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Analysing the Effectiveness of Monetary Transmission Mechanism in Mozambique: A VAR Model Approach

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Abstract

This study analyses the effectiveness of monetary transmission mechanism in Mozambique spanning from January 2008 to December 2022, employing a Vector Autoregressive (VAR) model. The analysis focuses on Gross Domestic Product (GDP) and inflation, exploring how these variables respond to changes in monetary policy. The study's findings underscore a negligible impact of monetary transmission channel variables on GDP. In terms of inflation, the study identifies the existence of interest rate, money, and exchange channel, while credit channel exhibit negligible effect. Variance decomposition and impulse response analysis confirm the transitory nature of monetary shocks on GDP and the comparatively stronger influence on inflation.

Keywords: monetary policy, monetary transmission channel, GDP, and inflation

1. Introduction

Monetary policy constitutes an important instrument for conducting economic activity available to authorities and has remained a focal point of discussion for both academic and policymaking circles for decades. It's intricately associated with a set of monetary transmission mechanisms that influences economic activity.

Monetary policy in Mozambique is guided by ultimate objectives established in the Government's economic policy. Notably, it emphasizes stability in general price levels and gross domestic product (GDP) growth as primary goals. To conduct these policies effectively, the Bank of Mozambique uses tools called monetary policy instruments, with the aim of achieving its main objective of preserving the value of the national currency.

The Monetary transmission mechanism, as elucidated by Mishkin (2004), encompass the diverse channel through which monetary policy influences the economy. Therefore, this research seeks to contribute to the discourse on the effectiveness of monetary policy transmission channels in Mozambique, specifically by analysing their effects on GDP and inflation.

Most research has emphasized the importance of understanding how monetary policy affects GDP and inflation. However, existing studies have shown inconsistent findings and research focusing specifically on Mozambique's economy has been limited. Therefore, this study seeks to address this gap by analysing monetary transmission mechanisms in Mozambique and their implications for GDP and inflation this study also aspires not only to contribute to the academic discourse but also empower policymakers, businesses, and investors, by providing insights into potential vulnerabilities or opportunities linked to change in monetary policy and their impacts on key economic indicators.

The paper's stricture is outlined as follows. In Section 2, we provide a comprehensive review of the previous research. In Section 3, we introduce our proposed model using a vector autoregressive (VAR) approach. Moving to section 4, we expand upon established VAR model to analyse the monetary transmission channels in Mozambique, assessing our findings. And finally in section 5 there is conclusion.

2. Literature Review

Monetary policy plays an important role in economic outcomes through various transmission channels. Several empirical studies have delved into the intricate mechanisms through which monetary policies affect real economic variables across different countries.

To examine the existence of credit channel in Portugal from 1990 to 1997, Farinha and Marques (2002) have

employed Pooled OLS, the regression outcome confirmed the existence of credit channel in Portugal monetary transmission mechanism, especially for less capitalized banks, while size and liquidity seemed less relevant in affecting credit. This counterintuitive result was due to the fact that, at the beginning of the sample period Portuguese banks had a high liquidity ratio due to the existence of credit limits and mandatory minimum public debt holding ratios.

In contrast, Alam and Waheed (2006) explored the monetary transmission mechanism in Pakistan economy at a sectoral level from 1973.1 to 2003.4, to achieve its objective VAR Model were employed. The result revealed that sector such as manufacturing, wholesale and retail trade and finance and insurance were more sensitive to interest shock than sector like agriculture, mining and quarrying, construction and ownership of dwelling were insensitive to shocks on interest rate.

Al-Mashat and Billmeier (2007) focuses in analysing Egypt's monetary transmission channel, by employing VAR models, result indicated a weak credit and asset pricing channel, while the exchange rate channel playing a dominant role in transmitting monetary shocks to output and prices. The study also highlighted that interest rate channel straightened after the introduction of interest corridor in 2005, a mode directed towards adopting an inflation targeting framework.

Hung and Pfau (2009) analysed the monetary transmission mechanism in Vietnam, using the vector autoregression approach (VAR). Their focus was on the relationships between money, real output, price level, real interest rate, real exchange rate and credit. The result displayed strong link between money supply and real output. Surprisingly, the connection between money and inflation is less clear in the Vietnam case. As for the interest rate channel result suggest that there is limited role in Vietnam economy compared to exchange rate and credit channel which plays a more significant role. This is due the increased capital inflow and accumulating of foreign exchange reserve which pushes additional liquidity in banking system at the given period.

Aleem (2010) examined credit, asset pricing and exchange rate channel in India, applied VAR model, finding suggest importance of credit channel in influencing GDP and prices, as its depicts a decline in GDP and prices following a positive call for money rate, highlighting the impact of credit in the economy, on the contrary, asset price and exchange rate appear less influential due to underdeveloped capital market and frequent intervention of central bank.

Wulandari (2012) assesses the role of the credit and interest rate channels in managing inflation and contributing to economic growth in Indonesia, for this purpose structural VAR model were employed and result elucidated irrelevance of interest rate on output level, suggesting restrained investment growth despite lower interest rate. In contrast, credit channel proved relevant in affecting output level. For inflation, contrary to impact on output level, interest rate channel played more significant role compared to the credit channel in maintaining price stability.

On contrast to previous studies Mishra, Montiel, and Spinilibergo (2012) reviews the monetary transmission channel in low – income countries compared to advance and emerging market. The study emphasizes the impact of financial market structure on monetary transmission mechanism, weak financial market limit securities market and increase cost of bank lending to private firm. Bank with high excess reserves tend to invest domestically in public bonds or foreign bonds due to the financial system's inefficiencies, imperfect competition, impairing traditional monetary transmission channels, interest rate, bank lending and asset pricing channel. Additionally, evidence suggest that exchange rate channel may be operative in some low-income countries but in other countries it result could not support its effectiveness. So basically, standard transmission channel tends to be weak, unreliable, and poorly understood in low-income countries.

Kelikume (2014) have investigated interest rate channel of monetary transmission mechanism in Nigeria from 1996-2013, employed cointegration test, in the long run Interest rates had the expected sign and was statistically significant in influencing output, showing a negative relation, that is an increase in interest rate will reduce output.

Abrita et al. (2014) delved into credit channel in Brazil from 2011 to 2014, employed VEC model, their research supported the efficiency of credit channel, stressing the intensified negative effect of the real interest rate shocks on output, when loan is incorporated in the model.

Ogbonna and Uma (2015) examines the monetary transmission mechanism in Nigeria and its challenge over the years. Similarly, to Mishra, Montiel and Spinilibergo (2012) they also conducted a comprehensive literature review. The empirical reviews from studies show that interest rate, credit and exchange rate channels are among the channel of monetary policy transmission to the economy. Based on different period, one channel become more predominant than the others, like in some studies Interest rate channel proved to be effective in sector like

agriculture and manufacturing while exchange rate found effective in building, construction, mining, wholesale, and service sectors, but in other study found that credit channel more effective. Overall, it's a mix result based on different period, which indicate how volatile is the economy.

Nyumuah (2018) explored monetary transmission mechanism in Ghana, analysing different channel like money supply, exchange rate, credit, and interest rate channel, employed VAR model. The study reveals the strength of the money supply channel in the long run and the influence of the exchange rate in the short run, nevertheless, result also indicated that the interest rate, credit channel acted as weak channels for monetary transmission, mirroring the outcomes of the preceding studies.

Tapşın (2019) focused on studying transmission mechanism of monetary policy in Turkey from 1995 to 2018, different from previous studies Tapşın (2019) employed Toda – Yamamoto Causality Test, the finding highlighted a causal relationship from money supply, interest rate and the foreign exchange to inflation in the short run. On other hand, no causality relation was identified from the Credits and Industrial Production Index to Inflation variable.

Okur, Akkus, and Durmaz (2019) in their study investigated on which channels the monetary transmission mechanism works effectively. In this context, quarterly data for 2005-2017 were used and analysed by the VAR method. The obtained results indicate that the credit and exchange rate channel play an important role in transmission mechanism while impact of reserves (cenral bank foreign exchange reserve) is low compared with other variables. Considering inflation, result revealed that loan and reserve play dominant role while exchange rate and loan have a more dominant role on GDP.

Macane and Seixas (2021) examined monetary transmission channel in Mozambique, focusing primally on the credit channel from 2008 to 2019. Employing Vector Autoregressive Model (VAR) verified inefficiency in credit channel, particularly limited impact of the reference rate on real economic variable such as GDP and inflation.

Tas and Yilmaz (2022) investigated the efficacy of the interest rate channel in developing countries from 1995 to 2021. Diverging from previous studies, they employed a panel VAR model using annual data. The study unveiledthat while interest rates exerted a weak and negative influence on GDP in the short term, their impact turned positive after the sixth year, in the long run. Regarding inflation, the findings showed that interest rate shocks initially positively affected inflation in the first two years but turned negative in subsequent years. Furthermore, the study found that interest rate shocks had no statistically significant impact on loans.

Jackson et al. (2023) analysed the effectiveness of the intereste rate channel to domestic price level in Sierra Leone, VAR Model were employed to examine monetary policy rate on lending and domestic price levels. the study revealed that while the monetary policy rating effectively impacts to the lending rate through the lending facility and interbank rate, the lending rate channel does not effectively transmit to other variables such as credit to the private sector, money supply, exchange rate, and consumer price index.

This research highlight how intricate and varying impacts of monetary policy channels is across countries, it reveals disparities in channel effectiveness, emphasizing credit, interest rate and exchange rare impact in different economies. Some studies results emphasise credit channel inefficiency, Macane and Seixas (2021), while others underscore its significance, like Abrita et al. (2014). In single economy one channel proved efficient in affecting output but inefficient in affecting prices, or one channel doesn't affect all sector of economy. These findings underscore multifaceted dynamics influencing economic across regions also cited factor contributing to weak channel in developing countries as mentioned by Ishioro (2013) and Nedkwu (1993) and (1990) as cited in Ogbonna and Uma (2015) and Mishra, Montiel, and Spinilibergo (2012). These include inefficient financial system, notably the near absence of a capital market which increases cost of bank lending to private firm, government interference which intertwine monetary to fiscal policy, monetary policy was used to support fiscal operation, unachievable central bank independence, and prevailing uncertainty in the economies.

3. Methodology

The main objective of the research is to investigate the effectiveness of monetary policy within the Mozambican economy by analysing how real variables, such as gross domestic product and inflation, respond to changes in the primary instruments of monetary policy between 2008.1 and 2022.12. To achieve this goal, various econometric tests were employed. Firstly, the stationarity of the variables was examined using the Augmented Dickey-Fuller (ADF) tests. Following this, the optimal number of lags was determined, and subsequently, an analysis of variance variation and impulse response functions was conducted.

3.1 Data

The data for the variables under study spans from January 2008 to December 2022. Sourcing from the National

Statistics Institute (INE) and the Central Bank of Mozambique, monthly data were be collected for inflation, interest rate, exchange rate, money supply and loan and for gross domestic products, consumption, government spending, and investment annal data were collected which were transformed in monthly. Additionally, variables not initially in percentage form will undergo transformation into natural logarithms for consistency and analytical purposes.

In this study, we focused on different indicators for each transmission channel. For the interest rate channel, we considered the Policy Rate the Permanent Facility Lending Rate (FPC) which is applied to liquidity lending operations by the Bank of Mozambique to banks facing temporary liquidity deficits that access the window voluntarily. (Banco de Mocambique) and T-bills rate. The credit channel has assessed private and public loans. The money channel has been represented by M3. Lastly, the exchange rate channel is examined using exchange rates for MZM/Rand and MZM/USD.

Table 1. Variable descriptions

Variable	Description
GDP	Gross Domestic Product
IPC	Consumer Price Index
CONS	Consumption
GOV	Government spending
INV	Investment
TBILLS	Treasury bill rate for 364 days
INTEREST	FPC
PRIVATE_LOAN	Private Loan
PUCR	Public Lona
MONEY	M3
RAND	Exchange rate (MZM/RAND)
USD	Exchange rate (MZM/USD)

The econometric model required the inclusion of the following variables: interest rates, money supply, exchange rates, consumer price index, gross domestic product, credit to the economy, government spending, private consumption, and investment as evident from table 1.

3.2 VAR Model

Economic models intricately capture the interplay among key variables. However, expressing such analyses becomes challenging due to the limitations of diverse models. To address this, the Vector Autoregressive (VAR) model emerges as a pivotal solution, extensively employed to navigate the complexities inherent in understanding the relationships between these variables.

As outlined by Gujarate (2003) the VAR model shares similarities with simultaneous equation modelling, necessitating the simultaneous consideration of multiple endogenous variables. Each endogenous variable is elucidated by its own lagged values and the lagged values of other endogenous variables within the model. Notably, the model typically lacks exogenous variables.

The VAR methodology emerges as a solution to challenges posed by traditional economic models. Its virtues include the elimination of the distinction between endogenous and exogenous variables, as all variables in VAR are considered endogenous. Additionally, the simplicity of the methodology allows for the application of the standard Ordinary Least Squares (OLS) method to each case independently. Moreover, VAR liberates analysts from the need to adhere strictly to underlying economic theories, focusing instead on variable selection as a primary concern.

The VAR methodology has gained widespread acceptance in the examination of monetary policy transmission, offering consistent empirical findings. A review of the literature reveals its recurrent application by researchers such as Alam and Waheed (2006), Aleem (2010), Abrita et al. (2014), Kelikume (2014), Nyumuah (2018), Okur, Akkus, and Durmaz (2019) and Macane and Seixas (2021) attesting to its reliability and effectiveness in unravelling the complexities of monetary dynamics across diverse economic contexts.

3.3 Variance Decomposition and Impulse Response Function

The exploration of a VAR model entails a thorough analysis through two key methodologies: Variance

Decomposition (VDC) and Impulse Response Function (IRF). VDC elucidates the distribution of projected error variance, discerning the contributions from innovations' effects on the same variable and their influence on other variables. This process offers valuable insights into the relative importance of internal and interconnected factors shaping the variability in the system. Simultaneously, IRF analysis unveils the dynamic responses of variables to innovations, portraying how each variable reacts to a one-standard-error unit impact in the context of others, Lütkepohl (2005).

4. Result

In this section, we rigorously assess the efficacy of Mozambique's monetary policy from 2008.1 to 2022.12. Initial scrutiny involves the Augmented Dickey–Fuller test to establish variable stationarity, determining optimal lags. Subsequently, employing the Granger Causality test and Block Exogeneity Wald Test, we explore causal relationships among monetary variables and economic indicators. Additionally, the Rots Characteristics Polynomial test enriches our analysis, and finally analysis of variance variation and impulse response functions elucidates real variable responses to policy changes, unveiling nuanced connections between policy instruments and economic responses, contributing significantly to our understanding of monetary policy dynamics.

4.1 Stationarity Test

The table below (Table 2) report Augmented Dickey-Fuller (ADF) statistics for various variables at different orders of integration. The ADF test is commonly used to determine the stationarity of a time series variable. Tested all variable, result highlights that every variable are stationary at order one, besides Government expenditure and Private loan, which are i(2) and I(0), respectively.

Table 2. ADF test

Variable	Order	ADF statistics	Critical value 5%	P value	Stationarity
GDP	I(0)	-1.091395	-2.877823	0.7189	Not stationary
	I(1)	-3.432065	-2.877823	0.0111	Stationary
IPC	**I(0)**	**-1.457911**	**-2.877544**	**0.5527**	**Not stationary**
	I(1)	**-13.57119**	**-2/877636**	**0.0000**	**Stationary**
CONS	I(0)	0.061674	-2.878829	0.9619	Not stationary
	I(1)	-4.004999	-2.878829	0.0018	Stationary
GOV	**I(0)**	**-2.669133**	**-2.878829**	**0.0816**	**Not stationary**
	I(1)	**-1.638590**	**-2.878937**	**0.4606**	**Not stationary**
	I(2)	**-5.224808**	**-2.878937**	**0.0000**	**Stationary**
INV	**I(0)**	**-2.457831**	**-2.878829**	**0.1278**	**Not stationary**
	I(1)	**-3.017498**	**-2.878937**	**0.0353**	**Stationary**
INTEREST	I(0)	-2.000080	-2.877999	0.2867	Not stationary
	I(1)	-3.922758	-2.877919	0.0023	Stationary
TBILLS	**I(0)**	**-1.505232**	**-2.877544**	**0.5289**	**Not stationary**
	I(1)	**-11.76497**	**-2.877636**	**0.0000**	**Stationary**
PRIVATE_LOAN	**I(0)**	**-4.545239**	**-2.877544**	**0.0002**	**Stationary**
PUCR	I(0)	-0.198343	-2.877544	0.9353	Not stationary
	I(1)	-14.42209	-2.877636	0.0000	Stationary
MONEY	I(0)	-2.782271	-2.877544	0.0628	Not stationary
	I(1)	-12.19229	-2.877836	0.0000	Stationary
RAND	**I(0)**	**-2.343650**	**-2.877636**	**0.1596**	**Not stationary**
	I(1)	**-9.671027**	**-2.877636**	**0.0000**	**Stationary**
USD	I(0)	-1.129875	-2.877636	0.7069	Not stationary
	I(1)	-8.762923	-2.877636	0.0000	Stationary

The orders of integration at which the variables become stationary are crucial for further analysis, especially when employing models like VAR that often assume stationarity. Variables need differencing (I(1), I(2)) to achieve stationarity and meet the assumptions of the model. So, variable that are stationary at order one, was differencing once, and at order 2, was differentiated twice.

4.2 Causality Test

The Granger Causality test, outlined in Table A1 within the appendix, provides valuable insights into the

correlations between monetary variables and economic indicators. The test highlights the absence of causality between the wider range of monetary transmission variables (interest rate, T-bills rate, money supply, exchange rate and loan) and GDP implies that none of the monetary transmission channel notably trigger changes in GDP. This suggests that direct causal relationships between these factors and the overall performance of the economy is negligible or limited.

This result resonates with studies such as Macane and Seixas (2021) in Mozambique and Nyumuah (2018) in Ghana, where the limited impacts of monetary transmission channels on GDP were observed.

The results also reveal a causal relation between inflation and interest rate adjustments (interest rate channel), suggesting the central bank's response to inflationary pressures. These findings support the conventional use of interest rates as a tool for managing inflation within monetary policy frameworks, as Central Bank of Mozambique is shifting toward Inflation Targeting. The connection between inflation and interest rates implies that changes in one factor prompt adjustments in the other, offering insights into how the central bank regulates inflation through interest rate alterations.

The test also reveals specific causal relationships between interest rate and T bills rate could cause changes in private investment. This implies that change in borrowing cost may play a predictive role in business decision to invest.

Furthermore, the test results have pointed out a causal relationship between the behaviour of the USD (United States Dollar), exchange rate channel, and various economic factors such as interest rates, inflation, consumption, and private loans, as its p value is less than 5% which suggest the association between the USD and these variables is unlikely to be a random occurrence.

This causality implies that fluctuations or changes in the USD might have a discernible impact on interest rates, inflation levels, consumption patterns, and the availability of private loans in the economy. For instance, a stronger or weaker USD could influence borrowing costs, affecting interest rates. Additionally, changes in the exchange rate might impact the costs of imported goods, thereby affecting inflation rates. It might also influence consumers' purchasing power and spending behaviour.

The logic behind exchange rates Granger causing interest rates could be explained through economic mechanisms. Changes in exchange rates might influence a country's interest rates, and one contributing factor is inflation expectations. this is particularly relevant for Mozambican economy given its status as an importing economy, its Net Export Deficit have grown 737% from 2002 to 2022 (INE, 2023). Any shock in exchange rate affects inflation expectation. If a currency depreciates, it led to higher import costs, potentially causing inflation. In response to such inflationary pressure central bank respond by adjusting its interest rate.

The Block Exogeneity Wald Test, found in Table A2 in the appendix, indicates that inflation lacks significance concerning GDP, mirroring the results seen in the previous Granger causality test. Similarly, none of the monetary transmission channel variables show statistical significance. This alignment with the prior Granger causality test implies a consistency in the lack of explanatory power of these variables concerning GDP, which is in concordance with Keynesian views.

The findings reinforce a strong causality between interest rates and T-bill rates affecting inflation, demonstrating their considerable predictive power over changes in inflation levels. Meanwhile, consumption, government spending, and USD exhibit moderate statistical significance, indicating potential associations with inflation. These results align with the earlier Granger causality test, affirming the influential role of interest rates and T-bill rates on inflation, while suggesting possible connections of consumption, government expenditure, and USD with inflation dynamics.

The outcomes revealed a significant causality between the USD and consumption, denoting the USD's substantial influence on changes in consumption patterns. Additionally, government expenditure and T-bills demonstrated moderate statistical significance, implying potential connections with consumption trends. These results suggest that the USD has a noteworthy predictive impact on consumption behaviour, while also indicating plausible relationships between government expenditure, T-bills, and consumption patterns, reflecting potential influences of these factors on consumer behaviour.

The findings also indicate a noteworthy causality between T-bills and investment, signifying that T-bill rate variations considerably influence investment decisions. Moreover, inflation, USD, and government expenditure displayed moderate statistical significance, hinting at potential associations with investment patterns. This implies that T-bill rates possess a substantial predictive power over investment choices, while also suggesting plausible connections between inflation, USD, government expenditure, and investment trends.

Both test highlights causality between monetary transmission channel variable with inflation and a limited causation between theses variable with GDP, implying that central bank responds to inflationary pressure by adjusting its interest rate, aligning with conventional monetary policy strategies. This observation suggests that Mozambique's monetary policy is focused towards minimizing volatility in prices. By maintaining stability in prices, the aim is to establish a favourable environment for economic output.

4.3 Lag Length Criteria

To conduct a robust analysis of the monetary transmission channels, its crucial to determine the appropriate lag length, as it impact the accuracy and reliability of the results. By employing lag length criteria, we aim to enhance the precision of our analysis and ensure that the identified monetary transmission channels are robust and well-supported by the data. Table 3 presents the results of lag selection criteria for the Vector Autoregressive (VAR) model, providing insights into the optimal lag order for the endogenous variables.

Table 3. Lag selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	3588.624	NA	3.62e-33	-40.64346	-40.42729	-40.55578
1	4437.528	1572.401	1.21e-36	-48.65372	-45.84352*	-47.51392*
2	4662.457	385.9588*	4.91e-37*	-49.57338*	-44.16915	-47.38145

* Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

For the VAR model, we have implemented a lag order of 2 based on the results presented above. This decision was informed by the lag selection criteria, with the Akaike Information Criterion (AIC) suggesting that a lag order of 2 is appropriate, which is aligned with the sequential modified likelihood ratio (LR) test, and final prediction error (FPE). By incorporating two lagged values of each variable in our model equation, we aim to capture the temporal dependencies and better represent the dynamic relationships between the variables over time.

4.4 Rots of Characteristics Polynomial

The roots of the characteristic polynomial in a Vector Autoregressive (VAR) model are essential eigenvalues indicating the system's stability. Their position relative to the unit circle informs about the persistence and behaviour of shocks in the VAR model, aiding in the assessment of its overall dynamics and predictive capabilities.

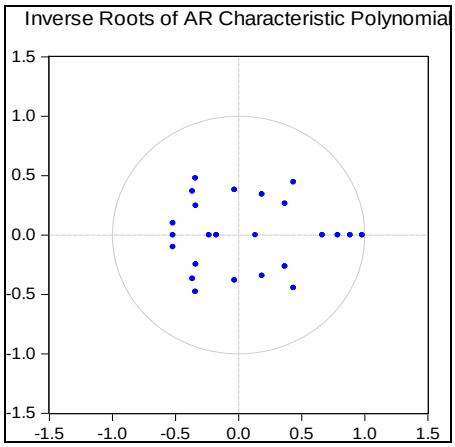

Figure 1. Inverse roots of AR characteristics polynomial

At roots of the characteristic polynomial, the unit circle is a circle with a radius of 1, centred at the origin in a coordinate plane. If the roots are within this circle, it signifies stable system. And as depicted at figure 1, all the

roots are inside the circle, which indicates that shocks or disturbances introduced into the system will not grow uncontrollably over time; instead, their effects will diminish. This is essential for the reliability of the VAR model, ensuring that it provides meaningful and predictable insights into the behaviour of the variables it encompasses. Essentially, the location of the roots inside the unit circle signifies a well-behaved and stable dynamic system.

4.5 Variance Decomposition

Variance decomposition is a statistical method that dissects the overall variability in an economic variable into specific factors, unveiling the contributions of individual elements to fluctuations observed in the variable over time.

For GDP, as illustrated in table 4, in Period 1, the variance decomposition indicates that GDP entirely explains its own variations, signifying that fluctuations observed in GDP during this period are solely caused by internal factors or its own dynamics. Notably, monetary transmission channel variables such as interest rates, exchange rates, private loans, public loan and money supply are insignificant throughout the observed periods. This suggests an inefficiency in the monetary channel directly affecting GDP fluctuations.

Conversely, the composition of GDP variance attributed to other factors gradually increases from 0.47% at the outset (Period 2) to 5.25% by the tenth period for consumption, 0.02% to 1.89% for money supply, while other variables have almost negligible impact on GDP, underscoring the minimal impact of money channel on GDP over time.

Table 4. Variance decomposition of GDP

Period	S.E.	GDP	IPC	CONS	GOV	INTEREST
1	0.003178	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.003439	96.17881	0.000632	0.470707	0.095582	0.697207
3	0.003762	93.32397	0.039862	1.278542	0.212009	0.747320
4	0.003904	92.03865	0.041623	1.879505	0.196883	0.880410
5	0.004018	90.90764	0.039782	2.717610	0.238842	0.982576
6	0.004097	89.97425	0.038290	3.413736	0.232173	1.004382
7	0.004153	89.37718	0.037327	3.974686	0.230404	1.018711
8	0.004196	88.79388	0.036575	4.501276	0.229039	1.024785
9	0.004227	88.37239	0.036060	4.906087	0.228931	1.027739
10	0.004251	88.00266	0.035667	5.254362	0.228347	1.032300

INV	MONEY	PRIVATE_LOAN	PUCR	RAND	TBILL	USD
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.011320	0.015234	0.054774	1.420780	0.220227	0.244105	0.590626
0.116915	1.344329	0.109537	1.270279	0.189621	0.388293	0.979328
0.116116	1.558615	0.284708	1.356147	0.180446	0.403805	1.063089
0.147707	1.660272	0.310373	1.291695	0.172810	0.417570	1.113121
0.147785	1.797755	0.387154	1.316166	0.167622	0.402806	1.117881
0.155227	1.827323	0.416272	1.301390	0.163747	0.392268	1.105464
0.152503	1.868038	0.441313	1.308653	0.164571	0.386736	1.092632
0.151221	1.881817	0.457632	1.308032	0.163876	0.386713	1.079501
0.149636	1.890082	0.467500	1.311987	0.165434	0.393031	1.068993

This observation implies that beyond the explicit monetary variables analysed, there exist additional unidentified elements that gradually play a more substantial role in shaping GDP fluctuations.

Table 5 illustrate the variance decomposition of the IPC in different periods. In Period 1, result shows that IPC is explained by its own variation for nearly 99.34%, indicating a dominant self-explanatory nature. Conversely, the influence or contributions from other variables are minimal during this period, emphasizing the IPC's self-determining nature in explaining its fluctuations.

As time progresses from Periods 2 to 10, there is an observable change in the variance decomposition of IPC. Results show growing influence of interest rate and money channel. Specifically, the results highlight the significant role of interest rates, explaining approximately 27.14% of the variations observed in IPC, t bills 25%

and money supply around 4%. This suggest that monetary policy decision, especially regarding interest rate and t bills, are increasingly geared towards controlling IPC.

The result also underscores a weak exchange rate channel over the periods. Results highlight the impact of USD (1.53%) and RAND (1.11%) on inflation, signalling a minimal role of external factors in explaining inflation fluctuations over time, which suggest a scenario of importing inflation, emphasizing some relevance of global economic conditions in shaping local inflation dynamics.

Table 5. Variance decomposition of IPC

Period	S.E.	GDP	IPC	CONS	GOV	INTEREST
1	0.016715	0.661904	99.33810	0.000000	0.000000	0.000000
2	0.017788	1.260712	87.88279	1.232353	0.109660	5.830706
3	0.028036	1.160031	36.49441	1.209664	0.244523	29.04366
4	0.028755	1.666371	35.04619	1.224958	0.232611	28.20307
5	0.029151	1.626308	34.22287	1.370882	0.436313	27.52039
6	0.029287	1.613108	33.90614	1.382707	0.634606	27.29595
7	0.029402	1.659476	33.64453	1.381059	0.640288	27.18638
8	0.029424	1.668622	33.60149	1.394334	0.645165	27.16633
9	0.029433	1.684173	33.58407	1.407821	0.658836	27.14972
10	0.029435	1.686777	33.57917	1.412142	0.659070	27.14729

INV	MONEY	PRIVATE_LOAN	PUCR	RAND	TBILL	USD
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.135401	0.177506	0.392918	1.010296	0.130569	0.722766	1.114325
1.701049	1.077921	0.315858	0.525621	0.934895	26.62015	0.672224
1.908206	3.768108	0.350730	0.508411	0.890911	25.39027	0.810162
2.303640	3.952532	0.461782	0.723443	0.870248	24.96554	1.546053
2.556048	3.928160	0.511190	0.731892	1.112268	24.78851	1.539418
2.640343	3.974197	0.507475	0.769646	1.104409	24.95941	1.532778
2.673811	4.003240	0.510508	0.768519	1.110808	24.92594	1.531228
2.673724	4.002197	0.510388	0.773831	1.110447	24.91107	1.533729
2.675704	4.002252	0.510810	0.773863	1.111868	24.90752	1.533544

Additionally, the relatively subdued impact of the exchange rate on CPI, albeit still contributing, could reflect the secondary role of exchange rate adjustments in an inflation targeting regime. While changes in exchange rates influence import prices and, subsequently, consumer prices, they may be managed differently within an inflation targeting framework, where direct focus on interest rates and money supply prevails in controlling inflation.

4.6 Impulse Response Curve

The impulse response curve besides examines statistical patterns it also discerns their alignment with economic theory. The observed response of GDP and inflation on shocks on variables like interest rates, exchange rates, money supply, T-bills rate, public and private loans, are not only not integral to understand their dynamics but also carry a significant implication for monetary policy in Mozambique.

In the analysis of the shocks in variable like interest rate, exchange rate, money supply, t bills rate and private loan on GDP, a consistent pattern emerges. Each monetary variable displays a minimal immediate impact, characterized by a slight initial deviation from zero, followed by a rapid convergence back towards zero in subsequent periods as shown Figure 2.

This uniform pattern indicates a transitory and negligible effect of monetary shocks across these variables, suggesting a brief and fleeting influence that fades swiftly over time. The result aligns with the outcomes of both the variance decomposition and causality test, revealing that none of the variables granger cause GDP.

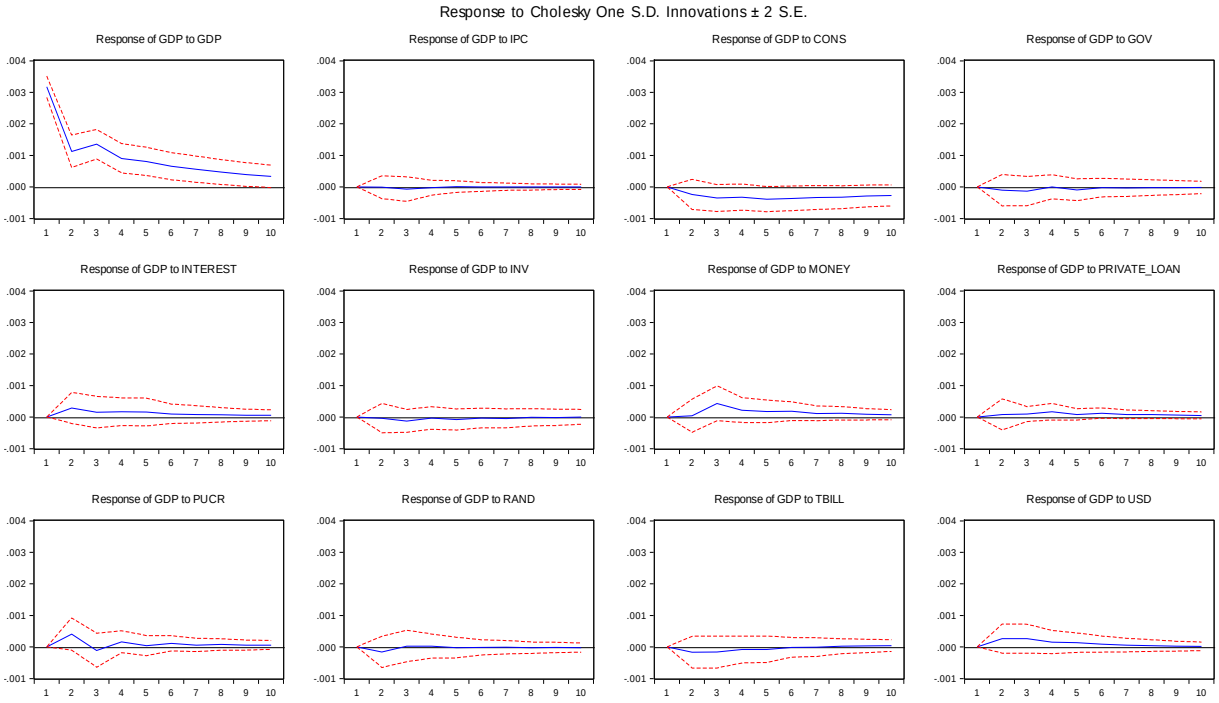

Figure 2. GDP impulse response function

As for IPC, Figure 3 impulse response function indicates that a one-standard-deviation shock in interest rates significantly affects inflation. Initially, there's an increase in the first period, signifying an immediate impact on inflation. However, from third to sixth period, this trajectory shifts downward, becoming negative, suggesting a subsequent decrease in inflation. Subsequently, inflation stabilizes, oscillating around zero in later periods. This pattern reflects an initial inflationary impact followed by a subsequent deflationary effect, eventually leading to a stabilization of inflation within the analysed timeframe, the deflationary effect may cause because an increase in interest rate could impact consumption and investment, people and companies start adjusting to higher borrowing expenses.

The impulse response analysis demonstrates that a one-standard-deviation shock in T-bills rate initially impacts inflation positively for the first two periods. However, by the third period, this effect shifts to a negative trend, continuing until the fourth period. Subsequently, inflation stabilizes. This pattern is in accordance with the effect of interest rate, the impact of interest rate channel is verified in the short-term.

Analysing money channel, the impulse response analysis demonstrates that a one-standard-deviation shock in money supply significantly affects inflation. Initially, there is an immediate increase in the first period, indicating an immediate inflationary impact due to the shock. Subsequently, starting from the fourth period, the trajectory begins to decline, albeit remaining positive, signifying a diminishing effect on inflation. By the sixth period, inflation stabilizes, oscillating with minor fluctuations.

The impulse response analysis reveals that a one-standard-deviation shock in private loans has a minimal effect on inflation. The line depicting the response remains close to zero throughout, indicating a negligible impact.

And regarding exchange rate, the impulse response analysis indicates that a one-standard-deviation shock in the exchange rates (Meticais/Rand and USD) has a minimal effect on inflation.

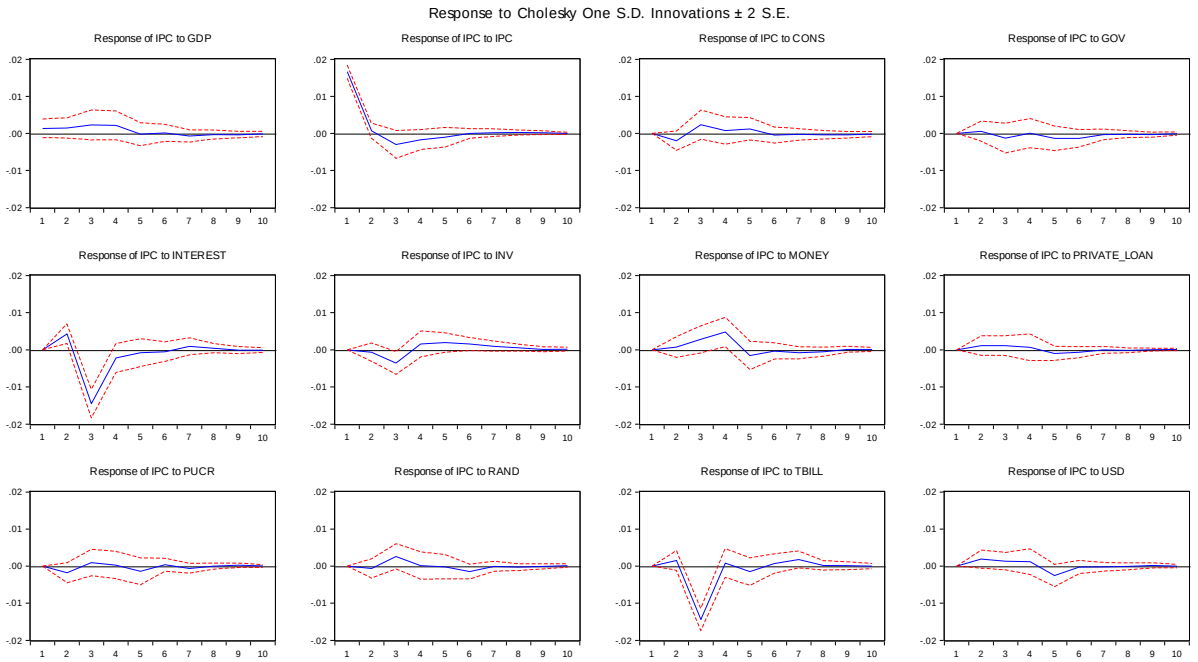

Figure 3. IPC impulse response function

The impulse response analysis depicts that monetary variable like interest rates, money supply, T-bills rate have some impact on inflation while private loans, and exchange rates (Meticais/Rand and USD) exhibit minimal effects on inflation within the observed timeframe. Despite initial fluctuations, each shock leads to a negligible and short-lived impact, as evidenced by rapid convergence back to zero in subsequent periods for all variables. Based on this analysis, an inflation targeting system in Mozambique might be advantageous due to the transitory impact of monetary shocks on inflation.

Both analyses, variance decomposition and impulse response, complement each other that is monetary policy channels exert a limited impact on Gross Domestic Product (GDP) but affect the Consumer Price Index (CPI). This underscores the central bank's commitment to its mission of price stabilization, evident in the increasing emphasis on inflation targeting in recent years. Prioritizing price stability aims to foster a favourable environment for sustained economic growth by mitigating uncertainties associated with inflation,

Another notable finding from the results is that the interest rate and money channels exhibit the most significant effectiveness in influencing prices, although their impact is still limited. The exchange rate channel also shows some impact, due to the demand for external goods in the Mozambican economy, a perspective supported by studies such as Alam and Waheed (2006), Al-Mashat and Billmeier (2007), Wulandari (2012), and Kelikume (2014)

Contrastingly from Farinha and Marques (2002), Hunf and Pfau (2009), Aleem (2010), Wulandari (2012), Abrita et al. (2014), and Okur, Akkus, and Durmaz (2019) the credit channel appears to have no discernible effect on both GDP and inflation.

Weaknesses in Mozambique's monetary channels can be attributed to an inefficient financial system. According to (BM, 2023) only 31% of the population have access to financial services, indicating lack of financial inclusion. This is further accentuated by the almost non-existent capital market, with only 13 companies coated at the Mozambican Stock Exchange (BVM, 2024). Other concerns arise regarding the questionable independence of the central bank from political influence.

A third factor contributing to the inefficiency of monetary transmission mechanisms is the informal market which implies limited control over economic activity and consequently disrupt monetary transmission. The informal markets complicate the effectiveness of monetary policy in reaching and impacting the broader economy.

These factors collectively contribute to the challenges faced by the monetary transmission mechanism in Mozambique, limiting its effectiveness in influencing economic variables. Addressing these issues may be essential for strengthening the monetary channels and establishing a more robust and responsive financial framework in the country.

5. Conclusion

In the comprehensive analysis of Mozambique's monetary policy transmission channels from 2008.1 to 2022.12, key insights into the effectiveness of the system emerge. The stability of the system, as indicated by the roots of the characteristic polynomial within the unit circle, assures the reliability of the Vector Autoregressive (VAR) model in capturing the intricate dynamics of economic variables. The Granger Causality test unveils a limited direct impact of monetary variables on Gross Domestic Product (GDP), emphasizing the central bank's predominant focus on ensuring price stability.

The variance decomposition analysis sheds light on the evolving role of interest rates, Treasury bills (T-bills), and money supply in influencing inflation over time. Notably, the results align with the objectives of an inflation targeting framework, revealing a growing impact of these monetary instruments on inflation. Interest rates play a substantial role, explaining around 27.14% of inflation variations, followed by T-bills at 25% and money supply at approximately 4%. This underscores the central bank's commitment to controlling inflation and maintaining a stable price environment.

The impulse response functions provide further nuance, illustrating the transitory and short-lived effects of monetary shocks on various economic variables. This pattern supports the efficacy of an inflation targeting system in Mozambique, where monetary policy decisions aim at achieving price stability with minimal and temporary disruptions to other economic indicators.

However, challenges are evident in Mozambique's monetary channels, linked to an inefficient financial system characterized by the absence of a capital market, questionable central bank independence, and the prevalence of informal markets. These weaknesses limit the effectiveness of the monetary transmission mechanism. Addressing these challenges becomes crucial for fortifying the monetary channels, ensuring a more robust and responsive financial framework that can better contribute to sustained economic growth. In conclusion, Mozambique's monetary policy demonstrates a commitment to inflation targeting, but improvements in the financial system and institutional frameworks are imperative for enhancing the overall effectiveness of monetary channels in the country.

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Appendix A. Eviews Output

Table A1. Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause CONS	177	0.11668	0.8899
CONS does not Granger Cause GDP		2.05496	0.1312
GOV does not Granger Cause CONS	176	0.72894	0.4839
CONS does not Granger Cause GOV		2.51704	0.0837
INTEREST does not Granger Cause CONS	177	0.78695	0.4569
CONS does not Granger Cause INTEREST		2.32800	0.1006
INV does not Granger Cause CONS	177	0.04921	0.9520
CONS does not Granger Cause INV		0.04605	0.9550
IPC does not Granger Cause CONS	177	0.08645	0.9172
CONS does not Granger Cause IPC		0.53998	0.5837
MONEY does not Granger Cause CONS	177	2.89768	0.0578
CONS does not Granger Cause MONEY		0.07744	0.9255
PRIVATE_LOAN does not Granger Cause CONS	177	1.28282	0.2799
CONS does not Granger Cause PRIVATE_LOAN		0.34375	0.7096
PUCR does not Granger Cause CONS	177	1.61049	0.2028
CONS does not Granger Cause PUCR		0.01658	0.9836
RAND does not Granger Cause CONS	177	1.46612	0.2337
CONS does not Granger Cause RAND		2.29607	0.1037
TBILL does not Granger Cause CONS	177	0.14551	0.8647
CONS does not Granger Cause TBILL		1.52981	0.2195
USD does not Granger C2ause CONS	177	3.05254	0.0498
CONS does not Granger Cause USD		0.85035	0.4291

GOV does not Granger Cause GDP	176	0.61240	0.5432
GDP does not Granger Cause GOV		0.57296	0.5649
INTEREST does not Granger Cause GDP	177	0.31889	0.7274
GDP does not Granger Cause INTEREST		2.24419	0.1091
INV does not Granger Cause GDP	177	0.06256	0.9394
GDP does not Granger Cause INV		0.09315	0.9111
IPC does not Granger Cause GDP	177	0.03408	0.9665
GDP does not Granger Cause IPC		0.47439	0.6231
MONEY does not Granger Cause GDP	177	1.56929	0.2112
GDP does not Granger Cause MONEY		0.60112	0.5493
PRIVATE_LOAN does not Granger Cause GDP	177	0.39952	0.6713
GDP does not Granger Cause PRIVATE_LOAN		1.06324	0.3476
PUCR does not Granger Cause GDP	177	2.25492	0.1080
GDP does not Granger Cause PUCR		0.08856	0.9153
RAND does not Granger Cause GDP	177	0.97314	0.3800
GDP does not Granger Cause RAND		1.97878	0.1414
TBILL does not Granger Cause GDP	177	0.04906	0.9521
GDP does not Granger Cause TBILL		1.19803	0.3043
USD does not Granger Cause GDP	177	1.82253	0.1647
GDP does not Granger Cause USD		1.95953	0.1441
INTEREST does not Granger Cause GOV	176	0.76303	0.4678
GOV does not Granger Cause INTEREST		0.99596	0.3715
INV does not Granger Cause GOV	176	0.98315	0.3762
GOV does not Granger Cause INV		0.21280	0.8085
IPC does not Granger Cause GOV	176	0.02311	0.9772
GOV does not Granger Cause IPC		0.00397	0.9960
MONEY does not Granger Cause GOV	176	1.35183	0.2615
GOV does not Granger Cause MONEY		0.20233	0.8170
PRIVATE_LOAN does not Granger Cause GOV	176	1.84766	0.1607
GOV does not Granger Cause PRIVATE_LOAN		0.15246	0.8587
PUCR does not Granger Cause GOV	176	0.48768	0.6149
GOV does not Granger Cause PUCR		0.09160	0.9125
RAND does not Granger Cause GOV	176	2.00096	0.1384
GOV does not Granger Cause RAND		1.26894	0.2838
TBILL does not Granger Cause GOV	176	1.56404	0.2123
GOV does not Granger Cause TBILL		0.21574	0.8062
USD does not Granger Cause GOV	176	1.37148	0.2565
GOV does not Granger Cause USD		0.30759	0.7356
INV does not Granger Cause INTEREST	177	0.55106	0.5774
INTEREST does not Granger Cause INV		7.30056	0.0009
IPC does not Granger Cause INTEREST	177	1.32491	0.2685
INTEREST does not Granger Cause IPC		31.5198	2.E-12
MONEY does not Granger Cause INTEREST	177	0.03486	0.9657
INTEREST does not Granger Cause MONEY		2.23798	0.1098
PRIVATE_LOAN does not Granger Cause INTEREST	177	0.98015	0.3773
INTEREST does not Granger Cause PRIVATE_LOAN		0.13607	0.8729
PUCR does not Granger Cause INTEREST	177	0.06606	0.9361
INTEREST does not Granger Cause PUCR		0.24685	0.7815
RAND does not Granger Cause INTEREST	177	2.51328	0.0840
INTEREST does not Granger Cause RAND		0.39126	0.6768
TBILL does not Granger Cause INTEREST	177	0.85349	0.4277
INTEREST does not Granger Cause TBILL		5.83698	0.0035
USD does not Granger Cause INTEREST	177	4.06122	0.0189
INTEREST does not Granger Cause USD		0.08491	0.9186
IPC does not Granger Cause INV	177	2.35270	0.0982
INV does not Granger Cause IPC		0.59352	0.5535

MONEY does not Granger Cause INV	177	1.80757	0.1672
INV does not Granger Cause MONEY		0.02252	0.9777
PRIVATE_LOAN does not Granger Cause INV	177	0.90864	0.4050
INV does not Granger Cause PRIVATE_LOAN		0.24201	0.7853
PUCR does not Granger Cause INV	177	0.05102	0.9503
INV does not Granger Cause PUCR		0.01448	0.9856
RAND does not Granger Cause INV	177	0.05397	0.9475
INV does not Granger Cause RAND		0.75120	0.4733
TBILL does not Granger Cause INV	177	19.8322	2.E-08
INV does not Granger Cause TBILL		2.32491	0.1009
USD does not Granger Cause INV	177	0.49673	0.6094
INV does not Granger Cause USD		0.70155	0.4972
MONEY does not Granger Cause IPC	177	2.50075	0.0850
IPC does not Granger Cause MONEY		1.06465	0.3471
PRIVATE_LOAN does not Granger Cause IPC	177	1.15328	0.3180
IPC does not Granger Cause PRIVATE_LOAN		0.41512	0.6609
PUCR does not Granger Cause IPC	177	0.88420	0.4149
IPC does not Granger Cause PUCR		0.93518	0.3945
RAND does not Granger Cause IPC	177	1.32827	0.2676
IPC does not Granger Cause RAND		0.45421	0.6357
TBILL does not Granger Cause IPC	177	125.775	2.E-34
IPC does not Granger Cause TBILL		1.78456	0.1710
USD does not Granger Cause IPC	177	4.14370	0.0175
IPC does not Granger Cause USD		0.46082	0.6315
PRIVATE_LOAN does not Granger Cause MONEY	177	3.97538	0.0205
MONEY does not Granger Cause PRIVATE_LOAN		3.16213	0.0448
PUCR does not Granger Cause MONEY	177	0.06338	0.9386
MONEY does not Granger Cause PUCR		0.02149	0.9787
RAND does not Granger Cause MONEY	177	2.45373	0.0890
MONEY does not Granger Cause RAND		0.20488	0.8149
TBILL does not Granger Cause MONEY	177	1.38705	0.2526
MONEY does not Granger Cause TBILL		4.39315	0.0138
USD does not Granger Cause MONEY	177	1.15597	0.3172
MONEY does not Granger Cause USD		0.93592	0.3942
PUCR does not Granger Cause PRIVATE_LOAN	177	0.51719	0.5971
PRIVATE_LOAN does not Granger Cause PUCR		1.79590	0.1691
RAND does not Granger Cause PRIVATE_LOAN	177	1.39235	0.2513
PRIVATE_LOAN does not Granger Cause RAND		0.61759	0.5404
TBILL does not Granger Cause PRIVATE_LOAN	177	0.00698	0.9930
PRIVATE_LOAN does not Granger Cause TBILL		0.42618	0.6537
USD does not Granger Cause PRIVATE_LOAN	177	3.64576	0.0281
PRIVATE_LOAN does not Granger Cause USD		0.32657	0.7218
RAND does not Granger Cause PUCR	177	0.60797	0.5456
PUCR does not Granger Cause RAND		0.70043	0.4978
TBILL does not Granger Cause PUCR	177	0.51887	0.5961
PUCR does not Granger Cause TBILL		0.22800	0.7964
USD does not Granger Cause PUCR	177	0.98955	0.3738
PUCR does not Granger Cause USD		0.85828	0.4257
TBILL does not Granger Cause RAND	177	0.25306	0.7767
RAND does not Granger Cause TBILL		0.90349	0.4071
USD does not Granger Cause RAND	177	0.88919	0.4129
RAND does not Granger Cause USD		1.37393	0.2559
USD does not Granger Cause TBILL	177	4.68804	0.0104
TBILL does not Granger Cause USD		2.53342	0.0823

Table A2. Block Exogeneity Wald Tests

Dependent variable: GDP			
Excluded	Chi-sq	df	Prob.
IPC	0.352564	2	0.8384
CONS	2.949418	2	0.2288
GOV	0.505881	2	0.7765
INTEREST	1.682085	2	0.4313
INV	0.001944	2	0.9990
MONEY	0.121868	2	0.9409
PRIVATE_LOAN	0.559984	2	0.7558
PUCR	3.526340	2	0.1715
RAND	1.640475	2	0.4403
TBILL	0.689598	2	0.7084
USD	2.158526	2	0.3398
All	15.64753	22	0.8330
Dependent variable: IPC			
Excluded	Chi-sq	df	Prob.
GDP	2.158729	2	0.3398
CONS	5.569684	2	0.0617
GOV	7.213507	2	0.0271
INTEREST	10.08924	2	0.0064
INV	4.922888	2	0.0853
MONEY	0.325786	2	0.8497
PRIVATE_LOAN	0.330792	2	0.8476
PUCR	1.982863	2	0.3710
RAND	1.100936	2	0.5767
TBILL	140.8661	2	0.0000
USD	3.156177	2	0.2064
All	316.9723	22	0.0000
Dependent variable: CONS			
Excluded	Chi-sq	df	Prob.
GDP	0.846331	2	0.6550
IPC	0.062432	2	0.9693
GOV	1.667672	2	0.4344
INTEREST	3.835993	2	0.1469
INV	0.637919	2	0.7269
MONEY	1.143503	2	0.5645
PRIVATE_LOAN	5.915784	2	0.0519
PUCR	2.493180	2	0.2875
RAND	2.916035	2	0.2327
TBILL	3.509184	2	0.1730
USD	6.304813	2	0.0427
All	24.47927	22	0.3226
Dependent variable: GOV			
Excluded	Chi-sq	df	Prob.
GDP	0.301596	2	0.8600
IPC	1.901555	2	0.3864
CONS	5.410351	2	0.0669
INTEREST	3.063494	2	0.2162
INV	4.313945	2	0.1157
MONEY	0.574513	2	0.7503
PRIVATE_LOAN	4.549043	2	0.1028
PUCR	1.342488	2	0.5111
RAND	2.410006	2	0.2997
TBILL	1.128631	2	0.5687
USD	3.346185	2	0.1877
All	26.42008	22	0.2341

Dependent variable: INTEREST			
Excluded	Chi-sq	df	Prob.
GDP	1.148005	2	0.5633
IPC	9.141816	2	0.0103
CONS	3.877806	2	0.1439
GOV	5.543886	2	0.0625
INV	10.82350	2	0.0045
MONEY	2.082997	2	0.3529
PRIVATE_LOAN	1.447383	2	0.4850
PUCR	0.468246	2	0.7913
RAND	1.973718	2	0.3727
TBILL	1.409973	2	0.4941
USD	1.991335	2	0.3695
All	37.70831	22	0.0198
Dependent variable: INV			
Excluded	Chi-sq	df	Prob.
GDP	1.860141	2	0.3945
IPC	2.391184	2	0.3025
CONS	0.525592	2	0.7689
GOV	0.077996	2	0.9618
INTEREST	0.259740	2	0.8782
MONEY	1.734969	2	0.4200
PRIVATE_LOAN	2.067437	2	0.3557
PUCR	0.190553	2	0.9091
RAND	3.518235	2	0.1722
TBILL	20.74778	2	0.0000
USD	2.524337	2	0.2830
All	51.20111	22	0.0004
Dependent variable: MONEY			
Excluded	Chi-sq	df	Prob.
GDP	3.516250	2	0.1724
IPC	1.387504	2	0.4997
CONS	1.231835	2	0.5401
GOV	0.353054	2	0.8382
INTEREST	2.018520	2	0.3645
INV	0.015651	2	0.9922
PRIVATE_LOAN	7.479306	2	0.0238
PUCR	0.372134	2	0.8302
RAND	4.402128	2	0.1107
TBILL	0.629738	2	0.7299
USD	2.814146	2	0.2449
All	25.68207	22	0.2656
Dependent variable: PRIVATE_LOAN			
Excluded	Chi-sq	df	Prob.
GDP	3.630420	2	0.1628
IPC	1.835957	2	0.3993
CONS	3.820138	2	0.1481
GOV	1.609765	2	0.4471
INTEREST	0.080430	2	0.9606
INV	3.032426	2	0.2195
MONEY	2.107619	2	0.3486
PUCR	0.496110	2	0.7803
RAND	1.955371	2	0.3762
TBILL	0.072820	2	0.9642
USD	3.735155	2	0.1545
All	19.05135	22	0.6422

Dependent variable: PUCR			
Excluded	Chi-sq	df	Prob.
GDP	0.216014	2	0.8976
IPC	2.894372	2	0.2352
CONS	0.770939	2	0.6801
GOV	1.155176	2	0.5613
INTEREST	0.417293	2	0.8117
INV	1.770169	2	0.4127
MONEY	1.872386	2	0.3921
PRIVATE_LOAN	3.293377	2	0.1927
RAND	0.097388	2	0.9525
TBILL	1.155773	2	0.5611
USD	0.862362	2	0.6497
All	12.00232	22	0.9573
Dependent variable: RAND			
Excluded	Chi-sq	df	Prob.
GDP	1.203843	2	0.5478
IPC	2.679404	2	0.2619
CONS	1.343678	2	0.5108
GOV	5.343566	2	0.0691
INTEREST	2.038919	2	0.3608
INV	1.463574	2	0.4810
MONEY	1.264127	2	0.5315
PRIVATE_LOAN	1.058435	2	0.5891
PUCR	1.360358	2	0.5065
TBILL	2.436422	2	0.2958
USD	1.772129	2	0.4123
All	22.72363	22	0.4175
Dependent variable: TBILL			
Excluded	Chi-sq	df	Prob.
GDP	0.317458	2	0.8532
IPC	7.672761	2	0.0216
CONS	1.662358	2	0.4355
GOV	0.625554	2	0.7314
INTEREST	5.668387	2	0.0588
INV	13.25089	2	0.0013
MONEY	5.199846	2	0.0743
PRIVATE_LOAN	0.021651	2	0.9892
PUCR	0.352936	2	0.8382
RAND	0.493909	2	0.7812
USD	3.443306	2	0.1788
All	43.69870	22	0.0039
Dependent variable: USD			
Excluded	Chi-sq	df	Prob.
GDP	3.259014	2	0.1960
IPC	3.725988	2	0.1552
CONS	0.672807	2	0.7143
GOV	3.493024	2	0.1744
INTEREST	7.622681	2	0.0221
INV	2.950899	2	0.2287
MONEY	2.931513	2	0.2309
PRIVATE_LOAN	0.304789	2	0.8586
PUCR	1.709255	2	0.4254
RAND	4.399715	2	0.1108
TBILL	13.80193	2	0.0010
All	32.01587	22	0.0771

Table A3. Roots of Characteristic Polynomial

Endogenous variables: GDP IPC CONS GOV INTEREST INV MONEY PRIVATE_LOAN PUCR RAND TBILL USD	
Root	Modulus
0.980151	0.980151
0.884690	0.884690
0.786809	0.786809
0.664188	0.664188
0.436297 + 0.445708i	0.623707
0.436297 - 0.445708i	0.623707
-0.341521 + 0.476643i	0.586366
-0.341521 - 0.476643i	0.586366
-0.519938 - 0.100264i	0.529517
-0.519938 + 0.100264i	0.529517
-0.520159	0.520159
-0.365482 - 0.366968i	0.517921
-0.365482 + 0.366968i	0.517921
0.367865 - 0.264014i	0.452800
0.367865 + 0.264014i	0.452800
-0.338433 + 0.246104i	0.418454
-0.338433 - 0.246104i	0.418454
0.185730 - 0.342202i	0.389356
0.185730 + 0.342202i	0.389356
-0.031560 - 0.380248i	0.381556
-0.031560 + 0.380248i	0.381556
-0.232556	0.232556
-0.174184	0.174184
0.134001	0.134001
No root lies outside the unit circle.	
VAR satisfies the stability condition.	