RE-EXAMINING THE EFFECTIVENESS OF MONETARY POLICY IN ACHIEVING PRICE STABILITY AND OUTPUT GROWTH IN BOTSWANA

A Research Report submitted in partial fulfillment of the Degree of Master of Commerce (Economics) in the School of Economics and Finance, University of the Witwatersrand

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Word Count: 13335

Date; 1 April 2024

DEDICATION

This work is dedicated to my only begotten son, Letlotlo-Larona Eden Tlhako.

ACKNOWLEDGEMENTS

My sincere appreciation goes to God almighty. I am particularly indebted to my supervisor Dr Nyasha Mahonye who guided my work with all the enthusiasm. His persistent help made me reach the goal of this project. Gratitude is highly indebted to my parents and my employer Bank of Botswana who sponsored me to enrol in this programme. Their help made the completion of my studies easier and allowed me to get closer to my goals. Lastly, I would like to pass my gratitude to all my classmates, your contribution was immensely unmeasurable.

ABSTRACT

This study reassessed the effectiveness of Botswana's monetary policy, emphasizing its two main goals of maintaining price stability and promoting output growth. Output and inflation are our dependent variables, and they are proxied, respectively by mining and non-mining GDP and the consumer price index. We examined quarterly data from 2005 to 2022 using a Vector Error Correction model. Stationarity tests were conducted using both the ADF test and the Phillips-perron (PP-test), where both tests confirmed all variables to be stationary at levels except money supply which was stationary at first differences. Through the integration of macroeconomic factors like inflation, GDP, interest rates, exchange rates, money supply, and the bank rate, our goal is to offer a thorough comprehension of the relationship between monetary policy decisions and their consequences in the economy of Botswana, a small open economy that is prone to both internal and external shocks. By considering both internal and external elements that could have an impact on the framework's performance, our analysis provides light on how less effective Botswana's monetary policy framework has been over the studied period. The results from the study show that policy shocks have little effect on output growth and inflation. This is proven by the results of the VECM showing a significant impact of the bank rate on non-mining GDP only, while the other two variables; mining GDP and inflation proved that the bank rate does not impact them both in the short run and long run. The VAR decomposition also showed that at most 5% of the changes in our dependent variables are explained by the shocks on the bank rate. The results bring us to the conclusion that other external shocks, such as controlled prices and exchange rates, are the primary causes of inflation than it is driven by the bank rate. With respect to output, the results bring us to the conclusion that the mining sector is heavily influenced by global commodity prices, which are determined by international supply and demand dynamics, rather than domestic interest rates. So significant changes in the bank rate may not alter these global factors. Lastly the non- mining GDP is seen to respond to changes in the bank rate due to the interest rate sensitivity of the sector. The non-mining sector is made up of sectors such as manufacturing, services, retail etc, and these are very sensitive to changes in the interest rates as they rely mainly on short term borrowings for capital and investment. Therefore, changes in the bank rate quickly affect lending rates, consumer loans and business financing, leasing to more immediate economic impacts. Based on the above results, we therefore recommend that policy makers should diversify monetary policy tools and implement sector specific support for the mining industry and focus more on controlling external factors such as exchange rates.

Enhanced financial sector regulation and coordination with fiscal policy are also crucial. The employment of these measures can help stabilize the economy and improve the effectiveness of monetary policy, and ensure that non-mining sectors which are more sensitive to interest rates changes, benefit from targeted interventions. This holistic approach acknowledges the varying responsiveness of different sectors and the influence of global economic conditions.

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CHAPTER 1

1.1 INTRODUCTION

Without a doubt, one of the most sought-after goals in any economy is macroeconomic stability. This is because low and steady inflation promotes more investment, which raises productivity and keeps import and export prices competitive. Additionally, steady expectations and higher levels of consumer and corporate confidence are anchored by macroeconomic stability, and these factors help the economy draw in foreign direct investment. Numerous macroeconomic strategies have been proposed to achieve this goal, with monetary policy taking the lead.

Like many other economies, Botswana faces a variety of economic issues, making monetary policy a critical topic. Botswana's economy is primarily reliant on natural resources for extraction and exportation, particularly diamonds, and their prices are prone to fluctuations in the international marketplace. In addition, Botswana depends on other countries for its food requirements and energy sources such as oil, petrol, etc and these items' prices are subject to international commodity fluctuations. This volatility can have an impact on the country's revenue and overall economic performance. To handle the economic consequences of these swings, the central bank must employ its monetary policy tools. The value of Botswana's currency is impacted by global trade and foreign exchange flows since it exports resources. To uphold the stability of Botswana's national currency, the Pula, and ensure its competitiveness and reliability for trade, the central bank must employ its monetary policy instruments to intervene in the foreign exchange market. This intervention is crucial for maintaining exchange rate stability, especially considering that the country operates under a managed float exchange rate system. Lastly for the financial sector to remain stable, effective monetary policy is essential to avert systemic risks and preserve public confidence in financial institutions. The central bank must take appropriate measures and monitor the banking sector accordingly and employ its monetary policy tools to ensure the stability of the financial sector. The aforementioned are also the reason why inflation remains an ongoing issue in Botswana.

Investigating the transmission of monetary policy in Botswana is crucial for several reasons, including the fact that it offers important insights into the efficiency and impact of the nation's monetary policy measures. It aids in the evaluation of policy effectiveness and assists in inflation control, economic stability, and exchange rate management. Like any other

nation, Botswana strives to keep prices stable to preserve a favourable business climate. Much like any other country, Botswana endeavours to maintain price stability to uphold a conducive environment for business activities. The central bank takes targeted measures to reduce pricing pressures by analysing the transmission channels to help identify the factors that contribute to inflation. The efficiency with which monetary policy is conveyed to the real economy determines the stability of the financial system and the entire economy. The likelihood of economic crises is also decreased, and financial imbalances can be reduced with the use of a strong transmission mechanism. Analysing this transmission in Botswana carries notable significance for a range of compelling rationales. Among these is its capacity to offer valuable perspectives into the efficacy and repercussions of the nation's monetary policy measures. This scrutiny assumes a central role in appraising policy efficiency, contributing to inflation management, ensuring economic steadiness, and overseeing exchange rate dynamics. Like any other nation, Botswana strives to uphold price stability as a means to sustain a favourable backdrop for business undertakings, hence making this issue of monetary policy transmission in Botswana worth studying.

This issue of the monetary policy transmission mechanism, particularly the impact of short-term interest rates on production growth and inflation, has been a subject of great interest among economists. Several studies, including those conducted by (Tillmann 2017), (Cevik 2013), (Ganev 2002), and (Aban 2013), have examined the effectiveness of monetary policy in developed countries. Overall, numerous studies have explored the relationship between short-term interest rates, economic growth, and inflation, contributing significantly to the understanding of monetary policy's effects in developed nations. A noteworthy outcome emerged from the examination by (Ganev 2002) in the context of the Eurozone, aligning with established economic theory. Their findings accentuated that heightened interest rates were linked to a reduction in inflation.

(Mangani 2012), (Nizamani et al. 2016), and (Chuku (2009) among others, conducted similar investigations in less developed countries and African economies. When investigating the transmission in South Africa, (Smal 2011) showed that adjustments in the real economy impact the price pressures via the adaptation of the output gap. Notwithstanding the topic's relevance, little research has been done on the case of Botswana, with the recognized contributors being (Alex 2017), (Seabe 2015), and (Lucky 2014). Although the significance of this topic is evident, there exists a limited body of research concerning the case of Botswana.

Botswana is a mineral-based economy, as such the study seeks to unpack the transmission in mining output together with non-mining output. Mineral-based and non-mineral-based sectors may react differently to monetary policy changes. Minerals are frequently commodities with unpredictable prices that are driven by global demand and supply dynamics. Because of their susceptibility to foreign market conditions, these industries may react differently to interest rate changes. Therefore, when examining monetary policy transmission in a mineral-based economy, disaggregating output into mineral-based and non-mineral-based sectors provides for a more comprehensive investigation of how policy actions affect different portions of the economy. This comprehension is critical for developing effective and well-informed policy.

It is widely acknowledged that economies are periodically susceptible to various forms of monetary shocks, including fluctuations in exchange rates and shifts in money demand. Additionally, economies can also experience shocks that impact the tangible aspects of the economy. This is particularly relevant for developing countries whose economic foundations are reliant on primary exports of commodities like cocoa, coffee, and tobacco. Such nations are particularly exposed to shocks related to trade terms. Shocks are destabilizing by nature, they cause volatility, which is harmful on its own. As a result of this realization, governments recognize the significance of policy actions to mitigate the detrimental consequences of these shocks to achieve economic stability. Consequently, determining the policies necessary to attain and uphold such growth remains an ongoing subject of deliberation within both political and economic domains. (Alex 2017).

There are, however, several strategies that could assist in achieving and stabilizing such economies. Since then, both fiscal and monetary measures have been utilized to achieve this goal. Deliberations about the significance and effectiveness of these economic initiatives have been ongoing. Fortunately, these debates have gradually narrowed over time as additional evidence supporting various policy approaches has surfaced. This progression has led to a consensus among most economists that both fiscal and monetary policies hold roles in achieving economic stability. Nevertheless, the prevailing consensus is that monetary policy is better suited for ensuring economic stability. The challenge associated with fiscal policy lies in its uncertain outcomes when dealing with budget deficits. Mishkin (2001) touched on this aspect, noting that there has been a trend among both economists and politicians to lean towards assigning the task of stabilizing output and inflation to monetary policy. This perspective stems from the observation that the allure of fiscal policy has

diminished since its peak during the 1960s. This decline can be attributed in part to concerns regarding persistent large budget deficits, and in part to doubts about the political system's capacity to make timely decisions regarding taxation and expenditures to achieve favourable stability outcomes.

STYLIZED FACTS USING LITERATURE DEBATE ON THE EFFECTIVENESS OF MONETARY POLICY ON BOTH INFLATION AND OUTPUT GROWTH.

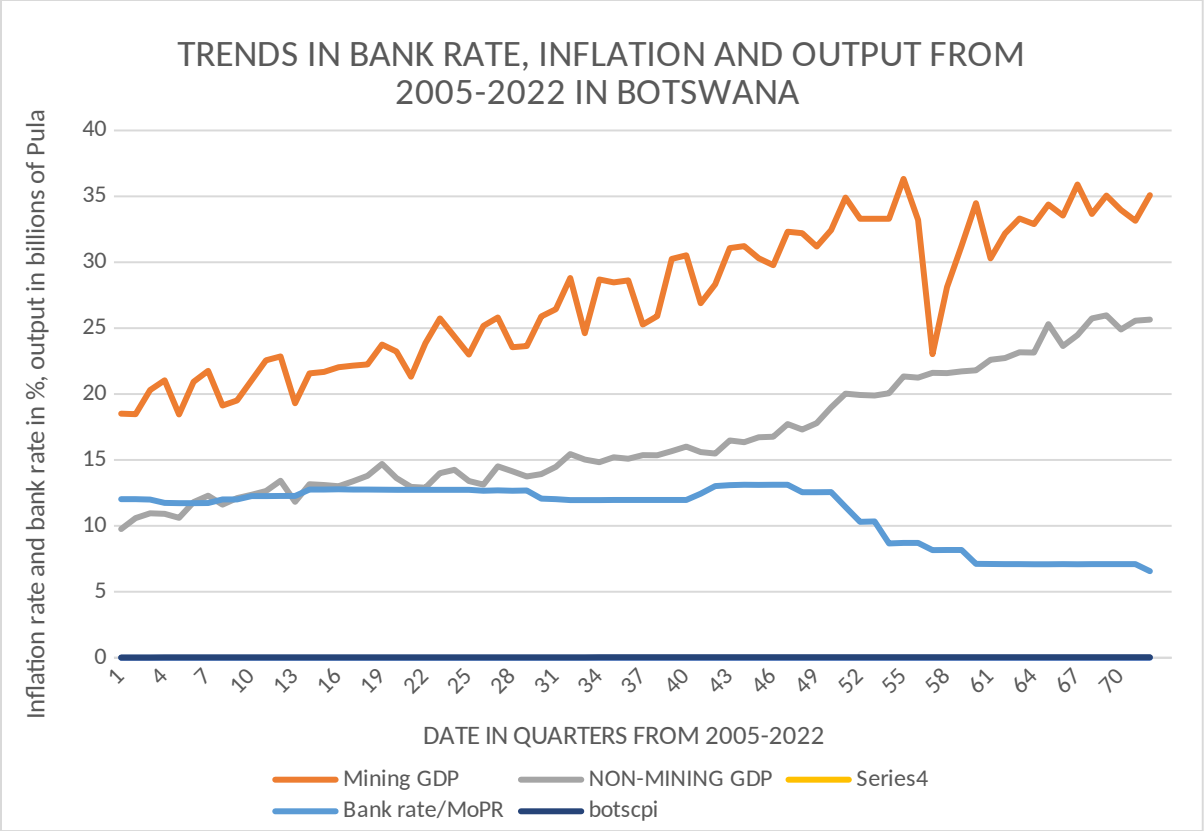
Stylized facts from the literature debate;

1. The inverse relationship between inflation and bank rates.

The inverse relationship between inflation and bank rates is a cornerstone of monetary economics. The Taylor Rule suggests that central banks should adjust rates in response to deviations of inflation from its target and output from its potential. The graph evidence higher bank rates leading to lower inflation and aligns with the rule and supports the view that monetary policy can effectively control inflation. However, for the case of Botswana, the influence is very little. Empirically, studies such as the one by (Campbell R, 2020) have shown that central banks that follow systematic rates tend to achieve better inflation outcomes.

2. Output Growth & Monetary Policy

The relationship between monetary policy and output growth is more complex. The Keynesians suggest that monetary policy can influence output in the short run due to price and wage stickiness. But the monetarists argue that in the long run, monetary policy primarily affect nominal variables like inflation and not real variables like output. This debate highlights the complexity of the relationship between monetary policy and output growth, as different schools of thought provide different valuable insights into how central banks can manage the economy.



Source; Authors own calculations

Stylized facts from the graph

1. Inverse relationship between the Bank Rate and Inflation; The graph indicates that periods of higher monetary policy rates often coincide with declines in inflation. This suggests an inverse relationship where increasing bank rate helps to control inflation. This aligns with the traditional view in monetary economics that higher interest rates reduce inflation by decreasing aggregate demand. Despite this being the case, the sharp decline in the bank rate is seen to not significantly impact inflation in Botswana, attributing inflation changes to other factors that the bank rate. A simple correlation analysis between the bank rate and inflation shows a weak negative correlation, suggesting that lower bank rates are not strongly associated with lower inflation in this data set.

2. Output Growth & Monetary Policy; The non-mining sector appears to be more responsive to changes in the bank rate compared to the mining sector, which aligns with the literature suggesting that capital intensive industries like mining are less

sensitive to monetary policy changes. The Non-Mining GDP shows a steady increase over the studied period, while mining GDP remains relatively stable with more fluctuations. The behaviour of the non-mining GDP shows that a decrease in the bank rate results in an increase in the sector GDP as seen from quarter 49 of the studied period. This greatly shows that indeed the non-mining sector is negatively correlated with the bank rate, and that the bank rate does influence it. The more dynamic mining GDP shows no correlation with the bank rate, proving that indeed the bank rate does not impact it, rather it is impacted by global supply and demand rather than local conditions.

Trends in inflation and Output

The bank rate shows a general decreasing trend from 12.03% in 2005Q1 to 6.56% in 2022Q4. This decline reflects a broader trend of monetary easing over the period, likely aimed at efforts to stimulate economic growth.

The level of inflation increased from 0.9% in 2005Q1 to 3.6% in 2022Q4. Despite the decreasing trend in the bank rate, inflation has shown to be steady, suggesting that other factors besides the monetary policy rate are influencing inflation.

The mining GDP fluctuated much with a general increase from 18.51 million in 2005Q1 to 35.09 million in 2022Q4 and showing no correlation with the bank rate. On the contrary, the Non mining GDP showed a more consistent upward trend from 9.75 million in 2005Q1 to 25.64 million in 2022Q4. The data indicates that both sectors have grown over the period with non-mining GDP showing more stability and consistent growth .

1.2 PROBLEM STATEMENT

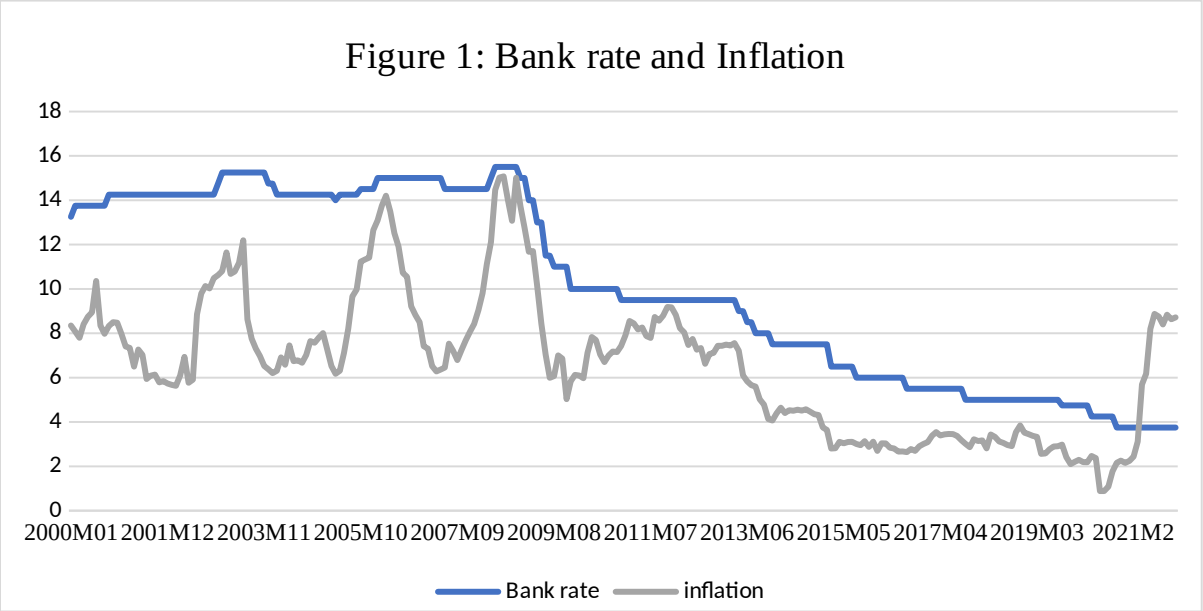
Botswana's economy is predominantly mineral-based and operates as a small open system. It is vulnerable to both external and internal shocks as such making inflation a topical issue. In the past, supply chain interruptions, changes in domestic demand, and changes in currency exchange rates have all had an impact on the frequency of inflation episodes in Botswana.

Internal shocks such as the tourism sector vulnerability, which is an important sector of Botswana’s economy as well as labour market disruptions, which lead to a reduction in productivity and output have also had an impact on inflation dynamics.

Inflationary pressures have been exacerbated by the nation's reliance on commodity exports, particularly diamonds, and their susceptibility to outside economic shocks. Given the country's distinctive economic structure and reliance on exports of natural resources, the monetary policy transmission in Botswana has been a topic of interest for academic research and public policy. While previous research has delved into the pathways through which monetary policy choices impact the economy, there remains a need for a comprehensive and contemporary reassessment of the transmission mechanism. A fresh inquiry is warranted to ascertain the relevance and effectiveness of monetary policy instruments in attaining the central bank's objectives, which encompass price stability, enduring economic growth, and financial stability. This assessment is essential considering the ever-evolving global economic panorama, shifts in domestic economic circumstances, and recent adjustments in monetary policy strategies.

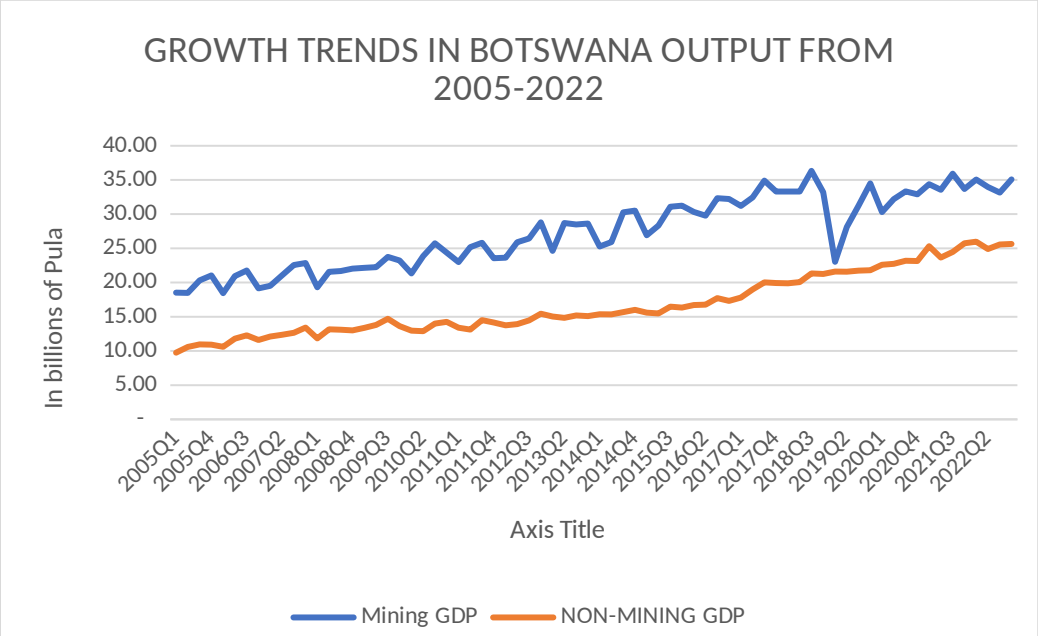
Furthermore, the theory posits a negative relationship between the bank rate and inflation, which warrants changes in interest rates to change inflation, (Meltzer (1995). In the end, contractionary monetary policy lowers aggregate demand and dampens inflation by raising interest rates, which raises the cost of borrowing and discourages investment and consumption. Conversely, expansionary monetary policy expands aggregate demand, leading to higher inflation.

However, in Botswana, there seems to be some contradiction with the theory. Both contractionary and expansionary monetary policies tend to have the opposite effect in terms of the expected results. For example, the bank rate decreased from 15.5 percentage points in November 2008 to 10 percentage points in January 2010. According to theory, the expectation was that inflation would trend upward during the period. However, the opposite happened, and inflation fell from 15 percent to 6 percent in the same period. Furthermore, when the bank rate fell from 9 percent in April 2013 to 3.75 percent in December 2020, inflation trended downwards from 7.2% points to 2.2% points in the same period (Figure 1). Thus, conclusions regarding Botswana's ineffectual monetary policy are easily drawn. This underpins the central question of the study: To what extent is Botswana's monetary policy effective?



Source; Author's calculations

Figure 2; BOTSWANA OUTPUT GROWTH TRENDS



Source; Authors own calculations

The economic performance of Botswana's Mining and Non-Mining GDP are depicted on the graph above. The mining GDP shows significant volatility with notable peaks and troughs. The volatility is indicative of the sector's sensitivity to global commodity prices and external economic conditions. For instance, the sharp dip in the first quarter of 2020 reflects a downturn in global commodity markets because of the novel corona virus which heavily impacted the demand of diamond in Botswana and the mining sector in general. The 2003 global economic crisis is also seen to have impacted the mining sector in Botswana. Despite the fluctuations, the overall trend for Mining GDP is upward, suggesting long term growth driven by high global demand and favourable commodity prices.

In contrast, the mining GDP demonstrates a more stable and consistent growth trajectory. The steadier increase is indicative that sectors such as manufacturing, services, retail, have less been affected by external shocks compared to the mining sector. The stability in Non-Mining GDP suggests a diversified economy, reducing reliance on the volatile mining sector. This diversification is very crucial for sustainable economic growth as it provides a buffer against global market fluctuations and contributes to more balanced economic growth. The divergence between the two lines, particularly during periods of mining sector downturns, underscores the importance of continued investment in and support for non-mining sectors to ensure overall economic resilience.

1.3 OBJECTIVES OF THE STUDY

There is a widespread belief that monetary measures have little impact on economic stability in underdeveloped countries. This impression is based on the claim that the mechanisms and institutions required for effective monetary policy transmission are either non-existent or inefficient.

In light of these considerations, the primary aim of this study is to evaluate the effectiveness of monetary policy within Botswana, situated as a developing nation. To provide greater clarity, the specific objectives of this research are as follows:

1. To investigate the impact of alterations in the bank rate on the inflation rate.
2. To examine the influence of changes in the bank rate on both mining and non-mining output.

1.4 HYPOTHESIS

Based on the above objectives, the alternative hypotheses of the study are:

1. A negative correlation exists between the bank rate and inflation.
2. An increase in the bank rate leads to a reduction in output due to the propagation of effects through savings and investment channels.

1.5 CONTRIBUTION OF THE STUDY

The primary objective of this study is to enrich the existing literature by broadening the scope of analysis concerning Botswana. This will be achieved by incorporating the latest available datasets, thereby extending the chronological span under examination. Additionally, the study aims to explore the transmission mechanism in both mining and non-mining sectors. This distinction is noteworthy since previously reviewed studies predominantly concentrated on the non-mining output exclusively and to the best of my knowledge based on the reviewed literature no study has unpacked the transmission on mining output, despite Botswana being a mineral-based economy.[1] It is therefore the intention of this study to unpack the effect of bank rate changes on mining GDP given that Botswana is a mineral based economy.

Understanding the transmission mechanism of monetary policy is critical to Botswana's economic stability and progress. Botswana's monetary policy actions, as a small, open economy primarily reliant on exports, have far-reaching consequences for its exchange rate, interest rates, and total economic activity. Understanding how changes in the central bank's policy rate affect financial markets, borrowing costs, investment decisions, and, ultimately, aggregate demand allows policymakers to better control inflation, exchange rate volatility, and overall macroeconomic stability. Botswana's authorities can undertake effective policy measures to buffer economic shocks, create sustainable growth, and ensure the country's long-term prosperity by first comprehending the monetary policy transmission channels.

1.6 ORGANIZATION OF THE STUDY

The forthcoming chapters of this study will be organized as follows:

In Chapter 2, a comprehensive examination of Botswana's economy, the existing monetary policy framework, and the macroeconomic shocks faced by the country will be presented.

[1] Refer to annexure for statistics on the contribution of the mining sector to the economy.

Chapter 3 will elucidate the theories associated with the transmission mechanism, alongside a review of pertinent empirical literature. Chapter 4 outlines the research methodology, encompassing data sampling and the specification of the model used. Chapter 5 outlines the empirical findings and the discussion together with the model diagnostics and the conclusion. Chapter 6 discusses the implications for policy, the limitations of the study, and areas for future research.

CHAPTER 2

2.1 BACKGROUND OF BOTSWANA'S ECONOMY

Before attaining independence in 1966, Botswana was a constituent of the Rand Monetary Authority (RMA), resulting in the utilization of the South African rand as the official currency. During this period, Botswana did not possess full autonomy over the determination of interest rates, the development of banking policies, or the evaluation of liquidity prerequisites. The South African Reserve Bank (SARB) had to approve all actions concerning the country's financial system.

Following the discovery of diamond reserves in Botswana during the 1970s, the nation experienced swift economic expansion due to the accumulation of significant cash surpluses, as noted by (Moffat 2017). Consequently, in 1974, Botswana made the strategic choice to withdraw from the Rand Monetary Authority (RMA). This decision was motivated by the country's ambition to bolster its domestic financial institutions and instruments, thereby ensuring proficient administration of the proceeds generated from the diamond industry.

The choice drew considerable criticism, particularly from the International Monetary Fund, as it underscored the susceptibility of a nascent and open economy to embark on such a course of action. Nonetheless, Botswana's leadership defended the decision, asserting that the advantages outweighed the associated drawbacks, as stated by the (Bank of Botswana 2021). Subsequently, in 1975, the Bank of Botswana (BOB) was established to promote an independent monetary policy. This was followed by the introduction of the national currency, the Pula, in 1976 which replaced the rand, which had served as the official currency until that point in time.

According to (Masalila & Phetwe 2011), during that period, the objective of achieving price stability had not yet been formalized. Instead, the primary focus rested on managing administered interest rates, implementing credit controls, and exercising exchange rate controls. The operations of the monetary policy were primarily centred around manipulating interest rates to influence the demand for credit and savings, with little consideration for inflation, as highlighted by (Hermans 1996). In the 1990s, to stimulate demand, the Bank of Botswana (BOB) persisted in reducing interest rates until real interest rates reached negative levels, a strategy documented by (Masalila & Phetwe 2011).

(Setlhare 2014) delineated the trajectory of Botswana's monetary policy into two distinct phases: financial repression and financial liberation. The era of financial repression commenced with the establishment of the central bank and persisted until 1988. During this period, challenges arose as excess liquidity could not be effectively managed due to the absence of appropriate monetary tools to absorb it. Furthermore, the restricted scope of the financial markets had a pronounced impact on the execution of monetary policy, as pointed out by (Setlhare 2014).

Subsequently, following the year 1989, Botswana entered a phase of financial liberation. In this period, the Bank of Botswana (BOB) deregulated interest rates, expanded the number of banks, and ultimately eliminated the imposition of currency controls. This shift aimed to augment market competition and concurrently address the issue of surplus liquidity, in accordance with the Bank of Botswana (2007).

The commitment to achieving price stability in Botswana commenced in 1998 with the issuance of the country's inaugural monetary policy statement. This policy framework positioned price stability as the central objective of monetary policy, incorporating the utilization of indirect policy tools and an inflation forecasting mechanism. Despite sharing certain characteristics with inflation-targeting frameworks, Botswana had not fulfilled all the fundamental prerequisites necessary to be classified as an official inflation-targeting nation.

The Bank of Botswana initially set a target inflation range of 4 - 6 percent, which was publicly disclosed in 2002. Later, in 2008, this target range was modified to 3 - 6 percent, to achieve it within about three years. To achieve its objectives, the Bank of Botswana employs various monetary policy tools, incorporating the short-term policy rate, known as the bank rate, and engaging in open market operations, which involve trading in Bank of Botswana Certificates. This framework is influenced by (Hicks' 1937) IS-LM model, providing insights into how monetary policy impacts the broader economy.

2.2 BOTSWANA’S MONETARY POLICY

The Monetary Policy Statement of the Bank of Botswana explains its objectives, which principally focus on producing low and stable inflation and matching aggregate demand with the economy's productive capacity. This is achieved by adjusting interest rates, which in turn influence various aspects such as the balance of trade, currency value, demand for credit, and government expenditure. The purpose is to keep real interest rates comparable to foreign capital markets, encouraging savers to save without discouraging investment. Open Market

Operations with Bank of Botswana Certificates, the Bank Rate signalling interest rate direction, and reserve requirements to manage money supply are the means utilized to achieve these goals. Botswana's approach is adapted to its specific financial system and economic goals, recognizing that while monetary policy objectives are similar around the world, execution methods differ.

2.3 MACRO-ECONOMIC SHOCKS FACED BY BOTSWANA.

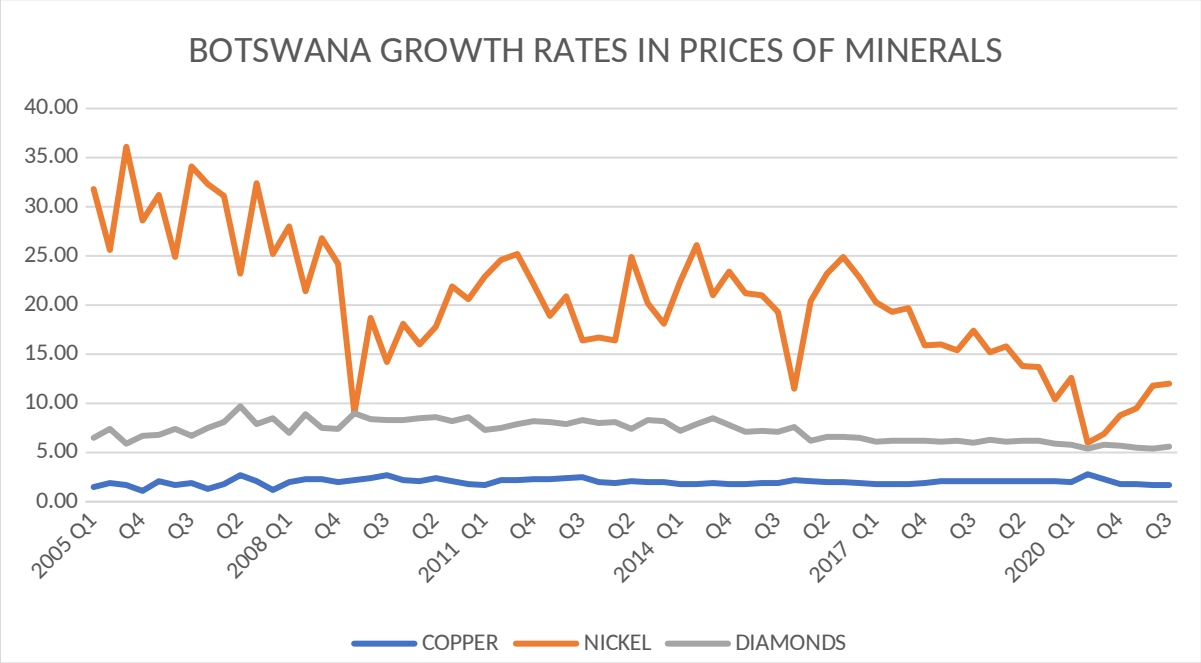
Some of Botswana's inflation can be ascribed to structural issues, as evidenced by the 2008-2009 financial crisis, the COVID-19 pandemic in 2020, and repeated droughts in Southern Africa. During the global financial crisis, the diamond sector, which contributes significantly to Botswana's GDP and export revenues, suffered a setback due to decreased demand for diamonds in the worldwide market. This decrease in diamond exports had an impact on government revenue and economic growth, potentially adding to inflationary pressures. Similarly, the COVID-19 pandemic caused interruptions in trade and tourism, which are significant contributors to Botswana’s GDP, thus resulting in a drop in economic activity and potentially higher costs thus exacerbating inflation.

Furthermore, periodic droughts in the region have long-term consequences on agriculture, livestock, and communities, necessitating government interventions like water conservation measures and disaster relief efforts, which can strain public finances and contribute to inflationary pressures. A study conducted by Masih et.al (2014) evidenced that Botswana has suffered economic damage of $3,000.00 due to the latest droughts of 2005 and 2010. This is clear evidence of the negative effects of drought on the economy. Thus, while external forces influence Botswana's inflationary environment, structural difficulties within the economy also contribute to inflation dynamics.

Terms of trade shocks also have a considerable impact on the Botswana economy, which is heavily reliant on exports, particularly diamonds. When the prices of Botswana's exports, such as diamonds, fall relative to its imports, the country experiences negative terms of trade shocks, which have a variety of consequences. For example, a fall in export revenues, particularly from diamonds, influences government income, potentially leading to budget deficits. Second, this shock has the potential to increase Botswana's current account imbalance by reducing export revenues in relation to import expenditures, putting external finances under strain and possibly necessitating external borrowing. Furthermore, despite the

reduction in export profits, if import prices stay unchanged, inflationary pressures might be induced, reducing purchasing power and negatively impacting consumer welfare.

FIGURE 2; GROWTH RATES IN PRICES OF COPPER, NICKEL & DIAMONDS



Source; Author's calculations

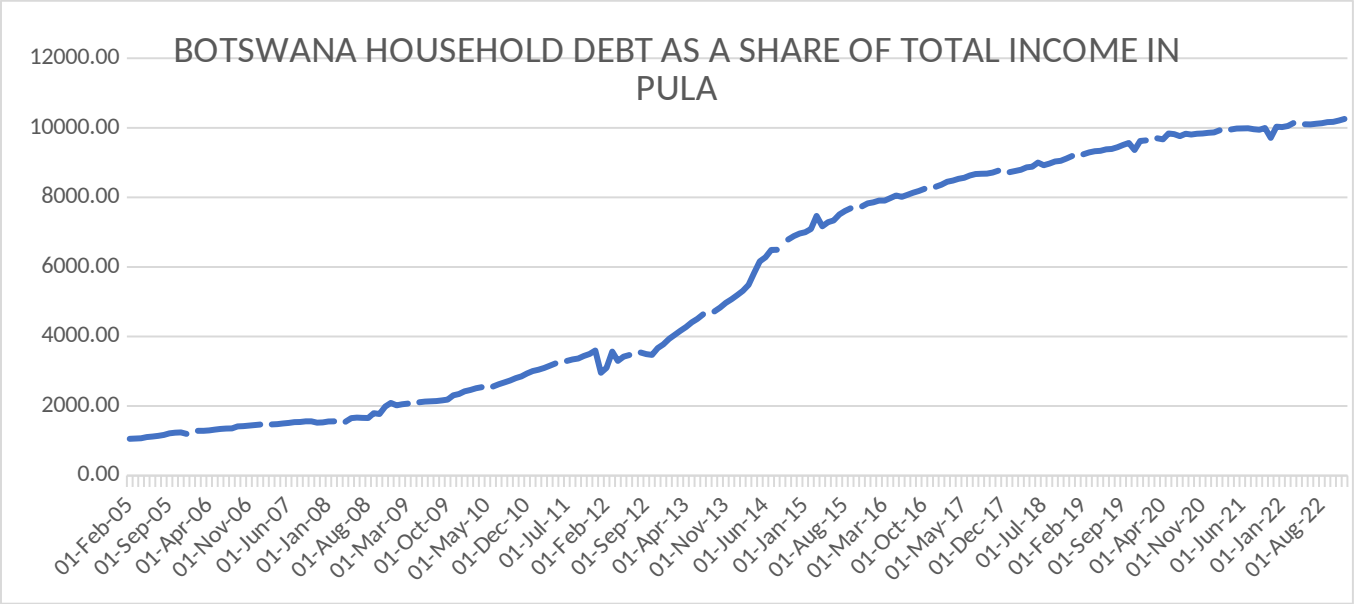
Depicted in Figure 2 above is an illustration of the terms of trade shocks of the minerals exported by Botswana. The price of diamonds is constant hence an indication that Botswana did not benefit from the international price changes. The combination of lower export revenues and greater import costs which result from the above can hinder economic growth by raising production costs and lowering profitability, reducing investment and job possibilities. In addition, terms of trade shocks can influence exchange rate dynamics, potentially leading to currency depreciation, increasing import prices, and amplifying inflationary pressures even further. This poses a challenge to the central bank's attempts to maintain price stability and stimulate economic growth.

It is important to highlight however that Botswana has put in place several economic policies and strategies to lessen the effects of these shocks. The nation has a reputation for good macroeconomic management and has built up a financial cushion through competent management of its mineral resources and prudent fiscal policies. Bank of Botswana (2021)

Re-examining the effectiveness of monetary policy transmission is vital as Monetary policy influences economic transactions primarily through its effects on interest rates, money

supply, and credit availability. Interest rates allow the Central Bank of Botswana to control borrowing and lending activities. Lowering interest rates stimulates borrowing by making it more affordable, leading businesses and individuals to seek loans for investment and consumption. This encourages economic activity, resulting in more transactions. Raising interest rates, on the other hand, increases the cost of borrowing, resulting in less borrowing and spending, thus reducing transaction volumes. Botswana has however shown a commendable impact of monetary policy affecting transactions in the economy as it has recorded a rising trajectory of household debt as a share of income which we can conclude is made conducive by an accommodative monetary policy shown in Figure 3 below.

FIGURE 3; BOTSWANA HOUSEHOLD DEBT AS A SHARE OF TOTAL INCOME



Source; Author's calculations from stata

An increasing debt-to-income ratio generally raises concerns about financial stability and household fragility, but it can also have a favourable impact on economic growth. Increased household debt might indicate increased consumer and corporate confidence, prompting investment in real estate, enterprises, and durable products, thus promoting economic activity and increasing employment and income levels. Rising debt may occur naturally during an economic upswing as borrowing boosts consumption and investment, hence promoting total growth by increasing demand and output. Furthermore, if household debt rises in tandem with asset prices such as real estate, household wealth can grow, potentially contributing to

increased consumer spending and economic activity. This indicates effective monetary policy measures, such as low interest rates which encourage borrowing and spending, hence supporting economic growth and inflation goals. This supports the idea that the lending channel exists in Botswana and is effective in contributing significantly to growth. This is in line with the findings of Evangelos (2017) who inferred that the implementation of unconventional monetary policy measures was effective in stimulating credit growth in the post-2007 crisis and this contributed significantly to economic growth in the post-2007 crisis.

SUMMARY

Botswana's journey towards effective monetary policy has been marked by significant milestones and adaptive strategies. Initially constrained by its membership in the Rand Monetary Authority, Botswana's decision to establish the Bank of Botswana and introduce the Pula laid the foundation for independent monetary policy. The early focus on interest rate management and credit controls evolved into a more sophisticated framework aimed at price stability and economic growth. The transition from financial repression to financial liberation allowed for greater market competition and better liquidity management. The commitment to price stability, formalized in 1998, and the adoption of indirect policy tools and inflation forecasting mechanisms, have enhanced the effectiveness of monetary policy in Botswana. Despite not being an inflation targeting country, Botswana's approach has successively maintained inflation within the target range, contributing to economic growth and stability. Against this backdrop, it is very important to ensure the revisitation of the policy from time to time to ensure its effectiveness in maintaining price stability and output growth. To the best of our knowledge, and based on the reviewed literature, no study has examined the transmission of monetary policy on mining GDP in Botswana, despite Botswana being a mineral based economy. It is therefore the intention of this paper, to fill the knowledge gap by studying the effectiveness of monetary policy in attaining output growth in the mining sector

CHAPTER 3

3.0 LITERATURE REVIEW

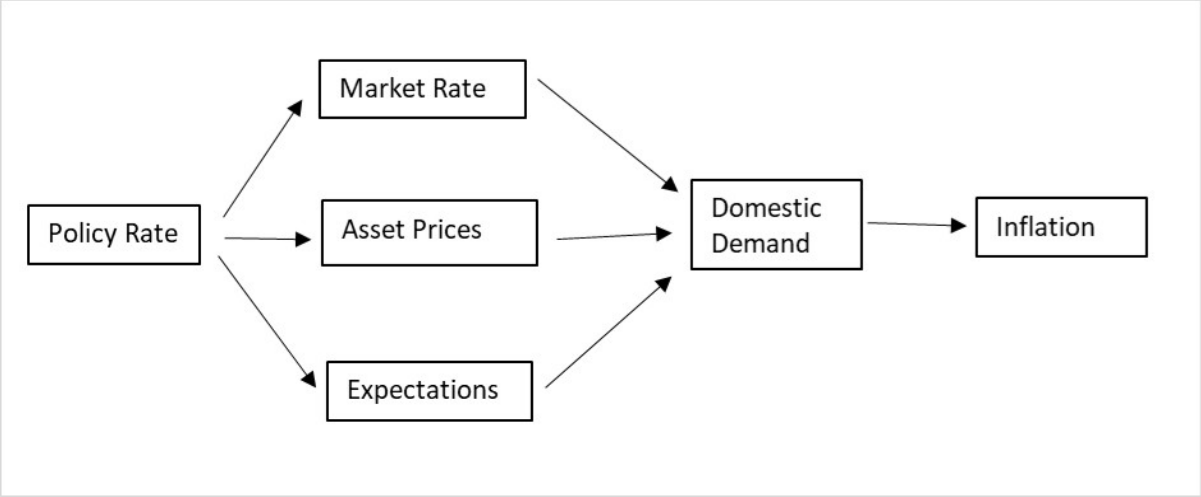
The purpose of this chapter is to give a theoretical and empirical foundation for understanding the intricacies of monetary policy transmission mechanisms, with a particular emphasis on their relevance and effectiveness in the setting of Botswana

3.1 THEORETICAL LITERATURE

Various theories exist to explain how monetary policy affects economic output and inflation. Some of them are the exchange rate channel, the asset price channel, and the interest rate channel, as discussed by (Alla 1995) and (Mishkin 1995). However, the effectiveness of these channels varies depending on a country's economic structure, financial market strength, and macroeconomic conditions (Mahommed 2014). In Botswana, the interest rate channel is particularly well-suited due to interest rate liberalization in the 1980s, as noted by (Alex 2017). According to (Mishkin 1995), monetary policy is not limited to nominal interest rates but can also affect real interest rates. The central bank's policy rate influences the rates at which commercial banks borrow, and they typically pass these changes on to their customers, impacting market interest rates. When the central bank raises the policy rate, it raises borrowing costs for commercial banks, which in turn affects investment and consumption by making savings more attractive and reducing disposable income (Seabe 2015).

The contractionary monetary policy additionally decreases demand for new loans and makes existing loan payments more expensive. Furthermore, the consumer's wealth is decreasing due to a drop in asset prices. The fall in asset values diminishes enterprises' net worth, limiting their capacity to get financing. In contrast, an expansionary policy (a reduction in short-term interest rates) encourages demand and increases inflation. The model to be employed in this paper's investigation of the effectiveness of monetary policy adheres to the same principle as in Figure 4.

Figure 4: Interest Rate Transmission Mechanism



Source: Alex (2017)

Although the primary emphasis of this study is on the interest rate channel, it's essential to recognize the presence of other transmission mechanisms. Among these, the exchange rate channel has a significant role. It is explained by the interest rate parity condition, as defined by (Cevik 2013). This condition outlines a connection between the exchange rates and interest rates of two distinct economies. According to this concept, currency fluctuations should account for the spread in yields between competing countries to minimize excess returns.

The implication of this is that foreign bonds must equal the domestic rate of return when adjusted for predicted appreciation or depreciation. (Taylor 2015) underscored this when he argued that interest rate parity was required for the exchange rate to function. He argued that in the absence of the necessary condition being fulfilled, capital will move towards a country offering higher returns, ultimately balancing the returns among competing nations.

Some empirical research has identified a strong connection between exchange rate regimes and overall price levels. (Broda 2016) found that emerging nations with fixed exchange rate regimes tend to experience higher inflation rates than those with flexible exchange rate

systems. In fixed-rate economies, expansionary policies lead to more significant real appreciation, while in flexible regimes, the impact is minimal. Additionally, (Miranda 2018) noted that fixed exchange rate systems constrain exchange rate movements, resulting in a weaker exchange rate transmission compared to countries with flexible exchange rate mechanisms. Given that Botswana employs a crawling peg exchange rate mechanism, monetary policy transmission through this channel may likely be less effective.

The Asset price channel offers an alternative perspective, addressing the limitations of the IS-LM model, which primarily focuses on interest rates as an asset price (Mishkin 1995). According to (Alex 2017), the monetarist viewpoint emphasizes two significant channels through which monetary policy operates: the Tobin Q and wealth effects, with the former relating to how businesses make investment decisions in the stock market.

According to (Mishkin 1995), increasing interest rates lowers the money supply to impact equity prices. The public will resort to the stock market to produce more money, cutting demand for equities and reducing its sale value. When share prices decrease, the q-ratio, which represents the relationship between asset prices and their replacement cost, also decreases. A lower q-ratio leads to reduced investment by businesses. This, in turn, results in lower levels of production and overall demand in the economy, ultimately contributing to a decrease in inflation. A reaffirmation has been made by (Mishkin 1995) that wealth has an impact on consumption.

(Mishkin 1995) goes on to say that because common stock accounts for a sizable portion of financial wealth, contractionary policy lowers stock values, which leads to a drop in consumption. Because of Botswana's less established financial sector, the asset price channel cannot be accurately examined. This channel's evaluation necessitates a reliable gauge of asset values (Al-Mashat 2017).

Several economic theories establish direct linkages between monetary policy and inflation. Below are some key theories and their relevance to Botswana’s monetary policy;

1. The Monetarist Theory: This theory, championed by Milton Friedman, posits that inflation is primarily a result of changes in money supply. According to the theory, if money supply grows faster than the economy’s ability to produce goods and services, then inflation will occur. Botswana therefore aligns accordingly with this theory by

focusing on controlling the money supply through tools like the bank rate and the open market operations to maintain price stability.

2. Quantity Theory of Money; This theory on the contrary, though related to the monetarism, asserts that the general price level of goods and services is directly proportional to the amount of money in circulation. This theory suggests that controlling money supply is crucial for managing inflation.
3. The Keynesian theory: The Keynesians emphasize the role of aggregate demand in influencing inflation and output. According to the theory, monetary policy can affect inflation by altering interest rates, which in turn influence investment and consumption. The IS -LM model forms the basis of this theory and shows that changes in money supply and interest rates impact the overall economy. Thus, Botswana's use of interest rates adjustment to manage economic activity and control inflation demonstrates the application of Keynesian principles.
4. New Classical Theory: Lastly the new classical economists argue that monetary policy affects inflation expectations, which in turn influence actual inflation. The theory emphasizes the importance of credible and transparent monetary policy to anchor inflation expectations. Botswana's commitment to publicly disclosing inflation targets and the issuance of monetary policy statements reflects an effort to manage inflation expectations effectively.

In conclusion, Botswana's monetary policy has evolved to incorporate elements from these theories to maintain price stability and output growth. The Bank of Botswana's use of the bank rates, open market operations and inflation targeting are practical applications of these theories. By controlling money supply and managing interest rates, Botswana aims to keep inflation within the target range thereby ensuring price stability and fostering growth.

According to the theoretical discussion above, macroeconomic variables impact inflation over time. Among these determinants are interest rates, money supply, the nominal effective exchange rate, and economic activity. The conceptual framework can be expressed functionally as;

CPI $= f$ (Bankrate, M2, NEER, GDP, diamond prices) ..... (i)

Where CPI= inflation, proxied by consumer price index, bank rate = policy rate, M2= Money supply, NEER=Nominal effective exchange rate, and lastly GDP= real GDP.

3.2 EMPIRICAL LITERATURE REVIEW

Empirical research has been conducted to examine the conceptual frameworks discussed in the preceding chapter, with a focus on both developed and developing economies.

Monetary policy is anticipated to have an impact on the overall rate of economic growth and inflation. However, the outcomes of several research do not appear to be as easy as the theory indicates. This is despite the use of various approaches tailored to diverse economic frameworks.

(Cevik and Teksoz 2013) conducted a study spanning from 1990 to 2010 on the Gulf Cooperation Council (GCC) countries. They employed a structural VAR approach to assess how effective monetary policy was when channelled through interest rates and exchange rates. Their findings indicated that the interest rate path did have an impact on output and inflation, but its effectiveness was limited. This implies the necessity to improve financial intermediation and promote the establishment of liquid domestic capital markets. However, the exchange rate channel was found to be ineffective primarily because of the fixed exchange rate regime prevalent in the GCC nations. Under fixed exchange rates, domestic interest rates closely mirror foreign ones, thus leaving little to no room for domestic monetary policy adjustment.

(Chen et al. 2017) analysed China's monetary policy using a Qual VAR approach from 1999 to 2015. This method incorporates binary policy statements to determine China's tightening and easing policies. The People's Bank of China (PBoC) employs a wide range of policy instruments, making a standard VAR challenging to apply. Their findings suggest that various policy tools can effectively achieve macroeconomic goals, like cooling an overheating economy and reducing inflation. Surprisingly, tightening measures were found to be ineffective as they led to rising stock prices, contrary to economic theory. This indicates that China's monetary policy might not be suitable for ensuring financial stability, prompting the PBoC to consider a new system centred on interest rates as the primary policy tool.

(Nizamani et al. 2016) conducted a study in Pakistan from 1992 to 2014 using a Structural Vector Autoregressive (SVAR) model with a non-recursive identification structure. This approach aimed to describe the characteristics of a small open economy by using economic theory to determine causal relationships between variables instead of relying on a strict

ordering of variables. Their findings showed that when monetary policy is tightened, it has a significant negative impact on domestic economic activity in the short term, while its influence on inflation becomes apparent in the medium to long term. Interestingly, tightening policy also leads to a beneficial effect on inflation, resulting in a price paradox. The study focused on the interest rate channel to observe these correlations, rather than examining the exchange rate and the asset price channels.

Various models have been utilized to study the effectiveness of monetary policy in different countries. For instance, (Fuddin 2014) employed a Vector Error Correction Model to examine Indonesia's case from 1961 to 2011. He found that interest rates played a crucial role in understanding inflation, while the credit channel was most effective in explaining economic growth in Indonesia, given the strong reliance on domestic economic activity fuelled by consumption supported by commercial bank loans. (Fuddin 2016) also recommended investigating the exchange rate channel, as it is closely tied to international trade operations in Indonesia. Another approach, pooled data regression, was employed by (Aban 2013) in the Philippines from 2008 to 2011, aiming to establish the existence of a bank lending channel. His study showed that small bank loan growth in the Philippines is sensitive to changes in monetary policy, indicating the presence of such a channel. However, the method's suitability for larger institutions and its failure to account for structural vulnerabilities in a small economy raised doubts about its applicability.

(Kganetsano 2017) conducted a comprehensive analysis of monetary policy channels in Botswana using two distinct methodologies. In the first approach, he employed the narrative method, emphasizing the significance of the interest rate channel in influencing both output and inflation. This method, pioneered by (Friedman and Schwartz 1963), identified monetary shocks without relying on statistical procedures and proved useful in cases with limited data series. Kganetsano found that interest rate changes led to a reduction in the money supply, subsequently boosting domestic demand and inflation, although credit initially showed limited response. In the second approach, utilizing econometric techniques such as VAR models and structural models, he observed that output reacted to interest rate increases after two quarters, aligning with theoretical expectations. However, inflation exhibited unexpected behaviour by rising instead of declining as predicted, prompting further analysis involving private-sector credit. Kganetsano acknowledged external shocks and various influencing factors as contributors to these inconsistencies in Botswana's monetary policy outcomes.

Time series models, which include VARs, linear regression, and multi-equation models, are commonly utilized in econometrics to evaluate the effectiveness of monetary policy, as highlighted by (Kalinasuskas 2009). Among these models, the structural VAR model stands out as particularly suitable due to its capacity to accommodate various approaches found in economic literature for studying the dynamics of monetary policy. Structural VARs represent each variable by considering its past values and the past values of other variables, a concept initially introduced by Sims (1980). These models include a system of simultaneous equations that elucidate how a group of time series variables collaboratively generates data. According to (Bernanke and Gertler 1995), VARs treat all variables as endogenous and offer valuable insights into understanding how policy actions influence target variables. However, some VAR models are statistical and lack a strong economic theory foundation, which can make interpretation challenging. Structural VARs overcome this limitation by incorporating economic structure, making them more informative and theoretically grounded than other modelling approaches.

There are many difficulties that structural models must overcome in developing countries like Botswana. (Tsangarides 2010) points out that structural fractures are a common issue in developing nations, making their use more challenging. These models run the danger of neglecting structural fractures, which could result in erroneous conclusions. Therefore, it is not advisable to employ such models for a nation like Botswana, which has seen several structural fractures. With all of these factors in mind, the following chapter will explain the theoretical specification of the VAR model.

CHAPTER 4

4.1 DATA & METHODOLOGY

This chapter provides details on the econometric models and the statistical methods employed in the study. It describes the data sets used, including their origin, nature, and characteristics. It further elucidates the variables chosen to measure the effectiveness of monetary policy in attaining price stability and output growth in Botswana.

This study, like other studies that explore the effectiveness of monetary policy, adopted the Vector Error Correction Model (VECM). The VECM was chosen because of its usefulness particularly when dealing with non-stationary time series data that are cointegrated. This model caters for the distinction between long run equilibrium relationships and short-run dynamics, which are crucial for understanding how monetary policy impacts price stability and output growth over different time horizons (Bhandari, 2024). The focal variables under examination include the bank rate (representing the policy rate), output (assessed through both mining and non-mining GDP), and inflation (measured using the consumer price index). Given constraints related to data availability, particularly regarding the money supply data, the study utilized quarterly data spanning from January 2005 to December 2022.

To kick-start this research, we conducted some tests to ensure rigid results. Some of the tests are discussed below.

4.1 Unit root tests; Checking time series data used for stationarity is crucial to preventing erroneous regression (Gujarati 2004). This is because non-stationary variables tend to move in tandem over time, giving the impression that they are connected even though they are not. By differentiating the variables to make them stationary, this issue can be resolved. Mokoti (2009) asserts that stationary data sets typically yield reliable results when compared to the data sets that are non-stationary.

Testing stationarity is done in several different ways. The Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test, which we used for this study, are the most suitable for

testing for stationarity when utilizing the VEC models Gujarati (2003). Given that the VEC model uses several lags, these tests are suitable.

4.2 Selecting an appropriate lag length; It is crucial for VEC models, as the inclusion of lags affects the model's efficiency. Lagged variables can lead to a loss of observations and a reduction in degrees of freedom Enders (2004), significantly impacting model performance. (Lada and Wojcik 2007) propose five tests for lag length selection: the Swartz Information Criterion (SC), the Final Prediction Error (FPE), the Sequential Modified LR test statistic (LR), the Akaike Information Criterion (AIC and the Hannan- Quinn (HQ) Information Criterion. These tests collectively suggest the most frequently recommended lag length, which is considered the optimal choice for use in the VECM.

4.3 The study evaluated the effectiveness of Botswana's monetary policy by examining the impact of changes in the policy rate on inflation and output through the interest rate channel. In achieving this objective, a recursive VAR model, which follows a method employed by (Enders 2014) and (Kganetsano 2005), was utilized. This model was chosen as the most suitable approach to investigate how market interest rates influence economic activity and inflation in the context of the study, and this was achieved through the specification of the model as below;

$$Y_t = \alpha_{10} - \alpha_{12}X_t + \beta_{11}Y_{t-1} + \beta_{12}X_{t-1} + \varepsilon_{1t}$$

$$X_t = \alpha_{20} - \alpha_{21}Y_t + \beta_{21}Y_{t-1} + \beta_{22}X_{t-1} + \varepsilon_{2t}$$

Where α_{10} and α_{20} are the intercept coefficients and, α_{12} and β denote the auto-regressor coefficients. The Yt and Xt are presumed to be stationary, while the errors ε1t and ε2t are uncorrelated white noise disturbances.

Enders (2004) notes that because Y_t and X_t are allowed to influence one another, this type of system has feedback. As an example α_{12} represents the immediate effect of a unit change in X_t on Y_t while β_{12} represents the impact of a unit change in X_{t-1} on Y_t. Thus, the regressors are no longer uncorrelated, which is against the estimation approach premise. (Enders 2004) proposes that this model be changed into a recursive model[2] to address this issue by placing constraints that force the system to take the form that follows:

$$Y_t = \alpha_{10} - \alpha_{12}X_t + \beta_{11}Y_{t-1} + \beta_{12}X_{t-1} + \varepsilon_{1t}$$

[2] Inorder to establish the recursive ordering, it is necessary that one of the feedback coefficients α_{21} must be suppressed and pushed to zero

$X_t = \alpha_{20} + \beta_{21} Y_{t-1} + \beta_{22} X_{t-1} + \varepsilon_{2t}$

where the link between the regression residuals e_t and the pure shocks ε_t will be given by

$e_{1t} = \varepsilon_{1t} - \alpha_{12}\, \varepsilon_{2t}$

$e_{2t} = \varepsilon_{1t}$

Where e_{1t} and e_{2t} denote the residuals of the regression from equations of Y_t and X_t. This system's interpretation is that X_t has a contemporaneous influence on Y_t whereas Y_t affects X_t with a lag. The ε_{1t} and ε_{2t} shocks influence the current value of Y_t but the ε_{2t} shock affects the current value of X_t.

4.4 Stability tests: If the model utilized contains non-stationary variables or is modelled with incorrect lengths, the model's stability may be jeopardized, resulting in incorrect findings. As a result, the VAR model must be validated for stability.

4.5 Cointegration tests; To ascertain whether there were any long-term correlations between the model's variables, a cointegration test was performed. By integrating the short-run dynamics with long-run equilibrium, cointegration analysis ensures that long-run equilibrium is restored in the time series data. Although there are several methods for cointegration, including the two-step process by Engle and Granger (1987) and Johansen's test, this study used the bounds test. The latter was chosen because it may be applied regardless of whether the model's regressors are mutually cointegrated, I(0), or I(1).

4.6 Impulse Response Function (GIRF); Pesaran and Shin (1998) introduced the impulse response function (IRF) for VAR-based models. Many scholars have used the IRF to track how a one-time shock to one of the innovations affects the endogenous variables' values. In conventional impulse response analysis, the underlying shocks to the VAR system are orthogonalized through the use of Cholesky decomposition Kim (2013).This results in orthogonalized impulse responses. The results of the generalized impulse response analysis are distinct from those of the standard impulse response analysis and are not affected by the variable ordering. As a result, this study used the generalized impulse response function's advantage to evaluate the impact of a single shock to the independent variables on the present and future values of the dependent variable.

4.7 Variance decomposition; Variance decomposition enabled us to examine the impact of various shocks on fluctuations in our dependent variables. It enables us to determine which

causes drive economic changes across the analyzed period by decomposing the variance of each variable into the proportions attributable to distinct shocks, such as monetary policy shocks. In contrast with the generalized impulse response function, it separates the variation in the target variable into component shocks.

4.8 Granger Causality Tests; Granger's causality method enabled us to determine whether one time-series has a short term causal impact on another. It determines whether the historical values of variable x could be used to predict the variable y. However, this does not imply that x is the sole element influencing y, rather it suggests a correlation between the past values of x and the current value of y. This hypothesis testing method suggests that if cointegration in an equation system is present, then there must be at least one granger causality because at least one equation in the system must react to the long run disequilibrium. The Granger Causality tested the null hypothesis that all lagged coefficients for an endogenous variable are zero against the alternative. The null hypothesis is then rejected to confirm that indeed x granger causes y. The choice of undertaking a granger causality test was then taken so as to unpack the direction of the causality between the variables.

4.2 DATA DESCRIPTION AND SOURCES[3]

In this section, I provide an overview of the variables chosen for the study, elucidate how they are measured, and specify their respective sources. These selected variables are commonly utilized in the construction of VECM to investigate the transmission of monetary policy and have direct relevance to the Botswana economy. My analysis encompasses the time frame from 2005 Q1 to the fourth quarter of 2022. I sourced data on GDP, money supply (M2), bank rates, and the nominal effective exchange rate (NEER) from the official website of the Bank of Botswana. Additionally, data about the consumer price index for Botswana was obtained from Statistics Botswana

The bank rate, which represents the cost at which commercial banks borrow money from the central bank, is anticipated to exert an instantaneous influence on the rates in the market, subsequently impacting output and inflation pressures. Whenever there is a change in the bank rate, it is anticipated that market interest rates will also adjust correspondingly. The Bank of Botswana's Monetary Policy Committee exclusively regulates the bank rate.

Non-mining real gross domestic product (GDP) is considered as a measure of output because rising economic activity will push inflation higher. However, taking into account the fact that

[3] See Table 1B in Annexure for Data Dictionary.

the economy of Botswana is mineral based, this was used in tandem with the mining GDP because mineral revenues account for 76 percent of the total GDP. The market value of all finished products and services produced in an economy during a specific period is expressed in monetary terms as the gross domestic product. High interest rates are anticipated to reduce real GDP, with falling GDP expected to curb inflation.

In this framework, inflation was measured using the consumer price index (CPI), which represents a weighted average of prices for various goods and services. An escalation in the policy rate is expected to lead to a decrease in the CPI.

To account for external shocks, the model incorporated the nominal effective exchange rate (NEER). The NEER is calculated by using a weighted average of the Special Drawing Rights (SDR) value, which includes the US dollar, UK pound, Japanese yen, and euro, along with the South African rand. The weights for these components are determined based on the volume of foreign trade between Botswana and the respective nations. An increase (decrease) in the amount of foreign currency per unit of the domestic currency represents exchange rate appreciation (depreciation).

To show how financial depth influences inflation, money supply (M2) was incorporated as an indicator of financial depth within Botswana.

CHAPTER 5

5.1 EMPIRICAL FINDINGS AND DISCUSSION

The empirical results of the models used to re-evaluate Botswana's monetary policy's efficacy are covered in this chapter. It is broken up into the following seven sections: The correlation matrix and the descriptive statistics are shown in sections two and three, respectively. While sections five and six address the cointegration results and the model diagnostics, section four addresses the findings of the stationarity tests. The impulse response function and forecast error variance decomposition results are covered in Section 7.

5.2 Descriptive Summary Statistics; The summary statistics of my variables are shown in Table 1. The findings show that Botswana's bank rate has reached a maximum of 14.65% and a minimum of 1.65%. This indicates much variation in the bank rate over the observed period which implies that Botswana has a dynamic economic environment in which monetary policy has been actively used to regulate economic conditions. These changes sure have had far-reaching consequences for many areas of the economy, including borrowings, savings, investment, housing, and foreign trade. The bank rate also has an average of 2.65%. All things considered, Botswana's average bank rate of 2.65% points to a generally accommodating monetary policy approach intended to boost growth, encourage borrowing and investment and stimulate economic activity.

Botswana has also registered a maximum of P22 543.92 billion in non-mining GDP, with a minimum of P8,686.03 billion and an average of P16 743.51 billion. This emphasizes the country's significant economic activity outside of mining, implying a diversified economy with multiple industries contributing to GDP. This diversity is considered beneficial for long-term economic stability, as it reduces reliance on a single sector that is susceptible to commodity price volatility. Furthermore, the difference between the greatest and minimum values of non-mining GDP reflects a diverse range of economic activity, potentially providing resilience to external shocks such as global economic downturns over the specified period and demonstrating the country's overall economic health beyond mining.

Mining GDP on the contrary has registered a high of P10 721.7 billion, a low of P1 451.3 billion, and an average of P5 610.4 billion. Botswana's mining economy is primarily reliant

on resource extraction and export, particularly diamonds, copper, nickel, and coal. Global commodity prices for these minerals have the potential to significantly impact the mining industry's GDP. During periods of high commodity prices, the value of mineral exports rises, resulting in higher mining GDP. Conversely, during periods of low commodity prices, the value of mineral exports falls, resulting in a reduced mining GDP. The volatility of mining GDP can be attributed to the complex interplay of global market forces, domestic policies, investment decisions, and infrastructure development practices.

Concerning Botswana’s growth rate in CPI a high of 14.7%, a low of 1.2%, and an average of 6.54% have been registered. Botswana's average CPI of 6.5% indicates that inflation has been moderate yet significant during the examined period. It shows that, while inflationary pressures were high at times, they were also moderated by periods of low inflation. Botswana's policymakers would need to closely monitor inflation patterns and execute appropriate policies to keep prices stable while encouraging long-term economic growth. This could include a mix of monetary policy tools, supply-side changes, and specialized measures to address specific inflationary drivers.

The Botswana diamond price index has a high of $184.4 million and a low of $119.1 with an average of $142.12 million. The variations in Botswana's diamond Price Index reflect the intricate interplay of global market forces, government policies, and economic situations that influence the diamond sector. Botswana's economic performance and government revenue are primarily reliant on diamond exports, therefore variations in diamond prices can have a big influence. As a result, Botswana policymakers must closely watch diamond market developments and implement measures to ensure the diamond industry's long-term viability and competitiveness.

Table 1. SUMMARY STATISTICS

Variables	Observations	Mean	Std. deviation	Minimum	Maximum
Non-mining GDP	72	16743.51	4169.26	8686.03	22543.92
Mining GDP					

	72	5 610.40	1.22	1 451.30	10 721.70
Bots C.P.I	72	6.54444	3.53	1.2	14.7
Diamond Prices	72	142.1292	14.29	119.1	184.4
Bank rate	72	2.65	0.53	1.65	14.65

Source: Author's *compilation from Stata*

5.3 Correlation Analysis; Table 2 displays the results of the correlation analysis for the study's variables. Testing for multicollinearity is crucial in time series econometric research because significant correlation between independent variables restricts the model's ability to find statistically significant independent variables and makes it more difficult to interpret results. This is because multicollinearity inflates the variance of the calculated coefficients, resulting in erroneous coefficient estimations for those explanatory variables.

An interesting observation is made between the bank rate and the CPI. The Pearson coefficient shows a negative correlation between the bank rate and the CPI. This is in line with the literature and the hypotheses of this study, together with the results of the VAR analysis. So, it can be argued from these findings that indeed Botswana's monetary policy could be effective in attaining price stability as the efforts of the monetary policy in attaining price stability through the manipulation of the rate attains its main objective. The results further show a positive relationship between the bank rate and output proxied by both mining and non-mining GDP. This relationship between the bank rate and the mining and non-mining output however goes against the hypotheses implying the effects of the propagation of the savings and investment channel as not strong enough to hold.

The correlation matrix of my variables shows very minimal levels for the possibility of multicollinearity. Almost all the variables have a Pearson's coefficient below 0.65. Except for Non-mining GDP with M2, CPI with NEER, and NEER with the diamond price index which all have a coefficient above 0.65. However, a stepwise regression was employed to counter the possible issues of multicollinearity resulting from this. These results are not shocking because, in a mineral-based economy like Botswana, the mining sector dominates economic activity, while other sectors remain underdeveloped. The limited economic diversification can lead to high interdependence among other economic variables, such as non-mining GDP

and money supply, resulting in greater correlations and possibly multicollinearity in regression analysis.

The same applies to the correlation coefficient between CPI and the NEER. The strong positive correlation is not a shock. Changes in the NEER, which evaluates a country's currency's value against a basket of foreign currencies, can have an impact on import costs and, as a result, the consumer price index. If the exchange rate depreciation raises import prices, inflation may rise, as measured by the CPI. As a result, exchange rate pass-through effects may provide a positive association between CPI and NEER.

Concerning possibilities of multicollinearity between the CPI and the Botswana diamond price index, the result is highly expected as diamond exports frequently account for a significant share of foreign exchange earnings in mineral-rich economies like Botswana. Diamond prices fluctuate, affecting the country's balance of payments, currency rate dynamics, and inflationary pressures. Changes in the value of diamond exports indicated in the diamond price index may have an impact on the country's currency value, influencing import prices and inflation as measured by the CPI.

Table 2. CORRELATION TESTS

	Diamond Price	NEER	M2	Bots C.P.I	Non-mining GDP	Mining GDP	Bank rate
Diamond price	1.00						
NEER	0.91	1.00					
M2	-0.41	-0.42	1.00				
Bots CPI	0.75**	0.74	-0.41	1.00			
Non-mining GDP	-0.46	-0.49	0.94	-0.57**	1.00		
Mining GDP	-0.13	-0.17	0.40	-0.30**	0.53	1.00	

Bank rate	-0.41**	-0.48	-0.06	-0.52**	0.11**	0.39**	1.00

Source: Author's compilation from Stata

** indicates significance at a 5% level

5.4 Stationarity Tests; The stationarity of the data for the variables included in the study was assessed using the Augmented Dickey-Fuller (ADF) unit root test and the Phillips-Perron (PP) test. Table 4 shows the five selection criteria that determined the optimal lag selection. According to Gujarati (2003), a visual evaluation of the variables using line graphs should be performed before subjecting them to the ADF and PP tests. The visual inspection revealed that all series oscillated horizontally with a constant variance, implying stationarity, except money supply, which showed a slightly rising trend and an inconstant variance, indicating non-stationarity at levels. After visually inspecting the variables, the study proceeded with the ADF and PP unit root tests as presented in Table 3. All variables are stationary at levels, at the 1% significance level except money supply which is only stationary at I (1), this is true for both the ADF & PP.

Table 3. UNIT ROOT TESTS

Variable	ADF At levels	PP TEST At levels	ADF First difference	PP TEST First differences
Diamond prices	3.15***	19.24***		
NEER	3.55***	13.44***		
M2	3.55	19.22	8.99***	24.99***
Bots CPI	2.91***	17.24***		
Non-mining				

GDP	2.59***	13.23***		
Bank rate	3.26***	11.80***		
Mining GDP	3.21***	13.55***		

Source: Author's compilation from Stata

*** indicates significance level at 1%, ** significance at 5%

Lag length selection; Several factors were considered when determining the suitable lag duration. Initially, I followed the lag selection criteria that Stata offered (LR, FPE, AIC, HQ, and SC). Second, I considered the idea put forth by the literature that there is always a gap between the implementation of policy and its effects on the actual economy. This suggests that a longer lag period could be the most suitable. Lastly, the response functions conduct also served as a reference. Because of these considerations, the ideal lag is three, as indicated by one or more of the selection criteria, and producing reasonably acceptable and well-behaved response functions.

Table 4. LAG ORDER SELECTION CRITERIA

Sample Q1-2005 through Q4-2022

Lag	LL	LR	p	FPE	AIC	HQIC	SBIC
0	-1592.32			1.2e+18	61.613	61.775	
1	-1468.92	246.81	0.000	7.1e+16	58.6506	59.4563	60.752
2	-1336.3	265.24	0.000	3.2e+15	55.4344	56.9449	59.3745*
3	-1247.3	177.98*	0.000	9.0e+14 *	53.8963*	56.1117*	59.675
4	-1216.45	61.697	0.000	3.3e+15	54.5944	57.5147	

*Indicates the optimal lag length

5.5 Cointegration Analysis; My series includes both I(0) and I(1) variables, necessitating the usage of the bounds test for cointegration. The test statistic is greater than the critical values for the upper bounds I(1), so I reject the H0 of no cointegration and conclude a long-term relationship exists between the cointegrating equations. This implies that, despite short-term oscillations, the variables have a stable equilibrium in the long run and monetary policy can

have an impact on the economy's performance over time. This aligns with policymakers' goals of maintaining stable prices and long-term economic growth.

ARDL Bounds Test

H0: no levels relationship F = 12.729

99% confidence interval lower Upper	95% confidence interval lower Upper	10% confidence interval lower Upper
3.17 4.14	3.79 4.85	5.15 6.36

Dependent variable	Lag structure	F-Statistic	LB CV at 5%	UB CV at 5%	Decision
CPI	3	12.729	4.85	6.36	There is cointegration
Mining GDP	3	13.80	3.33	7.85	There is cointegration
Non-mining GDP	3	22.76	6.90	11.14	There is cointegration

Source; Author's calculations from Stata

5.6 MODEL DIAGONOSTICS

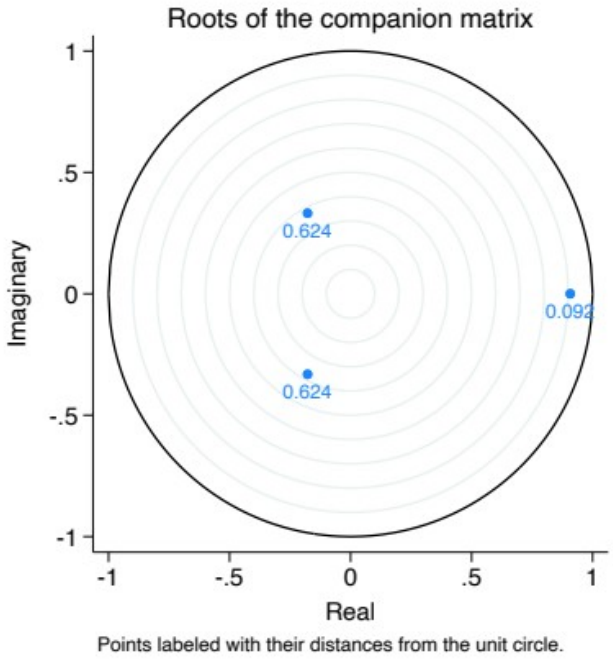
Regression diagnostics are used to test model assumptions and see whether any observations have a big and undue impact on the analysis. Therefore, the following diagnostic checks were run on the residuals of the model.

5.6.1 Stability Test; To ascertain that the model satisfies the VAR model's stability criteria, the inverse roots of AR Characteristic Polynomial were run. As a rule of thumb, the model is stable if the inverse roots of the AR characteristic polynomial are less than 1 and fall within

the unit circle. In the case where the VAR is not stable, then it implies that certain results such as the impulse response standard errors are not valid.

Figure 5. Inverse roots of AR Characteristic Polynomial

The estimated model's roots all lie within the unit root circle, indicating that the stability test is passed by the model. The reason the stability criterion matters is that certain conclusions, such as the standard errors of the impulse response, are invalid if the VAR is not stable (stata manual). The results of the stability of the VAR are below,



5.6.2 Test for Autocorrelation; Autocorrelation is the degree of correlation between two successive time intervals, Huitema & Laraway (2006). It evaluates how a variable's value in a time series relates to its original version when it is lagged. Autocorrelation analysis measures the relationship between observations at various periods in time to look for a pattern or trend in a time series. For this model, the Breusch–Godfrey test was utilized to check for autocorrelation. Because this test is based on Lagrange multiplier testing, it is also known as an LM test for serial correlation. The H0 asserts that there is no serial correlation up to order p, and it is accepted if the p-value of the LM statistic is greater than the 5% significance level.

There is no autocorrelation of the residuals. Autocorrelation in residuals indicates that the model fails to describe systemic patterns or dependencies. If the residuals show autocorrelation, it indicates that there is still information in the error terms that the model failed to capture. So, the absence of autocorrelation in residuals in our model is a desired

attribute as it validates the model's adequacy and ensures the trustworthiness of its predictions and statistical conclusions.

Table 6. AUTO-CORRELATION TEST

Lag	Chi2	Probability
1	75.28	0.60
2	122.78	0.50

Source; Author's calculations from Stata

5.6.3 Heteroscedasticity; The term heteroscedasticity describes a systematic variation in the residuals' distribution across a range of measured values. Ordinary least squares (OLS) regression indicates that all residuals come from a population with constant variance (homoscedasticity), which raises concerns about heteroscedasticity. Reliability of the standard errors and satisfaction of the regression assumptions depend on the residuals having a constant variance. To assess this model, White's Heteroscedasticity test was employed. If the test's p-value is greater than the 5% significance level, the null hypothesis, which states that there is no heteroscedasticity, will be accepted.

Table *7*: White's Heteroscedasticity

Chi-square	Probability
120.9425	0.2522

Source: Author's compilation from Stata

Table 7 shows that we accept H0 of no heteroscedasticity since the p-value is greater than the 5% significance level. Thus, we concluded that the model is free from heteroscedasticity and estimates from this model can be trusted.

VECTOR ERROR CORRECTION ESTIMATES

A Vector error correction model is a restricted VAR that is designed to be used with cointegrated non-stationary series. (Cas, 2011). Its specification includes cointegration relations that restrict the endogenous variables long run behaviour to converge to their cointegrating relationships while allowing for short run adjustments dynamics. The cointegration term is referred to as the error correction term because deviations from long run equilibrium are gradually corrected through a series of partial short run adjustments. This

study employed this technique because there is cointegration in the equations, therefore it was the intention to unpack both the short run and long run dynamics of the effect of the changes in the bank rate on inflation and output growth. The model also presents the speed of adjustment to equilibrium in case there is a shock from the independent variables. The tables below show estimates from our 3 equations of interest.

Table 7. VECTOR ERROR CORRECTION ESTIMATES ON THE EQUATION OF INFLATION[4]

Variables	Coefficient	P-value
ECT	-0.0500	0.00
Botswana CPI	1	
Bank Rate	0.002	0.001
NEER	0.013	0.000
M2	0.002	0.000
Diamond price index	0.81	0.00
SHORT RUN RESULTS		
Bank Rate	-0.0008	0.001
M2	1.2	0.016
NEER	0.0017	0.000
Diamond Price index	-0.00073	0.046

Source; Authors calculations from Stata

The table above presents results of the long-term effects of the bank rate on inflation levels. The error correction term is negative implying that errors relating to the previous period will be adjusted in the current period at a speed of 5%. In the same context, by rule of thumb, the p-statistic is significant which confirms an adjustment towards equilibrium in any disequilibrium situation.

The bank rate is also statistically significant at all levels, in impacting inflation. However, the coefficient is not statistically different from 0, implying that a 1%-unit shock in the bank rate results in inflation decreasing by 0.002%. This has already been shown by the IRF, on eye inspection, that shows no impact on the level of inflation from a one-unit shock in the level of the bank rate. As alluded earlier, it confirms that prices are shocked by other factors other than the bank rate, and that indeed monetary policy is not that effective in attaining price stability in Botswana. A decrease of 0.002% is not felt and therefore changes in the bank rate

[4] The signs are reversed when interpreting the long run results of a VECM.

do not result in significant changes in the level of inflation in the long run. The findings are similar to the findings of (Bijali, 2020) which examined the relationship between central bank policy actions and inflation rates. He highlighted that the traditional monetary policy tool of adjusting bank rates has limited impact on controlling inflation due to other factors such as fiscal policy and external economic conditions playing a much significant role in influencing inflation.

Table 8. VECTOR ERROR CORRECTION ESTIMATES ON THE EQUATION OF MINING GDP

Variables	Coefficient	P-value
ECT	-0.097	0.00
Mining GDP	1	
Bank Rate	-0.83	0.16
NEER	-3.82	0.34
M2	0.67	0.000
Diamond price index	-1.63	0.00
SHORT RUN RESUTS		
Bank rate	0.07	0.719
NEER	0.42	0.168
M2	0.0003	0.376
Diamond Price Index	-0.656	0.011

Source; Authors calculations from Stata

With respect to the equation of our second dependent variable, mining gdp, the error correction term is also statistically significant and negative, proving adjustment in the current period of any errors from the previous one. The errors will be adjusted for at a speed of 9.7% to equilibrium. The coefficient of the bank rate however is not statistically significant. This shows that the bank rate does not have an influence in the level of mining GDP in the long run. The same results are seen in the short run, where, all things constant, and on average, the bank rate does not affect mining GDP. The results are also shown by the IRF where any shocks in the bank rate seem to not impact the level of mining GDP. They are also in tandem with the finding of (Dempere, 2022) who found that bank rates may not significantly affect mining GDP due to various regional and economic factors that are characteristics of developing countries

Table 9. VECTOR ERROR CORRECTION ESTIMATES ON THE EQUATION OF NON-MINING GDP

Variables	Coefficient	P-value
ECT	-0.127	0.00
Non-mining GDP	1	
Bank Rate	11.12	0.00
NEER	6.9	0.34
M2	-5.67	0.000
Diamond price index	0.58	0.08
SHORT RUN RESUTS		
Bank rate	-4.62	0.046
NEER	-0.468	0.032
M2	0.000	0.395
Diamond Price Index	-5.656	0.914

Source; Authors calculations from Stata

Table 3 above presents results of our third dependent variable, the non-mining GDP. The results show an adjustment speed of 12.7% and it is significant. Like all the other variables, all shocks from the previous period are adjusted for in the current period at an adjustment speed of 12.7%.

With respect to the bank rate impact, the effect is highly statistically significant at all levels. A 1% shock in the bank rate is seen to decrease the level of non-mining GDP by 11.12%. This is also evidenced by the highly volatile IRF. The findings are similar to the finding of (Uwilingiye, 2008) who found that changes in the bank rate significantly affect non-mining GDP. Specifically, they found that an increase in the bank rate tends to reduce output in non-mining sectors due to higher borrowing costs, which dampen investment and consumption.

These findings underscore the importance of considering sector specific dynamics and regional economic conditions when making monetary policy decisions.

Table 10. VECTOR ERROR CORRECTION ESTIMATES ON THE EQUATION OF DIAMOND PRICES

Variables	Coefficient	P-value
ECT	-0.007	0.71
Diamond price index	1	
Bank Rate	-3.49	0.69
NEER	-24.50	0.00
M2	-1.58	0.00
SHORT RUN RESUTS		
Bank rate	0.13	0.346
NEER	0.384	0.031
M2	0.000	0.104

Source; Authors calculations from Stata

Lastly, with diamond prices as our dependent variable, the error correction term of the equation is negative which implies that errors relating to the previous period will be adjusted in the current period. However, by rule of thumb, a p-value greater than 0.05 implies that the coefficients are statistically different from zero, therefore, since the error correction term of the equation has a p-value greater than zero, the error correction term is statistically insignificant. This indicates lack of adjustment towards long run equilibrium in any disequilibrium situation. Furthermore, given the statistical insignificance of the bank rate impact on diamond prices in the long run, we conclude that the bank rate does not impact the diamond prices. The findings are similar to the findings of (Wouters, 2007) who found that bank rates have a limited impact on mineral prices because these commodities are influenced more by global supply and demand factors rather than domestic monetary policy.

(Vespignani, 2013) also found that the prices of oil and gold are primarily driven by global economic conditions. Geopolitical events and market speculation greatly overshadow the influence of domestic bank rate.

GRANGER CAUSALITY RESULTS

Table 11. Granger Causality X on Y

Y- Variable	**X-variable**	**P > Chi2**
Non-mining GDP	Bankrate	0.0029***
Non-mining GDP	Diamond Prices	0.4598

Non-mining GDP	NEER	0.3256
Non-mining GDP	M2	0.5687
Non-mining GDP	MINING GDP	0.8973
Non-mining GDP	Inflation	0.031**

*Source; Authors Calculations from stata ***indicates significance at 1% , ** indicate significance at 5% and * indicates significance level at 10%*

Table 11 above presents the results of Granger Causality estimation, where we conclude that the bank rate granger causes non-mining GDP at 1% level of significance. Differently put, the results indicate that the past values of the bank rate can be used in predicting the present value of the non-mining GDP observed today. The causality tests in this case are the short-run causal effect. The results also indicate that the past values of inflation can also be used to predict the observed values of non-mining GDP observed today, however at 5% significance. The above results are economically sensible as the bank rate influences borrowing costs and consumer spending which directly affect investment and economic activity in the non-mining sector. Similarly, inflation affects purchasing power and input costs, which influences demand and business operations in this sector.

Table 12. Granger Causality X on Y

Y- Variable	**X-variable**	**P > Chi2**
Inflation	Bankrate	0.0018***
Inflation	Diamond Prices	0.914
Inflation	NEER	0.5149
Inflation	M2	0.0001***
Inflation	MINING GDP	0.2712
Inflation	Non-mining GDP	0.945

Source; Authors Calculations from stata

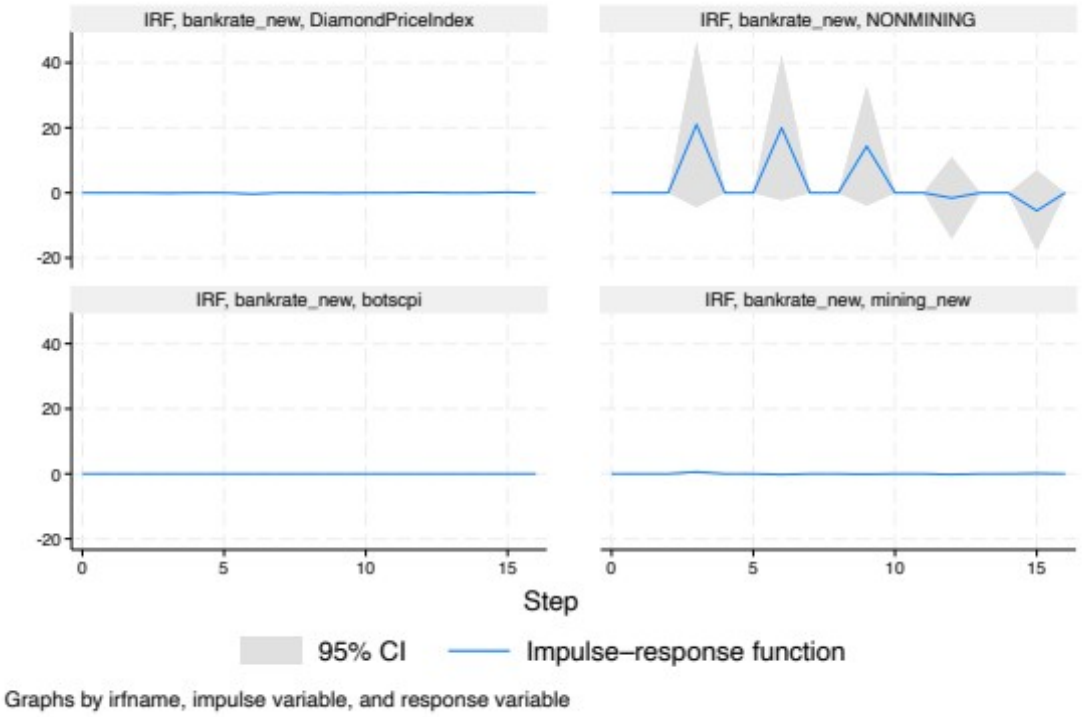
****indicates significance at 1% , ** indicate significance at 5% and * indicates significance level at 10%*

Lastly, on the equation of inflation, the bank rate and the Level of money supply are seen to granger cause inflation, at 1% significance level. In a similar manner and differently put, the above table shows that we can use the past values of the bank rate and the M2 to predict the

current values of inflation, in the short run. Economically the above results are not shocking as changes in the money supply directly affect the level of liquidity in the economy, influencing consumer spending and investment, which can drive prices up Similarly, the bank rate, as the primary tool for monetary policy affects borrowing costs and spending behaviours; lower bank rates typically shock demand, potentially leading to higher inflation hence the two would granger cause inflation.

The results show no two-way causality between our key variables. The causality is only uni-directional and its from the bank rate to the non-mining GDP and inflation and from inflation to non-mining and lastly M2 to inflation. For Granger causality between other variables, see Appendix (Table 3 and 4)

5.8 Figure 6; **Impulse response functions**



The impulse response functions are shown in the figure 6 above. The solid blue line traces the responses of diamond prices, non-mining GDP, inflation, and lastly mining GDP respectively, to a 1 standard deviation shock in the bank rate. The numbers on the vertical axis indicate the percentage variation including 0, the stability state. On the horizontal axis are the periods which are divided into 16 quarters.

Diamond prices are seen to not be impacted by shocks in the policy rate. This result is not shocking though because global currencies are often used to quote mineral prices, and Botswana is a small country hence the domestic economic conditions and policymaking will not influence the international prices of diamonds. Global market factors, including demand from developing nations, supply chain disruptions due to geopolitical events, and trade agreements, frequently impact the price of minerals more. As such, it is not shocking that changes in monetary policy might not have a significant direct effect on these international variables.

Interest rate fluctuations affect non-mining industries such as manufacturing, services, and agriculture. For instance, increased interest rates make borrowing more expensive for consumers and businesses, which would decrease investment, consumption, and total economic activity. Capital investments are frequently necessary for the expansion and growth of non-mining enterprises as such, interest rate fluctuations may have an impact on capital costs and, thus, investment choices. Lower interest rates encourage investment while higher rates may discourage it, which can affect the level of economic activity overall. So, the above response of non-mining GDP to a shock in the bank rate is not surprising. A one standard deviation shock to the bank rate results in a lagged positive effect on non-mining GDP, which only responds at the beginning of the 3rd quarter with a rise then followed by a decline to stability at the end of the fourth quarter. It is a plausible observation that following the initial positive response, non-mining GDP falls or stabilizes. This could happen as the initial stimulus from the monetary policy shock fades and other economic factors take effect. For example, if the early surge in economic activity leads to inflationary pressures or unsustainable levels of debt, policymakers may respond by tightening monetary policy, potentially dampening growth in the medium to long term.

The non-responsiveness of inflation to a shock in the policy rate is not a new finding. Inflation is essentially a monetary phenomenon; however, prices can fluctuate due to factors other than monetary policy. For instance, businesses and consumers may not alter their pricing and wage-setting behavior in response to a transient shift in the policy rate if inflation expectations are well-anchored. The influence on actual inflation may be limited if economic agents think the shock is only momentary or unlikely to cause long-term changes in inflation. Botswana is an open economy, and therefore a part of the global economy, external variables can affect domestic inflation. If the shock in Botswana's monetary policy rate has little effect on global economic conditions, by virtue of Botswana being a small economy and thus a

price taker, the impact on the CPI could be modest to none in extreme cases, as shown by the above IRF. This is hardly surprising given that Botswana's inflation is exposed to a variety of exogenous shocks. This is also reiterated by Seabe (2015) who emphasized that Botswana's inflation is structural and prone much more to external shocks than to monetary policy effects. For instance, fluctuations in administered prices, which are outside the purview of monetary policy, have an impact on Botswana's inflation in addition to international prices Seabe (2015). Rates set by government parastatals including Botswana Telecommunications Corporation, Botswana Housing Corporation, and Botswana Power Corporation are included in the administration pricing. This result is in tandem with the findings of (Alex 2007) who alluded that the determinants of inflation in Botswana are largely structural.

A one-standard-deviation shock to the policy rate is seen to have no impact on mining GDP for the first 3 quarters. This is in line with what theory posits about lags of policy shocks in influencing economic activities. It only slightly responds with an upward trend at the beginning of the fourth quarter and then back to its stable state. This is expected because minerals generally have inelastic demand, which means that price changes have little impact on the quantity sought. Minerals, particularly those utilized in critical industries like our diamonds, may have few replacements, making demand less sensitive to interest rate fluctuations. The government and mining industries, which are not affected by interest rates, dominate the structure of Botswana's economy.

5.9 VAR DECOMPOSITION TESTS

From the VAR decomposition, the results show that shocks in the bank rate explain only about 2% of the total changes in the mining GDP, about 5% of the total changes in the non-mining GDP, and lastly 2.8% of the changes in the inflation rate. Botswana's economic structure, which is heavily reliant on the mining sector, puts at risk the monetary policy's ability to manage output growth and preserve price stability. Mining's dominance in GDP contribution and export earnings makes the economy extremely vulnerable to external factors, particularly commodity price swings. As a result, the impact of monetary policy actions may be muted, as broader economic activity is heavily influenced by factors beyond the central bank's control. Furthermore, weaknesses in transmission mechanisms may explain Botswana's monetary policy's poor effectiveness. Underdeveloped financial markets, combined with limited access to credit for non-mining industries, impede the effective transmission of policy changes to key economic indicators such as non-mining GDP and

inflation rates. These structural limits highlight the necessity for a comprehensive policy strategy that extends beyond monetary measures. To promote long-term economic growth, stimulate non-mining industries, and strengthen resilience to external shocks, policymakers must consider implementing a combination of fiscal interventions, structural reforms, and targeted sector-specific policies.

Table 8. VAR decomposition tests

STEP	Mining GDP response to Bank rate	Non-Mining GDP response to Bank rate	CPI response to bank rate	Diamond prices response to bank rate
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	.012804	.06749	.008982	.001645
5	.012804	.06749	.008982	.001645
6	.012804	.06749	.008982	.001645
7	.019909	.053938	.026539	.027504
8	.019909	.053938	.026539	.027504
9	.019909	.053938	.026539	.027504
10	.02297	.05108	.023315	.024829
11	.02297	.05108	.023315	.024829
12	.02297	.05108	.023315	.024829
13	.02199	.054152	.025835	.024455
14	.02199	.054152	.025835	.024455
15	.02199	.054152	.025835	.024455
16	.02227	.051177	.028274	.029394

Source; Author's calculations from Stata

Interpreting a VECM is quite challenging as it is an equation system with variables acting as both dependent and independent. Variables affect one other over time, and different lags tend

to provide different information, making it difficult to determine and interpret the dynamics (Schmidt, 2020). To overcome this, we employed IRFs to trace out the dynamics.

Previous literature that examined the effectiveness of monetary policy in attaining price stability and output growth have concluded conflicting results. Some agree with the underlying theory, that an increase in the bank rate decreases the level of inflation and output growth, as intended by the central bank. Some conclude the opposite effects. Most of the reviewed studies used different models to test this ongoing debate. The main aim of this paper was to re-examine the phenomenon using a VECM model to test if the results obtained align with the given theory and therefore confirm the below hypotheses that;

1. A negative correlation exists between the bank rate and the level of inflation
2. An increase in the bank rate leads to a reduction in output due to the propagation of the effects through saving and investment channel.

In contrary to the previous estimated models, the VECM has a long run equilibrium and includes more endogenous variables to achieve a model that explains the relationship between the bank rate and inflation together with output growth. To test the research question, the two hypotheses stated above were set up.

This results of the VECM on the equation of inflation answer the first hypothesis since the null hypothesis can be rejected in favour of the alternative, concluding that ‘there is a negative association between the interbank rate and the level of inflation’. This is aligned with the theory and the findings of (Bijali, 2020).

With regards to the results of the VECM on output, the second hypothesis is also answered. The equation of Non-mining GDP shows that the null hypothesis of No association is rejected in favour of the Alternative, leading us to conclude that there is a negative association between the bank rate and the level of non-mining GDP in the long run. However, with mining GDP we cannot reject the Null hypothesis of no association, and we conclude that the bank rate is not associated with the non-mining GDP in the long run.

The econometric analysis’s findings lead us to the conclusion that Botswana's monetary policy is less successful. Real economic activity and inflation are not much impacted by policy shocks. Moreover, the findings lead us to the conclusion that other external shocks like controlled prices and exchange rates are the primary causes of inflation. This means that even while the interest rate channel is active, it only partially explains changes in output and inflation. Consequently, policymakers should look into how independent Botswana's monetary policy is from external influences. The findings are concerning because they suggest that a significant increase in bank rates will not ensure that inflation will quickly return to target; instead, it will hurt economic activity and destabilize the economy rather than stabilize it. The findings also generally demonstrate that exogenous factors most notably diamond exports drive Botswana's economy more than domestic ones. We also infer that Botswana's monetary policy is less successful because the VAR decomposition results suggest that the bank rate shocks only account for a maximum of 5% of the changes in our dependent variables.

CHAPTER 6

6.1 SUMMARY, CONCLUSIONS, AND POLICY RECOMMENDATIONS.

Chapter 6 presents a summary of the primary findings, conclusions, and policy recommendations that were derived from empirical research on the effectiveness of monetary policy in achieving price stability and output growth in Botswana. The research was divided into six chapters, starting with the background of the study, then an overview of Botswana's Monetary Policy, a literature review, and a discussion of the study's methodology. In chapter five, the study summarized the findings as per the objectives.

6.2 SUMMARY

The primary objective of this study is to evaluate the impact of the bank rate on inflation and output growth. The study employed the use of the Vector Error Correction Model to estimate the impact of changes in the bank rate on the mentioned macroeconomic variables over the studied period.The findings of the analysis imply that Botswana's monetary policy is less effective in reaching its intended goals. Specifically, policy shocks have a negligible influence on real economic activity and inflation. Instead, it appears that external factors such as administered prices and exchange rates are the primary drivers of inflation. This raises questions regarding the independence of Botswana's monetary policy from external pressures. Although the interest rate channel is operational, it accounts for only a small amount of the volatility in output and inflation.

The findings suggest that a considerable hike in the bank rate may not result in a speedy return of inflation to the target level, but may hurt economic activity, potentially destabilizing rather than stabilizing the economy. Furthermore, the analysis shows that Botswana's economy is heavily influenced by external forces, particularly diamond exports. The VAR decomposition results show that bank rate shocks account for just a small percentage of changes in the dependent variables.

The findings do align with theory and some of the empirical research on the subject matter. A study by (Ekundayo, 2020) found that monetary policy instruments such as mney supply and interest rates have limited effectiveness in controlling inflation due to the significant influence of external factors and informal financial sector. This aligns with our findings that external factors like administered prices and exchange rates are primary drivers of inflation in Botswana. Our findings show that even though the interest rate channel is functional, it only accounts for small amount of volatility in output and inflation. This aligns with the theoretical claims of the interest rate channel, that changes in the policy rate influence economic activity and inflation through their impact on borrowing and costs.

6.3 CONCLUSION

In conclusion, this study contends that Botswana's monetary policy is inadequate due to its low impact on real economic activity and inflation. The findings highlight the importance of policymakers re-evaluating the independence of monetary policy and considering alternate measures to achieve price stability and boost economic growth in Botswana.

6.4 IMPLICATION FOR POLICY

Reassessment of Monetary Policy Framework: the study's findings imply that Botswana's authorities should examine the existing monetary policy framework. Given monetary policy's limited effectiveness in influencing actual economic activity and inflation, policymakers should examine the transmission mechanisms by which monetary policy measures affect the economy. This evaluation could include looking at the channels of monetary policy transmission and identifying potential restrictions or inefficiencies that limit the effectiveness of policy actions.

Improving Policy Independence: the study emphasizes the necessity of keeping monetary policy independent of external factors, particularly exogenous shocks like administered prices and exchange rates. Authorities should assess the extent to which circumstances beyond their control influence monetary policy decisions and take actions to improve the independence of monetary policy operations. This may include taking steps to isolate monetary policy decisions from short-term volatility in external factors and building institutional frameworks to ensure policy independence.

6.5 LIMITATIONS OF THE STUDY

While this research attempts to re-examine the effectiveness of Botswana's monetary policy in achieving price stability and economic growth, it is vital to recognize several limitations inherent in the study. The limitation of this study is the scope and extent of discussion. Because I have not conducted many research studies as a scholar in the past, the extent and depth of discussions in this study are unlikely to be comparable to those of experienced academics who have published many academic papers in the past. Despite these limitations, the study's findings contribute to the continuing debate about the efficiency of monetary policy in Botswana and lay the groundwork for future research and policy considerations in this area.

6.6 AREAS FOR FUTURE RESEARCH

Given the data limitations encountered in the study, additional investigations with larger time series should be investigated. By doing this, the study will be able to gather more data points and get a deeper comprehension of the type of relationship that exists between the variables. Since the sample mean will be closer to the actual mean of the data, estimates made with a larger sample size will be more accurate.

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ANNEXURE

Contribution of the mining sector to Botswana's economy

TABLE 1

CONTRIBUTION	ECONOMIC INDICATOR
85%	Botswana forex earnings
1/3	Government revenue
25%	GDP
20%	Total employment

TABLE 2

Data Dictionary for the variables used

Main Variables	Description	Relation of the variable to the research question	Source
Bank rate	The cost at which commercials banks borrow money from the central bank	One important tool in the monetary policy toolbox is the bank rate, and shifts in this rate can have a big impact on production growth and price stability. Understanding how well monetary policy accomplishes its goals requires analysing the connection between the bank rate and the said	Bank Of Botswana website

		macroeconomic factors.	
Output	The value of goods and services produced in Botswana. It is segregated into both mining and non mining GDP.	One important measure of the overall growth and output of the economy is the GDP. In order to comprehend how changes in interest rates and other monetary tools affect the rate of economic activity, most researchers and policymakers do evaluate the effect of monetary policy on GDP. A robust and increasing economy is usually linked to a growing GDP.	Bank of Botswana website
Inflation	The rate of increase in prices over a given period of time, approximated using consumer price index.	Maintaining a low and constant rate of inflation is frequently associated with price stability. As part of their monetary policy framework, central banks around the world frequently	Statistics Botswana website.

		have explicit inflation targets. The study issue entails evaluating how well monetary policy, using measures such as interest rates, has been able to attain and sustain this aim.	
Control variables			
Money supply (M2)	An indication of financial depth in Botswana.	Changes in the money supply have a significant impact on both inflation and GDP growth via a variety of pathways. If other conditions stay constant, an increase in the money supply tends to drive more spending by individuals and companies, putting upward pressure on prices. A contraction in the money supply, on the other hand, might lead to reduced spending,	Bank of Botswana website

		which contributes to lower inflation. Furthermore, changes in the money supply affect bank credit creation; an increase might drive more lending, encouraging investment and consumption, and hence promoting overall economic output growth. A fall in the money supply, on the other hand, may limit credit formation, potentially decreasing economic activity. In summary, the money supply is a critical component in determining the success of monetary policy, as it influences inflation and output growth	
Nominal Effective exchange rate	A measure of the currency value against a weighted average of foreign currencies.	the nominal effective exchange rate is a key variable in assessing monetary policy's	Bank of Botswana website

		effectiveness in achieving both price stability and output growth. Changes in the NEER can have an influence on inflation and output by influencing import prices, export competitiveness, trade balances, and the transmission of monetary policy. When measuring the overall efficiency of monetary policy, the literature frequently makes use of the dynamic interplay between the exchange rate and other macroeconomic factors.	

TABLE 3

Y- Variable	**X-variable**	**P > Chi2**
Mining GDP	Bankrate	0.9245
Mining GDP	Diamond Prices	0.6314
Mining GDP	NEER	0.6689

Mining GDP	M2	0.6612
Mining GDP	Non-mining GDP	0.4953
Mining GDP	Inflation	0.8954

Table 4

Y- Variable	**X-variable**	**P > Chi2**
Bankrate	Mining GDP	0.5896
Bankrate	Diamond Prices	0.7321
Bankrate	NEER	0.4321
Bankrate	M2	0.1654
Bankrate	Non-mining GDP	0.6958
Bankrate	Inflation	0.6423