

# **MONETARY POLICY TRANSMISSION MECHANISM NEXUS ECONOMIC GROWTH: EVIDENCE FROM BOTSWANA**

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## ABSTRACT

Since its inception, monetary policy has been used as a tool to help achieve periodic quantitative targets for monetary aggregates that have been established. It is only recently that developing countries have taken a more modern strategy to achieving their inflation objectives by utilizing policy rates. Several factors have contributed to this phenomenon, including the weak link between money and inflation, global financial integration, greater exchange rate flexibility, lower fiscal financing requirements for governments, and the liberalization of financial markets, all of which have contributed to, or have perpetuated, instability in money demand. The primary goal of the research is examining the influence of monetary policy transmission on Botswana's economic growth. Data was sourced from Botswana's Statistics Office and the World Bank database in which annual time series data from 1980 to 2018 was collated and analysed. In determining the stationarity of the variables utilized in the study, the Augmented Dickey-Fuller (ADF) unit root test was applied. The presence of long-run correlations among the variables in the study was assessed using the Autoregressive Distributed Lag (ARDL) bounds test to cointegration. Only estimates for the short-run relationship are considered because the ARDL bounds tests revealed no long-term correlations between the variables. The Vector Autoregressive (VAR) found a significant unidirectional short-run causal association between gross fixed capital formation (GFCF) and real gross domestic product (GDP), as well as a significant unidirectional short-run causal relationship between bank rate and GFCF in the short term.

Even though the study's findings demonstrated that the variables had a causal relationship, it was expected that there would be more linkages between them. This study recommends the need for structural changes in Botswana's economy in order for adjustments in the monetary policy rate to have the desired effect on the economy. The study further suggests that monetary policy be used to foster an investment climate that attracts both domestic and foreign capital, so encouraging long-term economic growth.

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## GLOSSARY OF TERMS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lags
BOB	Bank of Botswana
BR	Bank Rate
CEE	Central and Eastern European
DSGE	Dynamic Stochastic General Equilibrium
FAVAR	Factor-Augmented Vector Autoregressive
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
IPVAR	Interacted Panel Vector autoregressive
IS-LM	Investment–Saving and Liquidity-Money
LM	Liquidity-Money
MPC	Monetary Policy Committee
M2	Money Supply 2
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
OMO	Open Market Operations
PVAR	Panel Vector Autoregressive
SVAR	Structural Vector Autoregressive
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WDI	World Development Indicators



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This is for you, Moathodi "Jarge" Sebabole — continue to soar with the angels my dearest friend. You will always be remembered and missed.

To the Almighty God, thank you for your blessings and for providing me with the motivation and confidence to keep going; nothing is impossible when you believe.

# CHAPTER 1

## INTRODUCTION

### **1.1 Background of the study**

Throughout the years, monetary policy has served as a tool utilised in achieving set periodic quantitative targets for monetary aggregates. It is only recently that developing countries have adopted a more modern approach by using policy rates to achieve their inflation objectives. This phenomenon has been influenced by the weak relationship that pertains between money and inflation, global financial integration, higher exchange rate flexibility, lower fiscal financing requirements and the liberation of financial markets which has resulted in, or perpetuated, instability in money demand. However, this newly adopted approach has not been without incident in its quest to achieve operational targets consistently, which has raised questions regarding the readiness of frontier economies to move more authoritatively to a self-sufficient framework focusing on setting inflation targets.

The transmission of the monetary policy mechanism is premised on the work of Sims (1972; 1986) and Friedman and Schwartz (1963) who employed the Vector Autoregressive (VAR) estimation framework in investigating the transference of the monetary policy mechanism. Boivin, Kiley and Mishkin (2010) diversified this thought process by dissecting the complexity of varying economic conditions in diverse economies with respect to the monetary transmission tool and emphasized the importance of appreciating the impact of monetary policy on economic performance and, consequently, the utilisation of the merited policy instruments. Akhtar (1997) concurs with this view and elucidates the monetary policy transmission mechanism as having an impact on aggregate demand, interest rates and asset pricing and therefore exerting influence on output, inflation, and employment. The study conducted by Friedman and Schwartz (1963) supports this perspective by asserting that this impact can last for more than two years.

The evolution of monetary policy transmission has been archived prudently over the years. It is strongly believed to have contributed to greater moderation in the United States which emulated a time of decreased volatility in American macroeconomic aggregates. This documentation or record of changes is notably well articulated in a report released by Boivin, Kiley, and Mishkin (2011). The VAR model is historically popular in demonstrating changes in conditional means which has been observed in studies conducted by Sims and Zha (2006) and Sargent and Cogley (2005). In more recent literature, Doh and Davig (2009), Bianchi (2012), Rossi and Inoue (2011), Primiceri and Justiniano (2008) and Surico and Benati (2009), exhibit this using Dynamic Stochastic General Equilibrium (DSGE) models. Cogley and Sargent (2005) demonstrate the composition in the time variation of the mean by analysing it through gradual developing parameters, which was archetypally put through various models using random innovation variance. Conversely, Bianchi (2012), Doh and Davig (2009) and Sims and Zha (2006), use instantaneously alternating variables whose transformation is ascertained by an imperceptible Markov chain. Furthermore, it has been suggested that the variance in time variation is usually modelled using elements of a “stochastic volatility specification both in VARs” (Zha and Sims, 2006) and DSGE models (Rubio-Ramirez, Guerron-Quintana and Fernandez-Villaverde, 2010).

With the cessation of the global financial crisis which occurred between 2008-2009, there was monetary policy easing across varying economies in order to make funds easily accessible and thereby promote economic growth. Brozda (2016) and Dalhuas (2014) demonstrated that the United States Federal Reserve interest rates dropped close to zero. However, Pain, Lewis, Dang, Jin and Richardson (2014) and Christensen Renne, Bouis, Watanabe and Rawdanowicz (2013) highlighted that despite this approach, economic recovery in many countries remained low post this period. Interestingly, Dalhaus (2014) and Krugman (2008) argue that the cost of funds in the United States surged despite these concerted and continuous efforts by the central bank of the United States. However, throughout the Great Depression that occurred during the 1930s, the Federal Reserve had implemented the same approach of lowering policy rates which had translated into lower credit costs (Stock, 2012). This therefore reinforced the perspective that monetary policy had an impact on economic growth.

Walsh (2014) further concurred with this conclusion but highlighted that the credibility, including the reliability of a central bank and market appreciation of monetary policy objectives, played a role in its efficacy.

In terms of monetary policy transmission efficacy and its impact on economic growth, empirical literature has yet to establish agreement or consensus. This has necessitated the need to conduct a study that determines if monetary policy is not only effective during financial distress periods or whether there are other variables that need to be incorporated in the framework to ensure that it is effective in both distressed and normal periods. This research is further driven by the fact that there have been changes in monetary policy over the years, hence findings drawn from older studies on the various channels in which monetary policy can be transmitted may no longer be applicable to the present macroeconomic dynamics. Furthermore, recent empirical research on monetary policy transmission mechanisms has tended to focus on established economies rather than emerging markets, hence findings on developed markets may be irrelevant to the emerging markets.

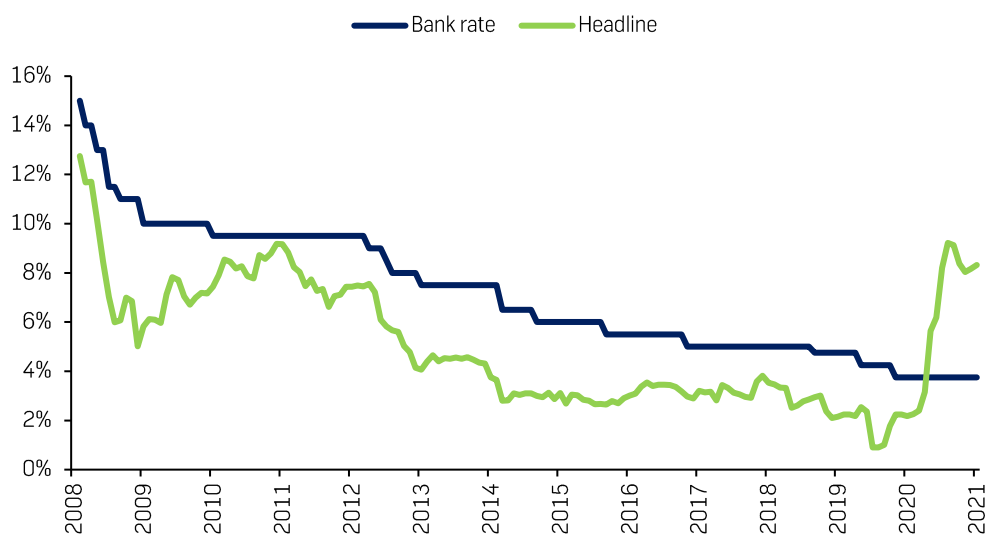
## **1.2 Research Problem and Questions**

The motivation of this paper emerges from the prevailing problem statement from empirical literature by Laeven and Valencia (2013) and Jansen et.al (2019). Laeven and Valencia (2013) reached no concurrence or solidarity in terms of the monetary policy transmission efficacy and its impact on economic growth particularly in emerging markets. Botswana remains one such country where little literature exists in terms of addressing the relationship of monetary policy transmission mechanism towards its economic growth.

Botswana has long recognised the importance of strengthening the monetary policy framework with the focus of boosting economic growth and limiting volatility in the capital markets and other macroeconomic variables. An effective monetary policy transmission tool should be capable of ensuring a manageable level of inflation, financial market/price stability and promote economic growth. In Botswana the

monetary policy rates have been systematically reduced since 2009, following Botswana’s poor economic performance during the period. According to the World Development Indicators (WDI), Botswana’s monetary policy rates declined from 10% in 2009 to 5% in 2018. Cuts in the monetary policy rate that followed from 2009 were aimed at stimulating economic activity by making it easier to access credit; this has borne some results, as reflected by elevated levels of market credit extension between 2009 and 2014. In terms of other efficacy metrics, inflation has not consistently followed changes in the Botswana monetary policy rate as expected and as a result, inflation has not been stimulated by the monetary policy rate. For instance, cuts in the monetary policy rate have not resulted in the desired response from inflation (as reflected in Figure 1). The expectation would be that cuts in the bank rate would induce consumption, resulting in elevated levels of inflation, but this has not been the case. Figure 1 shows that period 2011 to 2020 was characterised by a decline in the monetary policy rate from 9.17% to 4.25% and a decline in the headline inflation from 9.17% to 0.90% which is contrary to the expectation. Much of the sharp increase in the headline inflation from 2020 to 2021 is attributed to the COVID-19 pandemic which disrupted the global supply chain and production leading to shortage of commodities in the market.

**Figure 1: Botswana Bank Rate 2008-2021**



**Source: Statistics Botswana 2021**

The historic behaviour mentioned above highlights possible structural challenges in the Botswana economy, emphasising the need for structural reforms that will address issues such as the nation's unemployment challenges as well as low real wage growth. The conclusions that will be drawn in this study will augment the effectiveness of the central bank's policy rate in Botswana which can be included in future policy recommendations.

The study intends to address the following:

- What is the relationship between monetary policy and the level of domestic investments?
- Does monetary policy affect economic growth?

Following the 2007 economic financial crisis, many central banks eased their monetary policy. Dalhuas (2014) and Brozda (2016) stated that the United States Federal Reserve interest rates dropped close to zero. Pain et. al (2014) and Christensen Renne, Bouis, Watanabe and Rawdanowicz (2013) assert that despite these measures, recoveries in several economies were disappointingly lower than expected. Krugman (2008) and Dalhaus (2014) state that the cost of credit during the period of financial stress in the United States increased further despite the efforts by the Federal Reserve System to lower the interest rate. Stock and Watson (2012) are of the view that monetary policy was effective during the financial depression following the Federal Reserve's decision to reduce the interest rate to lower bound as this assisted with lowering the credit spread. This strategy was also common in other countries as the respective central banks triggered the expansionary monetary policy. Countries such as the United Kingdom, India, China and Nigeria significantly cut their interest rates to boost aggregate demand in their respective economies e.g. United Kingdom cut its interest rate from 5.75% to 0.5%; India 7% to 3.25%; China 7.47% to 5.58% and Nigeria 9.75% to 6% (Champroux, 2015; Allen, 2021; Ozsoz and Ay, 2016). However, Walsh (2014) stated that the "effectiveness of monetary policy depends on the credibility of the central bank and the understanding of the intentions of the monetary policy by market participants". This has triggered some interest in determining if

monetary policy is effective in triggering economic growth. Nonetheless, no study has been conducted to establish this premise with respect to Botswana.

Monetary policy influences the “rate of inflation, the supply of money and rate of interest in order to achieve a set of objectives that is beneficial for the strength, stability, and growth of the economy”, (Vedala Naga, 2018). The policy rate is particularly correlated to inflation rate and this has been the practice in both the developed and emerging markets. The Keynesian system stipulates that if an economy runs automatically without intervention, it will not reach full employment. This is because of the anticipated lack of demand from consumers leading to a deflationary gap. The framework therefore suggests that it is important to implement monetary policy tools to foster growth by promoting demand.

### **1.3 Research objectives**

The research objectives are as follows:

- To examine the efficacy of monetary policy in driving the level of domestic investment in the form of GFCF in Botswana.
- To examine the relationship between monetary policy and economic development in Botswana.

### **1.4 Scope and Justification of the study**

The study aims to assess the significance of the efficacy of monetary policy on signalling economic growth in Botswana with the view of articulating valuable conclusions. Rather than doing a cross-country comparative investigation of monetary transmission channels, studies have concentrated on specific economies. Furthermore, there is no clear indication on whether monetary aggregates play a large role in the transmission of monetary policy signals to the economy. The established empirical literature is mostly concerned with developed markets and less so with emerging markets, which highlights the necessity to investigate the transmission mechanism of monetary policy in emerging countries. As a result of the contribution of this paper,

the gap in existing literature on whether the effect of monetary aggregates on the transmission mechanism of monetary policy on selected developing and emerging markets policies will be addressed.

### **1.5 Organization of the study**

The study is organised as follows: Chapter 2 discusses the literature review and is divided into two sections. The first section focuses on explaining the theoretical background that guides this study. The second section outlines the empirical literature that provides relevant information for understanding the methods and approaches that were employed by past researchers on the topic of interest in different economies and settings and their main results. The review covers different perspectives and transmission mechanism presented by different authors on the subject matter. Chapter 3 discusses the methodological approach used in this study. This includes outlining the research approach and design, model adopted, the choice of variables and the data sources and period of interest. Chapter 4 presents a detailed discussion on the research findings. This covers descriptive statistics, correlation analysis, unit root tests, models result and the model diagnostics. Lastly, Chapter 5 gives a brief summary of the main findings of the study. This chapter concludes by giving policy recommendations based on the main findings of the study.



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents an overview of the research on monetary policy transmission. The chapter begins with the definition of monetary policy and thereafter proceeds to discuss the transmission of monetary policy in Botswana. The major economic theories, as well as theoretical questions relevant to monetary policy, are next explored. Then an assessment on the empirical studies conducted on monetary policy transmission will be presented. Lastly, a chapter summary concluded the chapter.

#### **2.2 Definition of Terms: Monetary Policy**

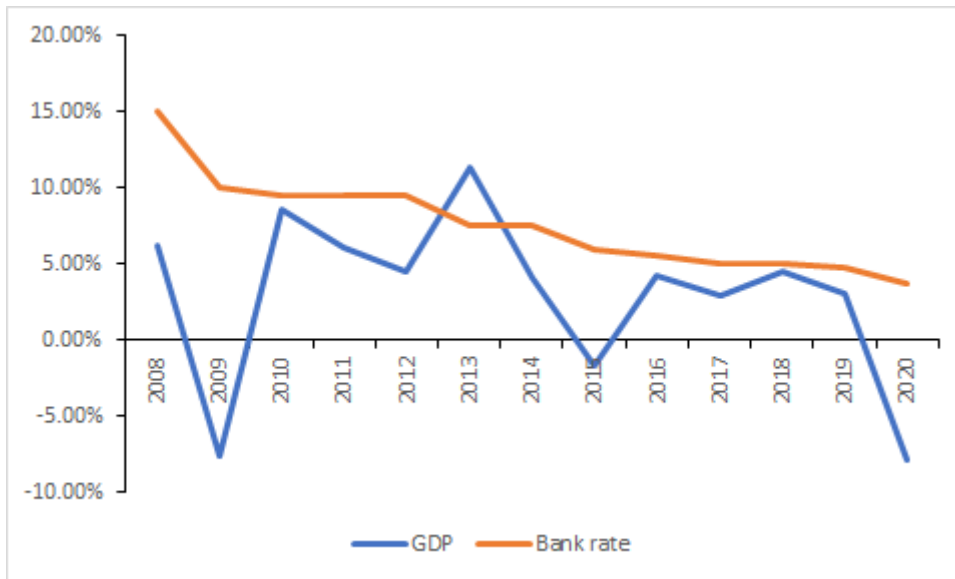
“Monetary policy is the process by which the regulatory authorities, government and the central bank of a country controls the rate of inflation, the supply of money and rate of interest in order to achieve a set of objectives that is beneficial for the strength, stability, and growth of the economy” (Vedala Naga, 2018). The policy rate is particularly correlated to inflation rate and this has been the practice in both the developed and emerging markets. Other variables that monetary policy has influence on include employment and the balance of payments. Therefore, it can be asserted that the transmission mechanism of monetary policy is effected through various channels which influence demand and supply monetary. The transmission channels are largely affected by the structure of monetary policy. According to Antonio (2019), “a central bank may employ strategies based on targets for a particular monetary aggregate or else it may choose to determine a path for short-term interest rates consistent with its goal of price stability or stability for any other nominal variable (the exchange rate, for instance)”. Antonio (2019) further states that it is “generally recognised, the type of uncertainty prevailing in an economy affects optimal selection of one or other monetary strategy”. The implementation of the policy is done by a sovereign’s reserve bank; in the case of Botswana, the policy is implemented by the Bank of Botswana (BoB). The BoB has the statutory objective of maintaining monetary stability so as to

influence sustainable economic growth. An effective monetary policy transmission tool should be able to ensure a manageable level of inflation and promote economic growth.

### **2.3 Monetary Policy in Botswana**

The current monetary policy framework that is being operationalised in Botswana has had many people deliberating whether indeed the transmission of the monetary policy framework has a significant contribution factor in the stimulation of economic growth. The central bank has employed various measures such as altering interest rates, in which, during the past decade, the policy rate being the “bank rate” has been consistently “reduced since 2011 from 9.75% to the current 3.75%” (Botswana, 2020), predominantly in response to the increasingly poor economic performance of Botswana. It remains debatable if this has impacted economic growth or if this requires additional structural support (Figure 1.1). Aggravating this deliberation or contemplation of whether monetary policy is effective or has impact on economic growth has been the tightening of monetary policy since 2000 to 2010 that unsuccessfully addressed inflationary pressures. “In a country that is heavily reliant on diamond revenue, which makes up 35% of total government revenue” (Botswana, 2020), it therefore becomes increasingly imperative that the signalling outcome of transmission mechanism is effectual and results in the core goal of boosting economic performance. As a result, Botswana's government has embarked on a diversification push that will require major support from the monetary policy framework.

**Figure 2: Relationship between GDP and Interest Rates in Botswana**



**Source: Statistics Botswana 2021**

## **2.4 Theoretical Framework**

There are various theories or schools of thought associated with monetary policy and extensive research has been conducted in support of these theoretical frameworks. The section below will elaborate further on key economic theories, namely the Keynesian theory, the Classical theory, and the Monetarist theory.

### **2.4.1 The Keynesian theory**

The Keynesian theory developed by economist John Maynard Keynes adopts three aspects, being the “investment multiplier, marginal efficiency of capital, and the interest rate” (Dickens, 2011). All these aspects are used in support of influencing buyers or investors to spend more. Keynes emphasizes the significance of examining how these three aspects interconnect from a short run and long run stance. The Keynes system stipulates that if an economy runs automatically without intervention, it will not reach full employment. This is because of the anticipated lack of demand from consumers leading to a deflationary gap. The framework therefore suggests that it is important to implement monetary policy tools to foster growth by inciting demand.

Conversely, the same tools are to be utilised to bridge inflationary gaps (Ozlen Hic, 2014). However, Keynes does concede that monetary policy is not as impactful in a liquidity trap as in this scenario there is considerable unpredictability in the market. The utilisation of interest rates would have no effect in this period if the rates are almost nil. This would translate into the in-efficacy of monetary policy in fostering economic growth (Olawoye, 2012). Another aspect affected would also be the ability to influence money supply as the market would not acquire any bond holdings if the yields are low due to low rates. On such a stance, Keynes advocates for fiscal policy more than monetary policy in terms of ensuring that there is growth in the economy (Fábio Henrique, 2017).

#### **2.4.2 The Classical theory**

The classical theory pioneered the essence of school of thought regarding monetary policy. This is entrenched in the Irving Fisher model which stipulates the interconnection of monetary policy tools and economic variables. This theory adopts the notion that interest rates have direct impact on the output as depicted on the Liquidity-Money (LM) curve. It stipulates that unlike the premise that the LM curve is horizontal as asserted by Keynes, the LM curve is in fact downward sloping, which means that production would be impacted by adjustments to this curve (Tavlas, 2018). This theory therefore cements the concept that monetary policy is indeed vital for economic growth. Classical economists generally have a differing view to Keynes, as they adopt the notion that the economy would reach full employment on its own without any intervention whatsoever. They believe that the government would need to not intervene even from a fiscal stance such as recommending a minimum salary, as full employment would translate into the correct adjustment of salaries emanating from firm competitiveness (Twinoburyo & Odhiambo, 2018).

#### **2.4.3 Monetarist theory**

Monetarists assert the phenomenon that inflation should be kept at low levels in order to affect money supply levels. This is because the belief is that it would be detrimental

for money supply to go lower or higher than a certain threshold for the economy. It also emphasizes that this targeted inflation should not experience volatility. Lower amounts of money in the market would initiate the power of supply and demand forces which will result in the natural re-adjustment of inflation to normalised levels. This theory or conclusion is supported by a study conducted by Fábio Henrique (2017), who asserts that to accomplish economic growth, “monetary policy can use its two classical tools, the interest rate and regulation, and it should also undertake debt management as one further instrument at its disposal”.

The monetarist view as advanced by Taylor (1995) explains the role that is played by “monetary aggregates through the interest rate channel”. Endut, Morley and Tien (2017) are of the view that the money supply perspective is backed by a dual asset model in which “money and bonds are imperfect substitutes”. According to the authors it is further asserted that if rational expectations and price stability prevailed, a tightening monetary policy shock would instigate an increase in the long-term interest rates which will consequently result in the gradual rise in the cost of capital. Endut et.al (2017) further explains that a decline in investment returns due to upsurges in the capital costs results in a pass-through effect of a decline in output and aggregate demand. Studies have alluded to the fact that the exchange rate also has an influential role in the transmission mechanism of monetary policy. Mishkin (1996) and Endut et.al (2017) have asserted that in an environment with a flexible exchange rate regime, the appreciation of the country’s currency will boost imports and in contrast also result in the decline of exports as the price of exports increases.

Mishkin (1996) expounded on the view that the reduction in interest rates by a Monetary Policy Committee (MPC) results in the weakening of the domestic currency which translates into cheaper goods and a nett export increase. This also allows for growth in output. Further to the above, governments utilise the credit channel as a substantial monetary policy transmission tool. Endut et.al (2018), Mishkin (1996) and Gertler and Bernanke (1995),) have asserted that this channel functions through the premise of bank loans and it gives emphasis to the importance of imperfect information on the transmission mechanism. It has been stated that any changes in monetary policy

directly influences the supply of credit by commercial banks to businesses and households. Endut et.al (2018) further assert that when interest rates are increasing this results in the decline in market liquidity which limits the disbursement of loans with the converse being true. Proponents of the credit channel are of the view that using a model with a two-asset perspective (money and bonds) in analysing the money supply trend is considered to be unsophisticated and simplistic. Bonds and loans offered by banks are distinct, hence cannot be used as perfect substitutes, and as such the argument is to further extend the Investment–Saving and Liquidity-Money (IS-LM) framework as a model which incorporates three factors, being bonds, loans, and money.

## **2.5 The Channels of Monetary Transmission**

In terms of money transmission, there are two schools of thought: neo-classical channels and non-neo classical channels. The neo-classical channels assume that financial markets function perfectly whereas non-neo-classical channels which assume financial markets are imperfect.

### **2.5.1 Neo-classical Channel**

The neo-classical framework is built on the assimilation of the classical and Keynesian models. This model stipulates that monetary policy transmission impacts the economic landscape, continuing over many years as prices vary over time. It also depicts positive outcomes from the removal of inflation as it translates into improved transaction efficacy and less price volatility. Such activity gives emphasis to the constancy of the spread between the cost of goods and their price. This therefore implies inflation targeting as a tool to drive production (Gordon, 2015). Additionally, this model advocates for the importance of dependability and integrity by the administering body being the central bank if monetary transmission is to function optimally.

## 2.5.2 Investment Based Channels

Conventional mediums of monetary transmission are depicted in econometric models and emphasize the role of interest rates in relation to the cost of capital which will affect trade, expenditure, and financing. The neo-classical model demonstrates the significance of cost of capital in the demand for funding. With respect to investments, the standard neoclassical models have validated that the capital costs are essential in determining factor for any demands on capital, impacting gross capital formation and household final consumption. Decisions made by firms and households with respect to investment planning can also be considered in the Tobin's  $q$  framework developed by Tobin (1969). According to this framework, Tobin (1969) was able to define a ratio which was referenced as  $q$ , which was considered to be the "market value of a firm divided by the replacement cost of capital". It was further elaborated that the higher  $q$  is, this translates into the market price of firms being considerably higher in relation to the replacement cost of capital, with the capital charge on new equipment/plant being relatively cheap in relation to the value of firms within the market.

Firms would then be able to disburse shares and enjoy a high premium for it in comparison to the fixed assets they purchase. This then translates into heightened expenditure as companies are able to purchase substantial goods although only having a small amount of stock issued. It is also reasonable to state that in principle, comparable reasoning can also be applied with respect to investment decisions made by households. This is because the Tobin's  $q$  theory has linkages to the user cost of capital approach, as highlighted in the example made by Hayashi (1982). Undeniably, the  $q$ -formulation has proven to have great dominance in the modelling of formal micro-based efforts. Furthermore, as mentioned previously the DSGE literature has indicated that there are "prescribed links between  $q$ -theory and the user-cost methodology and the dynamic adjustment cost approach" that was employed by Hayashi (1982) which demonstrates that appropriate analytical expressions can be allowed in such models. Further to the above, the  $q$ -approach asserts that there is indeed a positive relationship between share value and investment pay-out. Tobin's  $q$  stipulates that in a dove-ish environment where the central bank keeps cutting interest

rates, the demand for stocks will rapidly increase with the prices of stocks also increasing, thereby resulting in an increase in investment spending and aggregate demand.

### **2.5.3 Consumption-Based Channels**

Brumberg and Modigliani (1954) were the first researchers to develop the standard applications used on the savings and consumption life-cycle hypothesis which at a later stage were augmented by Ando and Modigliani (1963). In the study by Ando and Modigliani (1963), it was demonstrated that any spending on consumption is significantly influenced by consumers' generational resources, which include accumulated wealth from stocks, real estate as well as other assets. Therefore, a monetary policy stance from central banks that is designed to be expansionary in the form of interest rates that are short term in nature are reduced in order to stimulate and grow the demand for assets which includes housing and common stocks in that way drives up their prices. Furthermore, as interest rates are lowered, this results in the discount rate declining which is applied to the service and income flows related with stocks, homes, and other assets, resulting in higher prices associated with these segments. Therefore, it is on this basis that it can be concluded that any increases in total wealth that may be experienced in an economy will result in increased consumption by households and aggregate demand. It can therefore be stated that the wealth effects throughout the life cycle, which are operationalized through asset prices, are thus an imperative component in the monetary transmission mechanism.

The second prominent consumption-based channel replicates intertemporal substitution properties. Through this second channel, any fluctuations in short-term interest rates will change the impact of a nation's general consumption profile. Basically, lower interest rates encourage higher consumption from the current moment until the short-term and vice-versa. The intertemporal substitution effect also provides a critical link between the current and future levels of consumption based on changes related to the real interest rate.



Another key consumption-based channel relates to a nation's exchange rate. When there is monetary easing, the value of domestic assets falls in relation to foreign assets. Consequently, the local currency will depreciate due to a decline in the return of domestic assets in relation to other currency assets. As the domestic currency depreciates in value, this results in foreign goods being more expensive in which expenditure switching will start to occur leading to an increase in exports, and by implication a reduction in imports. Therefore, any increases in net exports will directly be included to a nation's level of aggregate demand. Consequently, the exchange rate channel does have a pertinent role on how monetary policy affects the economy. Incidentally, the sensitivity of a country's exchange rate to interest rate movements is significant as it affects the degree of change in the level of aggregate demand – smaller, more open economies, with free-floating currencies tend to experience larger effects through this channel. On the other hand, smaller economies that employ a currency peg can offset the severity of this effect to some degree.

## **2.6 Empirical Literature**

Considerable analysis has been conducted with the aim of determining how monetary policy is transmitted. Sims (1972; 1980; 1986), Leeper et.al (1996), Mojon and Peersman (2001) and Angeloni and Ehrman (2003) used the VAR models to examine the monetary policy transmission mechanism in the United States and cross-country analysis in the Euro zone. Brozda (2016) studied the “Federal Reserve's monetary policy transmission mechanism under a setting of zero bound on nominal interest rates”. According to this paper, a zero nominal interest rate in the United States failed to influence economic activity through the use of the central bank's monetary policy instruments. In contrast, Endut, Morley and Tien (2017) examined the “importance of the exchange rate, interest rate and bank-lending channels in the transference of monetary policy in the United States”. The researchers employed the Structural Vector Autoregressive (SVAR) model which used the level of bank loans to identify any monetary policy shocks. Their findings highlighted that the bank credit transmission channel was insignificant in influencing economic activity at the aggregate level.

Dahlhaus (2014) used the smooth transition VAR model on quarterly data from 1970Q1 to 2009Q2 to understand the transmission mechanism of monetary policy in the United States between normal times and during financial stress. It was identified that during stress conditions, expansionary monetary policy had a persistent and stronger effect on consumption, output, and investment. Zubairy and Alpanda (2019) studied the influence of monetary policy transmission on household indebtedness in the United States and established that monetary policy was less effective during periods when household debt levels are high. In their findings, the borrowing capacity of the households becomes muted during high debt levels despite the stimulus presented by an expansionary monetary policy. Furthermore, they found that the interest rate transmission channel does reduce consumers' debt burden levels as the interest rate on pre-existing debt is reduced.

Creel and Levasseur (2005) used the SVAR model to examine the monetary policy transmission mechanism in selected European economies using monthly data from 1993 to 2004. They determined that none of the traditional monetary policy transmission mechanisms appeared to be significant in transmitting the policy. Ganey, Molnar and Wozniak (2002) conducted a similar study with monthly data from 1995 to 2000 from selected European economies. Their conclusion was that the exchange rate transmission channel was more significant when compared to the interest rate channel. In contrast to this finding, Hericourt (2005) examined six European countries and established that the exchange rate transmission channel had a somewhat diminishing effect when compared to the domestic credit and interest rate channel. Bagzibagli (2014) employed the Factor-Augmented Vector Autoregressive (FAVAR) technique on monthly time series data from 1999 to 2011 in the European area and found out that monetary aggregates and consumer prices displayed a time variant response to monetary policy.

Sims (1972) initiated the employment of VAR in examining the monetary policy transmission mechanism. Bernanke, Boivin and Elias (2004) advised that the quantity of parameters adopted in the VAR is crucial as this will induce results that are consistent and give a more conceivable scenario of the monetary policy transmission

mechanism. It is further highlighted that the VAR can consider all the parameters in the model as endogenous. Furthermore, it enhances the practicality of the impulse response function. Sims (1980) and Bagzibagli (2014) state that due to the curse dimensionality, VAR uses a maximum of eight variables at most, thus guaranteeing the maximum application of the degrees of freedom.

Jannsen et.al (2019) states that the Panel Vector Autoregressive (PVAR) model is used to analyse cross-country data dimensions hence improving the accuracy of estimation. Furthermore, the model caters for a high degree of heterogeneity between countries and considers the dynamics of the main explanatory macroeconomic variables. Hofmann and Goodhart (2008), Carstensen et.al (2009) and Gambacorta et.al (2014) are among the authors that have used this approach. The study will use annual time series data from 1980 to 2018 for Botswana. The explanatory variables include real GDP, GFCF, the interest rate, the effective exchange rate, bank credit and monetary aggregates (M2). Data will be sourced from Botswana's statistics office and the World Bank database of World Development Indicators.

In other regions, Bouis, Rawdanowicz, Renne, Watanbe, and Christensen (2013) studied the efficacy of monetary policy in seven selected Organization for Economic Co-operation and Development (OECD) countries. In their study, post the great recession, monetary policy was used as a stimulus to revive economic activity. However, despite the firm monetary measures implemented, GDP growth was far short of the forecasted levels. Their view was that a decrease in the natural interest rate is an indication that the monetary policy stance is not as accommodative as conventionally projected. This effect was evident in Japan, Canada, the United Kingdom and the United States. The authors have further stated that with the advent of the financial crisis, the OECD economies have demonstrated uncommon monetary policy. There has been monetary policy easing that rendered rates to border zero levels. Some central banks have kept these levels for a considerable amount of time, supporting this measure by significantly expanding their balance sheets.

Jannsen et.al (2019) and Valencia and Laeven (2013) evaluated effects of the monetary policy transmission on a scenario relating to the systemic banking crisis. Laeven and Valencia (2013) categorises the crisis into two categories. The first category is when there is substantial indication of distress in the financial structure, this being shown by losses in the banking system and liquidation. This is then followed by monetary policy intervention to address the crisis. The other category is when there is no distress in the financial system. A dummy variable will be used to identify the financial crisis. The dummy variable  $D_{\{i,t\}}$  will assume the value of one during a financial crisis for country  $i$  at period  $t$  and zero during periods of financial stability. For recessions and expansions, the Bry-Boschan algorithm will be used. Laeven and Valencia (2013) define the end of a financial crisis as the year before credit and real gross domestic product (GDP) are positive for a minimum of two years consecutively. Jannsen et.al (2019) and Harding and Pagau (2002) state that the Bry-Boschan algorithm identifies troughs and peaks in real GDP. According to the author, the algorithm outlines an economic downturn when assessing a “period from the peak to the trough and from the trough to the peak” (Jannsen et.al, 2019 and Harding and Pagau, 2002).

The coordinated monetary policy response from the World Central Bank during the Global Financial Crisis prohibited a whole collapse of the global and financial markets and eventually assisted the alleviation of volatility. Additionally, deflation across a host of countries was circumvented (apart from Japan) with forecasted inflation levels hovering between explicit or implied inflation projections. However, despite the strong monetary policy accommodation, real GDP performance and economic activity has continued to be weak. In 2012, growth projections in Japan, United Kingdom and the Euro zone were still below the levels before the financial crisis, with the levels in United States being 3% higher, highlighting the persistent economic deterioration. This has resulted in deliberation regarding the efficacy and limits of monetary stimulus in expanding economic activity during, and after, times of severe economic stress. The opposite of the natural interest rate effect was evident for Switzerland and Sweden. Borio and Zhu (2008; 2012) have supported the notion that the transmission mechanism of monetary policy is less effective when interest rates are significantly low. This is said to be attributed to balance sheet recessions and other non-linearities

that are associated with low interest rates such as commercial bank profitability and household consumption behaviour.

Kashyap, Stein, and Wilcox (1993) contend that the channel of loan-supply can be identified by analysing changes in the fund-raising mix of firms, across bank loans through to commercial paper. In most recent years, measures taken during the last financial crisis, motivated Ivashina and Becker (2014) to assess the replacement between loans and bonds at the firm-level. Similarly, Adrian, Colla, and Shin (2012) investigated the change in the structure of credit between loans and bonds. This paper's identification approach is undoubtedly stimulated by this component of the literature, although examination places greater attention on bank loans and uses a data set that precedes the financial crisis of 2008–2009. More closely related to the intention of this paper, Sofianos, Melnik, and Wachtel (1990) and Morgan (1998) explore the variances between loans under obligation and spot loans so as to thoroughly examine the monetary transmission mechanism, but sources of data and empirical framework is different from theirs.

Sims (1980) contributed to the foundation of work that has been done on examining the efficacy of monetary policy in stimulating development of the economy using the VAR modelling framework. Thereafter, a plethora of empirical literature has further evolved on the utilisation economic models like the VAR in analysing monetary policy transmission mechanisms, for example, Zha, Sims and Leeper (1996), Evans Christiano and Eichenbaum (1998) for the United States economy; and Gambacorta, Martinez-Pages, Ehrmann, Sevestre, and Worms (2001), Ehrmann and Angeloni (2003), for the areas in Europe. The above-mentioned investigations propose the presence of likeness between the areas in Europe and the United States economy in terms of similarities in their commercial operating processes. Furthermore, the similarities described was in the manner in which the economies respond to monetary policy shocks. This illustrates that turbulence to the economy and monetary policy transmission processes could be similar and hence highly comparable (Angeloni & Ehrmann, 2003).

With respect to the study done by Levasseur and Creel (2005) monthly data was collated from a 9-year times series, and using the SVAR models for Poland, Czech Republic and Hungary, the authors found that the monetary policy channels of exchange rate, credit channels and interest rates have a leading role in the transmission monetary policy. Once again, monthly data was used for the period 1995 to 2000 by Wozniak, Rybinski, Ganev and Molnar (2002) who asserted that the exchange rate channel is more robust and significantly absorbs shocks to the economy than the interest rate channel for most of 10 Central and Eastern European (CEE) countries that were examined. In contrast, Hericourt (2005) examined six CEE countries for the period 1995–2004 and gave substantive indication with respect to the deteriorating role of the exchange rate channel with preference given to the of the interest rate channel. This ultimately suggests that there are a select group of countries that a researcher may sample which may have absorbed large costs in accepting the euro and assimilating into the Eurozone, where the interest rate and credit channels play a dominant role in the transmission of monetary policy.

The studies that have indicated that any linkages between economic growth and monetary policy have shown contradictory outcomes. While Keynesians assert that any variations in monetary policy do not impact economic development, Monetarists believe that monetary policy changes in can influence growth of an economy. It therefore can be concluded that since research was conducted in various countries and time periods utilising different methodologies, hence the reason why diverse research papers and articles provide a variety of dissimilar outcomes.

## **2.7 Chapter summary**

Theoretical underpinnings show that they are divergent views on the transmission of the monetary policy in an economy as argued among others by the Keynesian and Classical economists and the role of the interest rates thereof. The Keynesians argue for government intervention while the Classicals advocate for no government intervention. Similarly, the empirical evidence as presented by past researchers show that monetary policy transmission differs according to the economy under

consideration, the time period covered, or the method of analysis employed. This implies that both the theoretical and empirical evidence do not provide clear policy guidance on the monetary policy transmission in Botswana. Consequently, the results cannot be used to generalize for Botswana given that the study has never being done in the country. Yet, as pointed out by Friedman and Schwartz (1963) and Akhtar (1997) monetary policy transmission mechanism has an impact on aggregate demand, interest rates and asset pricing and thus influence output, inflation and employment in the country. Therefore, this study attempts to fill this gap by investigating the monetary policy transmission mechanism for Botswana.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Introduction**

Within this section, deliberations will focus on the methodology that will be utilized for the analysis. The author will discuss the model adopted, the sample size, the data used and the time of data. The chapter opens with a summary of the research's technique and strategy, followed by a description of the variables used. There is also discussion of the data analysis process, the model used for the research, and dependability and validity of the research. The chapter finishes with a summary of the study's shortcomings.

#### **3.2 Research Approach and Design**

As discussed in the literature review, extensive studies utilised the VAR model to explore the dynamics of the transmission of monetary policy in various economies. Sims (1972) has pioneered the use of VAR in investigating the monetary policy transmission mechanism. Bernanke, Boivin and Elias (2004) state that the number of variables included in the VAR is crucial as this will produce results that are consistent and give a more plausible scenario of the transmission mechanism of monetary policy. The VAR is able to consider all the variables in the model as endogenous. Furthermore, it enhances the practicality of the impulse response function. Sims (1980) and Bagzibagli (2014) state that due to the curse dimensionality, VARs use a maximum of eight variables at most, in ensuring the maximum utilization of the degrees of freedom. This study adopts the Bayesian Panel Vector Autoregressive (PVAR) used by Janssen, Potjagailo and Wolters (2019) which extends the model by Sa, Towbin and Wieladek (2014) and Towbin and Weber (2013). The model will be augmented with monetary aggregates so as to test their significance in the transmission of monetary policy.



### **3.3 Data source and period, sample size**

The study used secondary data and utilized a quantitative approach. Data used in the study was annual time series data from 1980 to 2018, with Botswana as the study's unit of analysis. The key considerations for using Botswana as the basis of the research is that it has an independent currency or monetary policy framework. Secondly, the selected country has all the required data across the key variables available during the sample period. The sample period was determined by data availability for all the variables of the study from the sources where real gross domestic product was the dependent variable and while gross fixed capital formation and bank rate were independent variables. The sample size allows for enough observations to be used for analysis, following Kariuki's (2017) argument that a series of 10 data points or more is sufficient to produce a trend. Data on real gross domestic product and the bank rate was sourced from Statistics Botswana which is the national statistics agency responsible for disseminating official economic and demographic data for the country. Furthermore, data on gross fixed capital formation was obtained from the World Bank database of World Development Indicators since it was not available on Statistics Botswana.

The application of quantitative statistics was valuable because of the data sources' reliability, dependability, convenience, and efficiency from a cost perspective. Because of the reasonable quantity of data available from quantitative data bases, the study utilised a longitudinal approach. On the other hand, Kearey, Brooks, and Hill (2002) point out that using secondary data in research has drawbacks. The data may have been sourced for specific reasons by the initial users, which may differ from the objectives of subsequent research articles. There may also be issues with data quality, measurement validity and data aggregation.

### 3.4 Regression Equation

Following the reviewed empirical literature, the study intends to use the VAR Model which is defined as follows:

$$Y_t = \sum_{k=1}^L A_{i,k} Y_{i,t-k} + u_{i,t} \quad (1)$$

$t=1, \dots, T$  defines time,  $Y_{i,t}$  denotes a vector of  $q \times 1$  endogenous variables. Let  $A_{i,k}$  be a  $q \times q$  matrix of autoregressive coefficients of lag  $L$  and  $A_{i,0}$  is a country specific intercepts vector. The residuals at time  $t$ ,  $u_t$ , are assumed to follow a standard normal distribution with a mean of zero and variance of 1. As adopted from Janssen et.al (2019) and Sa.et.al (2014),  $A_{i,0}$  is allowed to be a heterogeneous intercept parameter and  $A_{i,k}$  is the heterogeneous slope parameter. As a result of focusing on a single country, our intercept will be denoted by  $A$ . The VAR model is then augmented with interactions between the exogenous variable and the endogenous variable.

### 3.5 Definition of Variables in Regression Equation

#### 3.5.1 Economic growth (GDP)

Gross Domestic Product (GDP) is the most used metric for determining the rate of economic growth in a country. GDP is a measure of a country's total output over a specific time period. It is an economic metric that is one of the most well-known around the world. The use of GDP as an indication of national prosperity and human well-being has been criticized and warned about for a long time, nearly from its origin. Nonetheless, GDP is now frequently used not only to quantify economic performance, but also to assess a country's overall development progress. Numerous alternative indicators have been proposed and created since the 1970s. None of these statistics, however, can match the widespread use of GDP. Ulfah (2015) conducted a study that aimed to understand the mechanisms and factors that induced the prevalent use of GDP

as an indicator for development progress, taking the national development plan of Indonesia as a case study. The study found that the present alternative indicators were unable to challenge the widespread use of GDP since they still had various mismatches with these parameters or the current structure. Annual real GDP data was collected from the year 1980 to 2018. This was possible using the various databases available at the National Statistics Office of Botswana

### **3.5.2 Gross Fixed Capital Formation (GFCF)**

Gross Fixed Capital Formation (GFCF) is the total amount of money invested in an economy over a given time period. In official national accounts, GFCF is a macroeconomic concept. It consists of residents' producers' investments, deducting disposals, in fixed assets during a given period. According to Statistics Botswana (GDP statistical report, 2021), GFCF is based on data relating to the level of investment in construction, from a mineral prospecting approach as well as changes in inventory relating to machinery equipment including transport equipment. The impact of domestic investment on growth can be demonstrated by including the GFCF variable in regression models. According to Mayer (2019), GFCF is a vital activity that has the potential to increase economic growth because it accounts for the majority of domestic investment. Mayer (2019) employed periodical "data from 1995Q1 to 2016Q4 as part of the Johansen cointegration and Vector Error Correction Models (VECM)". The observed evidence of the study suggested that domestic investment, employment, and economic growth are all linked over the long term, with causality moving from economic growth to investment rather than the other way around. Dritsakis (2006) supports this conclusion. The research by Dritsakis (2006) evaluated "the causal relationship between exports, gross capital formation, foreign direct investment, and economic development" in Greece from 1960 to 2002 by utilising the technique of the multivariate autoregressive VAR model. The outcome of the cointegration test revealed that there was only one cointegrated vector between the variables studied, whereas the results of the Granger causality tests revealed a unidirectional causal relationship between exports and GFCF, as well as a unidirectional causal relationship between foreign direct investment and economic

growth. Data for GFCF was gathered using annual data from 1980 to 2018 from the National Statistics Office of Botswana’s databases.

### 3.5.3 Bank rate (BR)

The central bank policy rate is the rate at which a central bank announces or implements its monetary policy position. It is also known as the policy interest rate. Interest rates have the potential to have a major impact on the rate and pattern of economic growth through influencing the amount and productivity of investment, as well as the volume and disposition of savings and other liquid assets. As a rule, this is true in countries with well-developed financial markets or in countries where private investment makes for a significant share of overall investment. Interest rates may have a major impact on the mobilization of household savings and investment decisions even in countries with less developed financial markets or when investment is mainly the responsibility of the public sector (Fund, 2018). The argument over the exact effects of interest rates on economic growth is ongoing. According to existing studies, the utility of interest rates as a policy instrument for restoring economic growth varies greatly. Research has demonstrated that lowering interest rates as part of an expansionary monetary policy can help to revitalize the economy by increasing economic activity (Jelilov, 2016), resulting in a positive and statistically significant influence on economic growth (Campos, 2012).

**Table 1: Definition of Variables in Regression Equation**

Variable	Description
GDP	Real Gross Domestic Product
GFCF	GFCF
BR	Bank rate

**Source: Author’s compilation**

The variables that influence the effectiveness of monetary policy transmission in Botswana were investigated using a time series approach, which was used in this study. To estimate this association, a Vector Autoregressive approach (VAR) was used, which was compatible with the empirical literature available.

### **3.6 Estimation Approach**

The sign-restrictions approach from Janssen et.al (2019), Gambacorta, Hofmann and Peersman (2014) and Sa et.al (2014) developed by Canova and De Nicolo (2002) was adopted. This robust check approach is independent of the ordering in the VAR. Test for stationarity of the data was also done so as to avoid spurious results and ensure that the data fits the estimation technique. Engel and Granger (1987) state that data is stationary if its probability distribution is stable over time. Unit root test will be conducted using the augmented Dickey-Fuller test. Cointegration test will be done using the Johansen test. The existence of cointegration means that the data has a long run relationship, hence this will prompt the use of the error correction model. Janssen (2019) states that the IPVAR model is estimated in recursive form, thus allowing for monetary policy shocks to be established implicitly by the ordering of variables. GFCF and GDP are ordered before the interest rate as these variables do not react instantly to monetary policy shock as stated by Sa et.al (2008) and Janssen, et.al (2019).

#### **3.6.1 Unit Root Tests**

To assess whether the variables encompassed in this research are stationary, the unit root test was performed. According to Nkoro & Uko, (2016), when there is “presence of unit roots in the time series, the data is considered non-stationary, and when they are absent, the data is considered to be stationary”. A data distribution is considered to be stable when the mean remains constant across time. When a data series is considered to be non-stationary series, it is illustrated with the mean fluctuating over time as the series progresses. Therefore, completing unit root tests after applying the model is essential since the occurrence of unit roots increases the likelihood of the attainment of erroneous outcomes from the model (Granger & Newbold, 1974).

Testing for unit roots can be accomplished using a variety of methodologies, including the Fuller (1979), Phillips and Perron (1988), the Dickey and Fuller (1979) and

Augmented Dickey-Fuller (1981), among others. As a result, the Augmented Dickey-Fuller (ADF) technique was used in this study, which is one of the prevalent and extensively utilised methods in the field of unit root testing. The ADF aims to provide more accurate results and tackles the bias inherent in the outcomes, caused by auto correlation. Adding lagged terms of the dependent variables to the test increases its power to liberate the residuals from serial correlation and so improves the test's accuracy. The Akaike Information Criterion (AIC) was utilized in determining the optimal lag length to apply in the analysis. The MacKinnon (1991; 1996) critical values were applied in the ADF which is in line with the Dickey and Fuller (1979) analysis used to determine whether the condition is met.

The following hypothesis was used to carry out the test:

Null hypothesis - H0:  $\delta = 0$  (data is non-stationary)

Alternative hypothesis - H1:  $\delta < 0$  (data is stationary).

Frequently, critical value and the ADF value are equated and findings lesser than the critical value show that unit roots are present and, as a result, the non-stationarity of the data. The ADF value is compared to the critical values.

### **3.6.2 Vector Autoregressive and Causality Analysis**

It is common practice in econometric investigations to apply vector autoregressive (VAR) mathematical modelling in order to obtain the unbiased linear estimator in instances when the ARDL test does not reveal signs of cointegration (Greene, 2003). VAR models can be described as short-run statistical models that include endogenous variates and in which the dependent variable is a “function of the lagged values of the dependent variable and the lagged values of the other variables in the model” (Sims, 1980; Gujarati, 2011). When estimating VAR models, the selection of the maximum lag length is essential since the more lags in the model might lead to a loss of degrees of freedom, while having too few lags can lead to misspecification. Using the Hannan–Quinn information criterion, it is possible to find the optimal lag selection.

According to Asteriou (2007), the most important advantages of modelling using the VAR is the ability to investigate the linkages in the causal relationship. When assessing data from a time series, analysis, the concept of causality can be applied to the past in order to predict the future. Causality is often established by tracing the relationship between the regressor and the dependent variable. Before doing causality tests, it is important to ensure stationarity of the time series from the onset of the first difference, among other things. With respect to the F-statistics and the meaning of p-values of the regressors in a VAR model, it is possible to draw conclusions about the short-run causal effects of the model. Additionally, by understanding the likelihood figure of the chi-squared data, interpretations can be drawn from the Pairwise Granger causality tests and Wald coefficient tests, as well as from Wald coefficient tests. It has been observed that if the significance of the lagged independent variable is significant on the equation of the dependent variable, but all of the lagged values on the dependent variable are insignificant in the independent variable equation, it is inferred that the independent variable is causally related to the dependent variable. Bi-directional causation, on the other hand, arises when the lagged values of the independent variable are significant in the dependent variable equation and the lagged values of the dependent variable are significant in the independent variable equation, both of which occur.

### **3.6.3 Summary of the chapter**

This chapter provided an overview of the data sources and data gathering processes that were used in the research. The study's hypothesis was tested using an econometric model, and the strategies used to test it were explored in greater detail. It was further discussed throughout the chapter how the variables were measured and what the predicted signs were. The chapter went on to discuss the estimating method and further discussed the several examinations of the model that were conducted such as cointegration and unit root tests. The findings of the paper are presented in the following chapter, as well as thorough and analytical assessment of the results.

## CHAPTER 4

### RESEARCH FINDINGS AND DISCUSSION

#### 4.1 Introduction

The empirical findings of the models used in the assessment of the efficacy of Botswana's monetary policy transmission in generating economic growth are presented and discussed in this chapter.

#### 4.2 Descriptive Statistics

The summary statistics for the three variables used in the study, namely real GDP, GFCF, and Bank rate, are presented in Table 2 below. From 1980 to 2018, average real GDP was 8.29e+10, with a peak of 7.05e+09 and a low of 1.90e+11 within that period. The GFCF averaged 1.05e+10 with a minimum 2.24e+08 and a maximum of 4.39e+10. Real GDP was the most volatile variable, since it had the largest standard deviation, while the bank rate was the least volatile, as shown by a low standard deviation.

**Table 2: Descriptive Statistics**

<i>Variables</i>	<i>Real GDP</i>	<i>GFCF</i>	<i>Bank_rate</i>
Mean	8.29e+10	1.05e+10	12.54059
Median	7.35e+10	3.45e+09	13.375
Maximum	1.90e+11	4.39e+10	24.20833
Minimum	7.05e+09	2.24e+08	6.5
Std. Deviation	6.09e+10	1.37e+10	3.701802
Skewness	0.344585	1.311356	0.472945
Kurtosis	1.76721	3.261212	3.708658
Count	39	39	39

*Note: GDP = real gdp, GFCF = GFCF, bank\_rate = bank rate. Source: Author's compilation from Eviews1*



Table 2 further shows that, real GDP and bank rate are fairly symmetrical with respect to skewness, and measures whether there is symmetry or not around the mean in data series. Their skewness values fall within the limits -0.5 and 0.5. However, GFCF appears to be highly biased to the right since it has a skewness value of more than 1. When a coefficient is positive this usually signifies a data set with a right tail whereas when a coefficient is negative this is depicted with a left tail that has a skew of 0 therefore implying that the symmetry around the mean is perfect.

In relation to kurtosis, which evaluates the frequency distribution's "tailedness" or sharpness, with greater values indicating a peak distribution and lower values indicating a flat distribution, table 2 shows that only real GDP has a kurtosis lower than the usual standard distribution value of 3. This implies that the data set for GFCF and bank rate have heavier tails than a normal distribution.

#### **4.4 Correlation Analysis**

The correlation analysis of the variables is depicted in Table 3 below. With the exception of real GDP and GFCF, the correlation coefficient of the other variables is below 0.5. By rule of thumb, multicollinearity is considered to be high if it is above 0.8. Real GDP and GFCF appears to be highly correlated since their correlation is 0.94. However, following Shrestha's (2020) argument that multicollinearity is a problem only if independent variables are highly correlated multicollinearity is not a major concern in this study since real GDP is a dependent variable. The variables' positive correlations vary from -0.19 to 0.04. As expected, real GDP is positively correlated with GFCF and bank rate while bank rate is negatively correlated with GFCF.

**Table 3: Correlation Matrix**

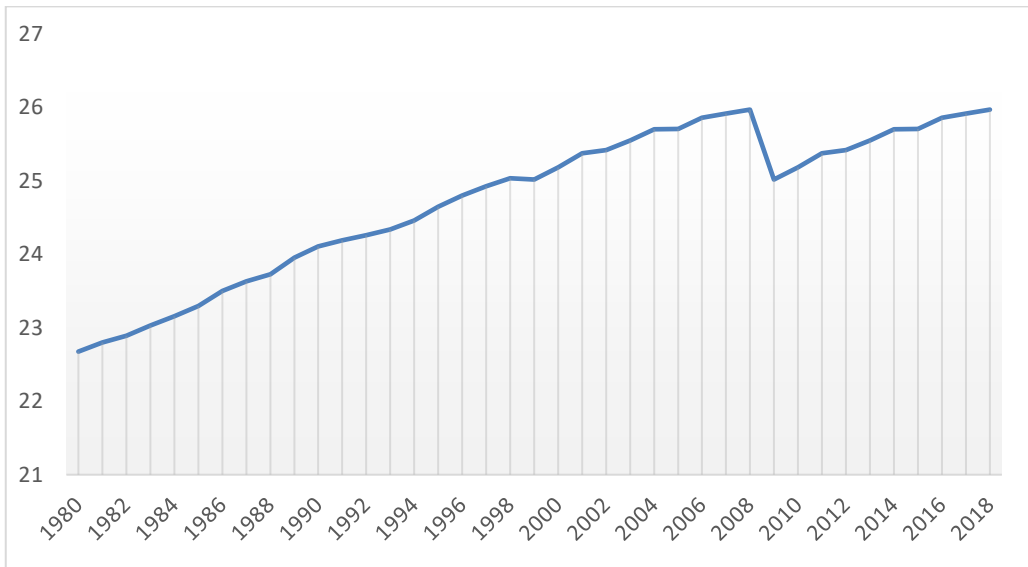
Variables	lngdp	lnGFCF	lnBank_rate
lngdp	1.0000		
lnGFCF	0.936336	1.0000	
lnBank_rate	0.042585	-0.187369	1.0000

*Lngdp = Natural log of real gdp, LnGFCF = Natural Log of GFCF, Lnbank\_rate = Natural Log of bank rate. Source: Author's compilation from Eviews11*

#### 4.5 Stationery test - Unit Test Results

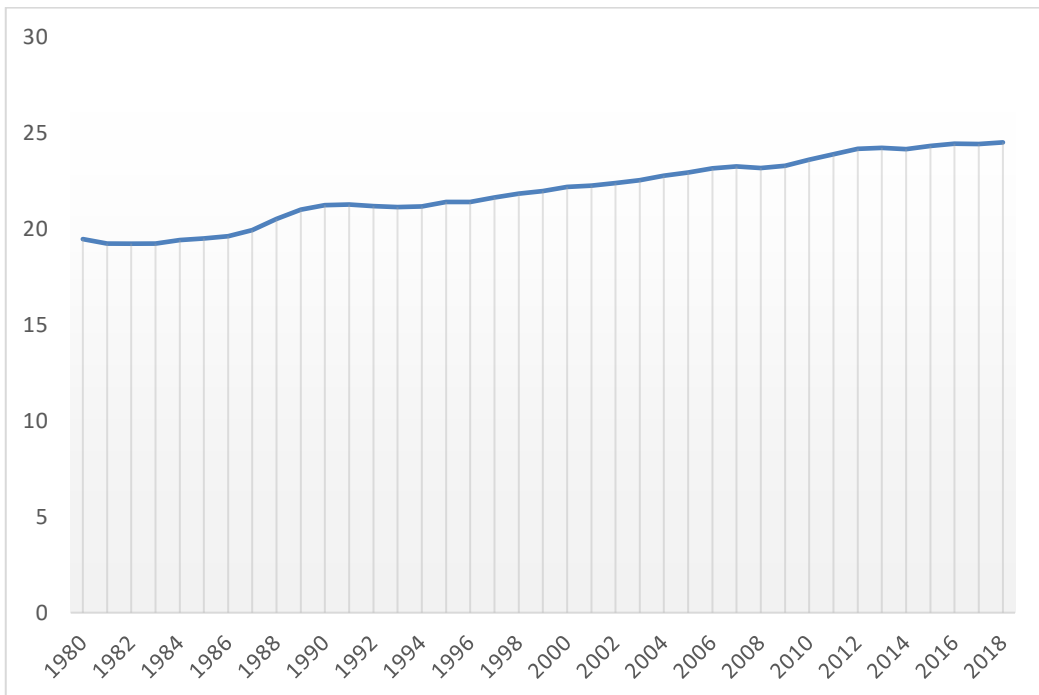
The Augmented Dickey-Fuller (ADF) unit root tests were used to determine the stationarity of the data series for the variables included in the study. The Akaike Information Criterion guided the appropriate lag selection (AIC). Before putting the variables through the ADF test, Gujarati (2003) suggests that a visual assessment by creating line graphs is essential, hence this study conducted a visual presentation of the variables. The graphs below show that real GDP generally has an upward trend overtime, GFCF also has an upward trend although the slope of the graph is considerably small. Lastly, the bank rate does not depict any notable trend over time as it fluctuates. Hence, the graphs indicate possible non-stationarity for Real GDP and GFCF.

**Figure 3: lngdp Line Graph**



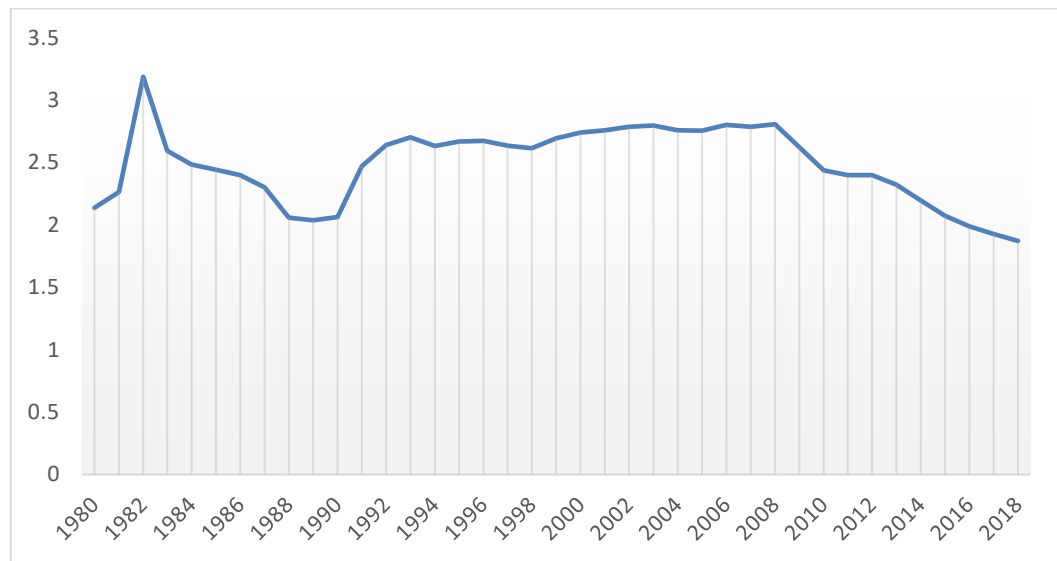
*Source: Author's compilation*

**Figure 4: lnGFCF growth Line Graph**



*Source: Author's compilation*

**Figure 5: Inbank\_rate Line Graph**



*Source: Author's compilation*

The ADF unit root tests were conducted after the variables were visually inspected. The variable GFCF, as shown in Table 4, is stationary at the level, whereas Real GDP and bank rate are non-stationary at the level but stationary at the first difference.

**Table 4: ADF Unit Root Test Results**

<i>Variable</i>	<i>Lag</i>	<i>T-Statistic</i>	<i>TCV (5%)</i>	<i>P-Value</i>	<i>Decision</i>
<b>LEVEL</b>					
lnGDP	1	-1.561	-3.552	0.128	Non-Stationary
lnGFCF	1	-3.810	-3.552	0.001	Stationary
lnbank_rate	1	-1.662	-1.691	0.106	Non-stationary
<b>FIRST DIFFERENCE</b>					
lnGDP	0	-6.094	-1.690	0.000	Stationary
lnbank_rate	0	-6.562	-1.690	0.000	Non-stationary

*Note: lnGDP = Natural log of real GDP, lnGFCF = Natural Log of GFCF, lnbank\_rate = Natural Log of bank rate. TCV = Test Critical Value. ADF = Augmented Dickey-Fuller; Lag length chosen was automatic based on Akaike Information Criterion (AIC). Source: Author's compilation from Eviews11*

Since the variables were differenced once to ensure that they were stationary, they are integrated of order one implying that they are significant at first difference.

Furthermore, the respective probabilities of the variables as obtained from the ADF unit root test confirm that the variables are stationary after first differencing since they are all less than 0.05.

Because all of the variables are steady, the model may be evaluated without the risk of erroneous findings. Stock and Watson (1988) claimed that when the variables have stochastic trends, traditional regression analysis procedures can lead to very misleading conclusions. The problem of spurious regressions has been labelled as such. The acknowledged answer to the problem of non-stationarity, using the techniques of Box and Jenkins as a guide, has been to modify the variables such that they appear to be stationary; in practice, this often means employing first differences of the series, as cited in Mapharing and Otuteye (2015). When the variables are believed to be non-stationary, the first difference of the time series is commonly utilized, according to Newbold and Granger (1974). Newbold and Granger (1974) said that this has been frequently used in most investigations, even though it does not always provide a solution.

#### 4.6 Cointegration Test Results

After running unit root tests, the next step is to assess the cointegration tests which will establish if, there are any relationships that are long-term in nature between the time series data variables. Thus, the ARDL bound test was run in order to identify the presence of any long-term relationship between the variables.

**Table 5: Pesaran/Shin/Smith (2001) ARDL Bounds Test**

<i>k = 4</i>	<i>F-statistic</i>	<i>T</i>	<i>CV 10%</i>		<i>CV 5%</i>		<i>CV 1%</i>	
			<b>I (0)</b>	<b>I (1)</b>	<b>I (0)</b>	<b>I (1)</b>	<b>I (0)</b>	<b>I (1)</b>
<b>Model</b>	1.268358	-3.233	2.63	3.35	3.1	3.87	4.13	5

Source: Author's compilation from Eviews11

Pesaran, Shin, and Smith's (2001) limits test for cointegration is rejected when the F-statistic is greater than the critical values of the I(1) series, which is the case when the

F-statistic is greater than 0. As a result, Table 5 demonstrates that the model's computed F-statistic of 1.27 is less than all of the lower limit critical values at the 1%, 5% and 10% significance levels, indicating that the model's F-statistic is less than the lower bound critical values. Due to the absence of a long-run relationship between the variables, only estimates for the short-run relationship will be taken into consideration.

**Table 6: VAR Model Results**

	Coefficient	Std. Error	P-value
<b>lngdp.D</b>			
lngdpL1.D	-0.106831	0.17438	0.5417
lngdpL2.D	-0.057839	0.17601	0.7432
lngfcfL1	0.456803*	0.25996	0.0824
lngfcfL2	-0.479152*	0.25421	0.0628
lnbank_rateL1.D	0.038507	0.16226	0.8130
lnbank_rateL2.D	0.098147	0.17449	0.5752
Constant	0.524471	0.49805	0.2952
<b>lngfcf</b>			
lngdpL1.D	-0.16677	0.11399	0.1470
lngdpL2.D	-0.041228	0.11506	0.7210
lngfcfL1	1.338350***	0.16993	0.0000
lngfcfL2	-0.367344**	0.16617	0.0297
lnbank_rateL1.D	-0.235765**	0.10607	0.0288
lnbank_rateL2.D	-0.058173	0.11406	0.6113
Constant	0.748669**	0.32556	0.0239
<b>lnbank_rate.D</b>			
lngdpL1.D	0.167546	0.13469	0.2169
lngdpL2.D	0.120469	0.13595	0.3780
lngfcfL1	0.151186	0.20079	0.4535
lngfcfL2	-0.138396	0.19635	0.4828
lnbank_rateL1.D	-0.167438	0.12533	0.1850
lnbank_rateL2.D	-0.013896	0.13477	0.9181
Constant	-0.365272	0.38468	0.3450

Note: *Lngdp* = Natural log of real gdp, *LnGFCF* = Natural Log of GFCF, *lnbank\_rate* = Natural Log of bank rate. \*\*\*, \*\* and \* denotes significance at 1%, 5% and 10% respectively. **Source: Author's results from Eviews11**

VAR model results were interpreted. In the first equation, the individual coefficients of the lagged variables GFCF and bank rate are both statistically insignificant as their p-values are greater than 0.05 (0.0824 & 0.8130). However, the first lag of GFCF is significant at 10% significance level. The lngdp equation further shows that the first lag of real GDP has a statistically insignificant impact on real GDP at 1%, 5% and

10% significance level. Theoretically, “investment increases the stock of capital in an economy, and the amount of capital accessible to an economy is a key factor in its productivity, thus implying that investment contributes significantly to economic growth” (Susic et al.,2017). It therefore makes sense to have a positive significant impact of GFCF on real GDP which is also consistent with Anwer and Sampath (1999)’s study who discovered a significant positive impact of investment on GDP.

Second, VAR results shows that when GFCF is the dependent variable, both the first and second lag of GFCF are statistically significant in the model at 5%. Furthermore, the first lag of the bank rate and the constant also appear to be statistically significant in the model at 5%. While the effect of the bank rate on investment is transmitted through the market interest rate it was expected to have a significant relationship between the two variables. These results are consistent with both the expectation of the study and the study carried out by Sunday (2012). He discovered that a decrease in interest rate will inevitably lead to increased employment, which will raise demand, pricing, profit, and further production expansion. Given Botswana’s relatively low interest rates compared to its peers it makes sense to have a negatively significant relationship between the bank rate and investment.

The final equation, which uses the bank rate as the dependent variable, indicates that real GDP has no effect on bank rate in both lags. Moreover, both lags of GFCF are also statistically insignificant in the model at all levels of significance. As expected, both real GDP and GFCF are insignificant when the bank rate is the dependent variable. This is possibly so given that the Central bank actively commit to maintaining a target interest rate. In other words, the bank rate is exogenously determined by the Central bank to achieve certain monetary objectives (Barth, 2002). They do so by directly interfering in the open market through open market operations (OMO), where they buy and sell Treasury securities to impact short-term rates thus, less likely to be affected by the real GDP and GFCF.



#### 4.8 Granger causality tests

The study then moved on to the Granger causality to test for both unidirectional and bidirectional causal relationships. If the p-value falls below 1%, 5% and 10% significance level, the null hypothesis of no Granger causality is rejected, therefore, the real GDP was found to be ineffective in forecasting GFCF and bank rate since the p-values 0.23356 and 0.6348 are greater than all levels of significance level.

Second, the summary table shows that GFCF does not granger cause both real GDP and bank rate at 5% significance level since 0.0745 and 0.1802 are greater than 0.05, hence we fail to reject the null hypothesis of no causality. However, GFCF is found to granger cause real GDP at 10% implying that GFCF can be used to predict real GDP. We can therefore conclude a unidirectional relationship between GFCF and real GDP at 10%. Similarly, Table 7 shows that the study fails to reject the null hypothesis of no granger causality of bank rate on real GDP and GFCF respectively, at 5% significance level. However, given a p-value of 0.0772 which is less than 0.1 for bank rate on GFCF we reject the null hypothesis of no causality at 10%. Therefore, we conclude that a unidirectional relationship between bank rate and GFCF exist at 10%. In conclusion, the summary table below shows that only unidirectional causality relationships between the variables exists at 10%. These results are somewhat contrary to the findings of Encinas-Ferrer and Zermeño (2015) who discovered that real GDP granger cause investment while investment does not granger cause real GDP in China. While a unidirectional relationship was also discovered in that study the causal relationship is opposite to that of this study between those variables. This is not surprising given that China is an advanced economy while Botswana is still a developing country with a relatively undeveloped financial market.

**Table 7: Granger Causality Test**

<b>Model Ho</b>	<b>P-value</b>
GDP does not granger cause GFCF	0.2856
GDP does not granger cause bank rate	0.3883
GFCF does not granger cause GDP	0.0704*
GFCF does not granger cause bank rate	0.7587
Bank rate does not granger cause GDP	0.9768
Bank rate does not granger cause GFCF	0.0772*

*Note: GDP = real GDP, GFCF = GFCF, bank\_rate = bank rate. \* denotes significance at 10%. Source: Author's results from Eviews11*

Conclusions that can be drawn from the granger causality test are therefore that:

- A significant unidirectional causal relationship between GFCF and real gross domestic product exists at 10% significance level.
- A significant unidirectional causal relationship between bank rate and GFCF exists at 10% significance level.

#### **4.10 Model stability**

Three model tests of stability were conducted in assessing the accurateness of the VAR model. The first test was to observe the OLS Durbin Watson statistic which displayed a value of 0.649972. This implies that there was evidence of autocorrelation in the model as the value is outside the bounds 1.5 and 2.5. The second test was to plot the correlogram which further showed evidence of serial correlation in the model as most of the probabilities were below 0.05. The last test was the serial Correlation LM test which also confirmed the presence of autocorrelation in the model as the probability of the F-statistic ( $p=0.0000$ ) and R-squared ( $p=0.0001$ ) were below 0.05. Autocorrelation was therefore corrected by

including a lag variable of the dependent variable in the model and the same tests confirmed that the model is now stable.

**Table 8: Breusch-Godfrey Serial Correlation LM Test results**

	Before including lngdp (-1)		After including lngdp (-1)	
F-statistic	14.10678	P=0.0000	0.007548	P=0.9925
Obs*R-squared	17.68632	P=0.0001	0.017917	P=0.9911

Source: Author's Compilation from Eviews11

**Table 9: Durbin Watson Test results**

	Before including lngdp (-1)	After including lngdp (-1)
DW statistic	0.649972	1.958289

Source: Author's Compilation from Eviews11

#### 4.11 Summary of the chapter

The results of the econometric models used in the study were presented and interpreted in this chapter. The variables' stationarity was determined using a graphical assessment of each variable. The assessment showed that GFCF was stationary at level while gross domestic product and bank rate were stationary at first difference which was confirmed by the ADF unit root test.

The existence of a long-term relationship between the variables was tested using the ARDL bound test which revealed that there was no cointegration among the variables, hence this necessitated interpretation for the short-run relationship only.

Because there was no cointegration, the VAR model was estimated to see if there were any short-run causal links between the variables. The outcomes indicated to a significant unidirectional short-run causal relationship between GFCF and real gross domestic product exists at 10% significance level, a significant unidirectional short-run causal relationship between bank rate and GFCF exists at 10% significance level. Lastly, the Breusch-Godfrey Serial Correlation LM Test and the Durbin Watson Test

showed the presence of autocorrelation in the model which was corrected for by including a lagged variable of gross domestic product in the model (dependent variable).

## **CHAPTER 5**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

The primary findings, conclusions, and policy recommendations coming from empirical research of the efficacy of monetary policy implementation in Botswana are summarized in this chapter. The research has been divided into five primary sections, starting with an introduction and context, and moving on to a literature review and discussion of the investigation's methodology. In chapter four, the study summarized the research findings. The conclusion and recommendations are presented in this final chapter.

#### **5.2 Summary and conclusion of the study**

The objective of the research was to determine the influence of the bank rate on spurring economic growth and influencing the level of investment in Botswana. According to theoretical literature, a reduction in the bank rate should have the desired effect of lowering the cost of credit in a country thereby having a positive impact on the level of investment and economic activity, and vice-versa. The study began with a survey of theoretical and empirical literature in the subject of monetary policy before delving into the methods used. The data for all the variables was readily available from Botswana's Statistics Office, and the study used time series data from 1980 to 2018. The stationarity of the variables used in the observed study was investigated using the ADF unit root test. Using the ADRL approach to cointegration, the evaluation of any presence of long-run correlations among the variables was examined.

Because the ARDL bounds tests revealed no long-term correlations between the variables, only estimates for the short-run relationship was evaluated. Outcomes from the VAR established that in the short run, there is a significant unidirectional short-run causal relationship between GFCF and real gross domestic product, a significant unidirectional short-run causal relationship between bank rate and GFCF. The

unrestricted VAR model investigation for short-run causal relationships showed unidirectional relationships at 10%.

### **5.3 Policy recommendations**

Botswana's monetary policy transmission has not yielded the desired results especially with regard to influencing GDP. This point highlights that structural changes to Botswana's economy are required to ensure that changes in the bank rate transmit the desired effect on the economy. The results of the study could also point to the need for a different monetary policy rate to be used. This tool could take the form of the repo rate or Bank of Botswana Certificate (BOBC) rate in order to communicate the central bank's policy stance and desired effect on the local economy. These rates are also used as reference rates for numerous commercial bank transactions, having closer ties to inter-bank activity, giving them a greater reach in determining Botswana's economic discourse. It is further recommended that there is need for continued development of the unsecured interbank and Repo markets in order to strengthen monetary policy transmission in Botswana.

Additionally, the Government of Botswana can take other steps to enable economic development. For instance, by intensifying fiscal disbursements on potentially industrious sectors to boost economic development, as well as encouraging foreign direct investment (FDI) to boost domestic investments, are examples of such policies. Moreover, the monetary policy framework should be operationalized with a key focus of creating a promising investment environment that is desirable to not only local investments but can attract foreign capital as well, therefore resulting in sustainable economic prosperity in the long run.

### **5.4 Recommendations for future research**

After obtaining the results, expectation was that there would be more of a causal relationship between the variables, therefore the author recommends that another enquiry into the subject be carried out using quarterly data. This will allow the study to have more data points hence get a better insight on the nature of the relationship

between the variables. Having a larger sample size will lead to more precise estimates and the sample mean will be closer to the true mean of the data points. This recommendation is based primarily on the conclusion that some relationships that were expected to be significant in the model turned out to be insignificant.

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