repo rate are mainly explained by changes in domestic credit, inflation and real GDP.** The decomposition results show that changes in the Repo rate are mostly driven by changes in domestic credit, which account for about 8 percent to 10 percent of variation in Repo rate from the second to the twelfth quarter. This is followed by inflation and GDP, which account for about 8 percent of the variations between quarter one to twelve. The influence of real exchange rate and asset price is minimal with less than 3 percent over the twelve quarters. The dominance of private credit, inflation and real GDP on the variations in repo rate shows that monetary policy reaction in Namibia is chiefly triggered by developments in credit conditions, inflation and real GDP.

- **The decomposition of private sector credit is mostly explained by variations in real GDP, asset prices, repo rate and inflation.** In this regard, real GDP accounts for about 17 percent to 39 percent of variations in domestic credit from quarter 2 to 12 followed by asset prices with 8 to 13 percent. Inflation, and Repo rate account for almost 4 to 7 percent of the variations in private sector credit, mainly from quarter 2 to 12, and to a lesser extent by the REER, which accounts for only about 2 to 5 percent of the variations in private sector credit from quarter two to 12. The fact that real GDP, asset price, the Repo rate and inflation dominate the variations in PSCE, also confirm

that monetary policy is likely to respond through credit channel in order to correct for any variations in GDP and inflation.

- **The variance decomposition of inflation is mainly explained by variations in the REER and repo rate.** The REER accounts for about 6 percent to 11 percent of changes in inflation over a period up to quarter twelve, while the repo rate accounts for about 2 percent in the second quarter and increases to about eight percent in the twelfth quarter. Domestic credit also accounts for about 2 percent in the first quarter and about 5 percent to 7 percent between quarter two to twelve. Asset prices accounts for about one percent of variation in inflation in the first and second quarter and increase to about 5 percent to 6 percent from quarter three to twelve. The influence of real GDP on inflation is significantly small (less than one percent), from quarter one to twelve. The low influence of real GDP on the variations in inflation, may confirm the assumption that much of the imported inflation is likely induced by developments in South Africa than in Namibia.

- **Private sector credit, Asset prices and the REER appear to be the key contributors to the variations in the real GDP**. In this regard, private sector credit accounts for almost 8 percent to 9 percent of the variations in real GDP in quarter one and two. It gradually reduces to about 5 percent and 4 percent in the third and fourth quarter, and about 1 percent by the twelfth quarter. Moreover, the influence of repo rate on real GDP is low in the first two quarters but increases thereafter to account for about 5 percent to 7 percent in quarter three and four and remains significant at about 5 percent until quarter seven and reduces to about 3 percent in quarter twelve. Asset prices and REER have a significantly low influence in the first two quarters but gradually increase to account for about 7 percent to 10 percent variation in GDP from quarter 5 to twelve. The results of the variance decomposition confirm that the interest rate, credit and asset price channels are key to achieving the monetary policy goal of stable prices and sustainable economic development in the short to long-term (first quarter to sixth quarter). The results further confirm that the speed of transmission to real GDP via the credit channel is faster from quarter one, i.e within 3 months compared to interest rate channel which only transmits the effects from quarter 4, that is, 12 months.

- **The variance decomposition of real effective exchange rate is mainly explained by variations in the Repo rate, inflation and credit.** In this regard, Repo rate accounts for about 1 percent to 15 percent of the variations in REER in quarter one to twelve, while inflation gradually accounts for about 2 percent to 4 percent variations over the same period. Domestic credit and asset prices account for about 2 percent to 3 percent from quarter two to twelve. Real GDP accounts for less than one percent of variation in exchange rate from quarter one to three and for less than 3 percent from quarter four to twelve. The result of this channel maybe purely mechanical, as Namibia is under a fixed exchange regime and has no influence in managing the movements in the exchange rate.

- **The variance decomposition of asset prices is mainly explained by variations in the Repo rate and REER.** The repo rate accounts for about 3 percent in the first three quarters and increases to 17 percent in quarter four and five and then declines to 16 percent variations in asset prices from quarter six to twelve. The REER accounts for 2 percent to 9 percent of the variations in asset prices in quarter one and two, before increasing to 10 percent from quarter three to twelve. GDP accounts for less than one percent in the first two quarters but increases from about 4 percent to 10 percent between quarter four and twelve. Private sector credit and inflation, account for less than five percent of the variations in asset prices over a period up to twelve quarters.

The conclusion from the variance decomposition confirms that the interest rate and credit channels are the most effective channels of the monetary policy transmission mechanism. This is because the Repo rate has influence on the variations of both inflation and real GDP, although this effect is very low in the first two quarters but becomes more significant from quarter four. Although the influence of Namibia's Repo rate on inflation is low compared to the South African repo rate, it does confirm that the Bank of Namibia's monetary policy has some degree of effectiveness in controlling domestically induced inflation through interest rate channel. In addition, the credit channel has influence on real GDP and inflation from quarter one to twelve, While the influence of asset prices on changes in real GDP is significantly low in the early quarters but gradually increases. Although REER, has minimal influence on the changes in inflation and real GDP, it is assumed that these variations are due to the effect import prices from South Africa. The asset price channel emerges to be the least effective channel as confirmed by its low and insignificant contributions to changes in both inflation and the GDP.

7. Conclusion and Policy recommendations

The analysis from both the impulse response functions and variance decomposition analysis concluded that the interest rate and credit channels are the most effective channels of monetary policy transmission to inflation and GDP. The study analysed four channels of transmission, namely the interest, credit, exchange rate and asset price channels, using the SVAR model with quarterly data from 2002Q1 to 2020Q4. The interest rate and credit channels emerged as the most effective channels of the monetary policy transmission mechanism to achieve the ultimate goals of price stability and sustainable economic growth.

The monetary policy transmission mechanism is the most effective through the interest rate and credit channels. The transmission of a positive repo rate shock to both inflation and GDP in the interest rate channel takes place from the first quarter with the effect on real GDP becoming stagnant around quarter ten. However, the variance decomposition analysis shows that the magnitude of the effect lasts from quarter two to twelve. Although the transmission to private sector credit extended is only effective from the third quarter, the effects also last until quarter twelve. A positive private sector credit extended shock to inflation, real GDP and the repo rate in the credit channel similarly transmits immediately from quarter one, and the effects become more significant around quarter two and four but with all effects broadly wearing off from quarter five. The magnitude of the effect on inflation and real GDP is the greatest in the latter and similarly lasts from quarter two to twelve. The transmission of a positive asset price shock to inflation and real GDP occurs immediately from quarter one and lasts until quarter twelve for real GDP while the effect on inflation becomes insignificant from quarter four. However, the magnitude of the effect is the least significant of all channels and hence the least effective. These findings are also consistent with the variance decomposition analysis, which revealed that the repo rate and domestic credit mainly explain the variations observed in inflation and real GDP. The transmission mechanism in the exchange rate channel is invalid due to Namibia's fixed peg arrangement. The variance decomposition analysis further confirms this invalidity as the effect on inflation and real GDP is the lowest for all quarters under review.

The overall finding is that monetary policy is effective as the transmission mechanism occurs much faster than theoretical expectations. Therefore, the effect of a policy rate change by the monetary authorities on inflation and real GDP occurs immediately from the first quarter with the effects lasting into quarter twelve. This translates into a monetary policy transmission mechanism of between 3 to 36 months and implies that the effects of monetary policy decisions occur much faster in the short-term and last longer in the long-term than the theoretical expectations of 12 to 24 months.

The key policy finding points to the validity of monetary policy decisions that are enacted, with some discretion, given the fixed exchange rate regime. In this regard, the key policy implication is that despite Namibia being in a fixed exchange rate regime, the monetary policy decisions enacted by the monetary authorities, given some level of discretion, have an effective impact on the aggregate economy. The interest rate channel and credit channels therefore remain the most effective conduits of the transmission mechanism to achieve the monetary policy objectives of price stability and economic growth.

8. References

Awana, C., (2021). The Relevance of the Credit Channel in the African Franc Zone: The Case of CEMAC. Academic Research International, 12(1).

Bank of Namibia., (2020). Namibia's Monetary Policy Framework.

Bernanke, B.S., and Gertler, M., (1995). Inside the Black Box. The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives*, 9(4), 27-48.

Brandao-Marques, L., Gelos, G., Harjes, T., Sahay, R., Xue,Y.,(2020). Monetary Policy Transmission in Emerging Markets and Developing Economies. IMF Working Paper. WP/20/35.

Deuker, M.J., (2006). The Price Puzzle. An Update and a Lesson. National Economic Trends, Federal Reserve Bank of St. Louis.

Drama, B. G. H., (2017). Estimation of the Impact of Monetary Policy on Economic Growth: The Case of Cote d'Ivoire in Line with SVAR Methodology. *Applied Economics and Finance*, 4(4), 66-83.

Fernández-Villaverde, J., and Rubio-Ramirez, J.F., (2008). Structural Vector Autoregressions, Second Edition, The New Palgrave Dictionary of Economics.

Gerlach, S., and Smets, F., (1995). The Monetary Transmission Mechanism: Evidence from the G-7 countries, Bank for International Settlements (BIS), Working paper no.26.

Jan, G., (2001). An Introduction into the SVAR Methodology: Identification, Interpretation and Limitations of SVAR models, Kiel Working Paper, No. 1072, Kiel Institute of World Economics (IfW), Kiel

Kamati, R., (2014). Monetary Policy Transmission Mechanism and Interest Rate Spreads (Doctoral dissertation). University of Glasgow, United Kingdom.

Kelikume, I., (2014). Interest Rate Channel of Monetary Transmission Mechanism. Evidence from Nigeria. The International Journal of Business and Finance Research, (8) 4, 1-12.

Khoabane, S., (2020). Monetary Policy Transmission Channels in Lesotho. Central Bank of Lesotho. December Research Bulletin, Vol.5, Issue 1.

Kingdom of Eswatini, Kingdom of Lesotho, Republic of Namibia and Republic of South Africa., (1993). Multilateral Monetary Agreement between the Government of the Kingdom of Eswatini, the Government of the Republic of Namibia, The Government of the Republic of South Africa and the Government of the Kingdom of Lesotho.

Mbazima-Lando, D., and Manuel, V., (2020). The Impact of Financial Innovation on the Demand for Money and its Implications for Monetary Policy in Namibia. Bank of Namibia Working Paper, WP1-2020.

Mishkin, F. S., (1995). Symposium on the Monetary Transmission Mechanism. *Journal of Economic Perspectives,* 9 (4), 3-10.

Mishkin, F.S., (1996). The Channels of Monetary Transmission: Lessons for Monetary Policy. NBER Working Paper Series 5464. https://doi.org/10.3386/w5464

Ouchchikh, R., (2017). Monetary Policy Transmission Mechanism in a Small Open Economy under Fixed Exchange Rate. An SVAR Approach for Morocco. *International Journal of Business and Economic Sciences Applied Research*.11(1), 42-51.

Republic of Namibia and Republic of South Africa., (1993). Bilateral Monetary Agreement between the Government of the Republic of Namibia and the Government of the Republic of South Africa of 1993.

Salihu, A., Sani, B, M., and Garba, G. I., (2020). Monetary Policy Transmission Mechanism: Evidence from Economic Community of West African States. *International Journal of Advanced Research in Economics and Finance.* 2(3), 8-21.

Sander, H., and Kleimeier, S., (2006). Interest rate Pass-through in the Common Monetary Area of the SACU Countries. Maastricht University School of Business and Economics. METEOR Research Memorandum; No. 023.

Sheefeni, J.P., and Ocran, M.K., (2012). Monetary Policy Transmission Mechanism: The Interest Rate Channel. *Journal for Studies in Economics and Econometrics,* 36(3), 47-63.

Sheefeni, J.P., and Ocran, M.K., (2013). Monetary Policy Transmission Mechanism: The Credit Channel. *Journal for Development and Leadership*, 2(2), 115-126.

Sheefeni, J.P.S., (2013). Demand for money in Namibia: An ARDL bounds testing approach. *Asian Journal of Business and Management*, 01 (03), 65-71.

Sheefeni, J.P.S., (2017). Monetary Policy Transmission Mechanism in Namibia: A Bayesian VAR Approach. *Journal of Economics and Behavioral Studies*, 9 (5), 169-184.

Sheefeni, J.P.S., (2020). Money Channel of Monetary Policy Transmission in Namibia. I*nternational Economics*, 73(1), 131-150.

Sims, C., (1980), Macroeconomics and Reality, Econometrica, 48.

Taylor, J. B., (1995). The Monetary Transmission Mechanism. An Empirical Framework. *Journal of Economic Perspectives,* 9 (4),11-26.

Uanguta, E., and Ikhide, S., (2002). Monetary Policy Transmission Mechanism in Namibia. Bank of Namibia Working Paper, No.2/02.

9. Annex

Table 3: Variance decompositions

Variance Decomposition of D(INFLATION)

Period	S.E.	D(REPOSA)	D(REPO)	D(INFLATION)
1	1.087557	7.696795	1.631954	90.67125
2	1.192130	15.40823	7.167615	77.42416
3	1.227394	16.59109	10.29713	73.11178
4	1.233747	16.71252	10.32460	72.96288
5	1.237428	16.79169	10.26419	72.94412
6	1.238170	16.78970	10.34676	72.86354
7	1.238356	16.79454	10.36305	72.84241
8	1.238485	16.79111	10.36689	72.84200
9	1.238502	16.79083	10.36678	72.84239
10	1.238510	16.79116	10.36705	72.84179
11	1.238513	16.79116	10.36734	72.84150
12	1.238514	16.79115	10.36736	72.84149

Variance Decomposition of D(REPO)

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	0.460426	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.558761	87.53689	7.820250	1.644427	2.109779	0.455502	0.433148
3	0.587002	82.06681	8.749523	5.124300	2.042929	0.901484	1.114952
4	0.604178	77.73494	9.121617	4.854348	4.823445	2.412220	1.053434
5	0.614461	75.17821	8.874679	5.235698	6.015328	2.685570	2.010514
6	0.623963	73.53115	8.678545	6.445251	5.926005	2.618266	2.800779
7	0.631328	72.46111	8.487078	7.000085	6.313745	2.623251	3.114728
8	0.632891	72.11345	8.449477	7.026878	6.398519	2.890255	3.121421
9	0.633839	71.89790	8.424468	7.024944	6.608691	2.930957	3.113041
10	0.637309	71.30700	8.475828	7.230161	6.982692	2.901320	3.103003
11	0.641313	70.44770	8.419465	7.490747	7.303730	2.906448	3.431912
12	0.643648	69.93814	8.360178	7.579125	7.766264	2.898624	3.457667

Variance Decomposition of D(LNPSCE):

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	0.016362	4.714542	95.28546	0.000000	0.000000	0.000000	0.000000
2	0.019250	4.893170	69.24632	0.186003	16.67440	0.933403	8.066706
3	0.022027	10.12252	54.60753	0.516250	24.35061	2.062812	8.340274
4	0.023226	10.10035	50.08935	3.560082	25.98008	1.858862	8.411272
5	0.024754	8.924205	49.33759	4.109428	27.44127	2.060506	8.126999
6	0.027211	8.320318	41.00657	5.170525	29.12238	4.421728	11.95848
7	0.028399	7.909800	37.76132	5.294636	32.74421	5.284095	11.00594
8	0.029263	8.211291	35.56446	5.738217	33.93842	5.564539	10.98307
9	0.030372	8.008330	34.22083	5.916108	35.55242	5.466739	10.83557
10	0.031692	7.444067	31.44599	6.384266	36.56447	5.438186	12.72302
11	0.032318	7.165729	30.32258	6.390454	37.97971	5.742198	12.39933
12	0.032662	7.017593	29.68959	6.340860	38.69215	5.754536	12.50527

Variance Decomposition of D(INFLATION):

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	0.956593	0.568586	1.716305	97.71511	0.000000	0.000000	0.000000
2	1.052883	0.488693	6.674852	85.38520	0.054649	6.201042	1.195567
3	1.096299	1.520171	7.327861	79.08923	0.050437	6.474225	5.538073

4	1.139156	6.122783	6.919103	73.76051	0.079474	6.924358	6.193775
5	1.268543	5.504408	5.613565	71.39791	0.630056	11.76551	5.088552
6	1.294510	5.890128	5.403202	71.63187	0.648781	11.53510	4.890921
7	1.311542	7.918892	5.266345	70.01965	0.686478	11.24017	4.868473
8	1.322106	7.853282	5.188028	70.38869	0.676640	11.10232	4.791038
9	1.329280	8.151895	5.185958	70.11533	0.687506	11.04837	4.810940
10	1.333089	8.306706	5.282103	69.85824	0.778679	10.99053	4.783740
11	1.338076	8.583310	5.271802	69.33946	0.898549	10.91101	4.995861
12	1.341825	8.548056	5.270560	69.30501	1.003753	10.90432	4.968299

Variance Decomposition of D(LNY):

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	0.006924	0.007257	7.988126	0.635509	91.36911	0.000000	0.000000
2	0.009160	3.996364	8.614573	0.771784	82.07021	1.903703	2.643362
3	0.011606	4.606698	5.422240	0.938658	82.34975	1.192731	5.489921
4	0.014353	6.652383	3.563936	0.651530	83.47018	1.141984	4.519989
5	0.016366	5.798518	2.741210	0.596306	77.65131	5.287564	7.925087
6	0.018171	4.761805	2.240573	1.000983	76.68266	7.178366	8.135617
7	0.019847	4.220250	1.895803	2.928269	73.74678	8.325209	8.883685
8	0.021276	3.907409	1.662365	3.605836	72.38754	8.951457	9.485389
9	0.022532	3.541116	1.504727	5.098157	71.15380	9.122880	9.579316
10	0.023476	3.273778	1.412931	5.616503	70.46958	9.065943	10.16126
11	0.024264	3.069257	1.329282	5.741354	70.23671	8.871135	10.75226
12	0.024905	2.977804	1.261938	5.950765	69.90129	8.918374	10.98983

Variance Decomposition of D(RER):

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	2.432286	1.144736	2.160023	2.021270	0.788601	93.88537	0.000000
2	2.478336	1.391327	2.352254	2.150516	0.807219	91.94203	1.356653
3	2.667660	13.74320	2.404416	2.096897	0.949555	79.63493	1.170997
4	2.729350	15.22438	2.304965	2.298476	2.074187	76.15220	1.945788
5	2.825013	14.37168	2.728974	3.239788	1.939348	75.59474	2.125476
6	2.831335	14.30869	2.747091	3.388506	2.126561	75.30934	2.119815
7	2.843462	14.37471	2.762067	3.971823	2.108538	74.67210	2.110760
8	2.863237	14.77917	2.861307	4.167723	2.255220	73.77864	2.157938
9	2.870207	14.98675	2.953564	4.148941	2.325356	73.42139	2.164003
10	2.879996	14.88871	2.933551	4.126794	2.692701	73.11226	2.245984
11	2.886042	14.84668	2.939008	4.241775	2.844105	72.86766	2.260774
12	2.893483	14.83860	2.943970	4.324777	3.101356	72.52732	2.263986

Variance Decomposition of D(LNHP):

Period	S.E.	Repo	PSCE	Inflation	GDP	REER	Asset Price
1	0.048451	0.287169	0.845335	0.150665	0.875002	2.334134	95.50770
2	0.052653	1.653818	2.350353	0.716228	0.994704	8.562691	85.72221
3	0.055386	3.531532	2.124789	3.051557	3.157515	10.21995	77.91465
4	0.063094	17.32685	1.972959	3.379413	4.917172	10.29600	62.10761
5	0.063707	17.02401	1.943785	4.302870	4.977113	10.10230	61.64993
6	0.064660	16.78499	1.967506	4.691935	6.464840	10.10129	59.98944
7	0.065086	16.58818	2.095390	5.350847	6.540978	10.13004	59.29457
8	0.065725	16.39545	2.068137	5.410024	7.600836	10.37140	58.15415
9	0.066397	16.38981	2.174143	5.313131	8.724852	10.17980	57.21827
10	0.067159	16.02797	2.197333	5.468186	9.456627	10.57753	56.27235
11	0.067482	15.88235	2.218864	5.421900	10.18929	10.47662	55.81098
12	0.067933	15.70672	2.229033	5.363322	10.74912	10.59947	55.35233

Table 4: Residual Serial Correlation LM Tests

	Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
	4	48.17057	36	0.0845	1.391172	(36, 156.5)	0.0875

Table 5: Heteroskedasticity Tests

	Chi-sq	df	Prob.
Interest rate	1053.129	1008	0.1574

Table 6: Normality tests

	Component	Jarque-Bera	df	Prob.
Interest rate	Joint	16.74383	12	0.1595

Figure 4: Inverse root of AR characteristic Polynomial -stability