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The Nexus between Inflation, Money Supply and Economic Growth in Ethiopia

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Approval Sheet

This is to certify that the thesis prepared by Kassa Wondatir, entitled: *The Nexus between Inflation, Money Supply and Economic Growth in Ethiopia; SVAR Approach* and submitted in partial fulfillment of the requirements for Master of science degree in Economics(Economic Policy Analysis) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

This study explored the nexus between inflation, money supply and economic growth in Ethiopia using a quarterly time series data form 1997/98 Q1 to 2021/22 Q4. The study employed Structural Vector Autoregressive (SVAR) Model and descriptive statistics in order to analyze data collected from National Bank of Ethiopia (NBE) and World Bank economic outlook. The research shows that inflation in Ethiopia is caused by the money supply, supporting the monetarist theory and variations in the average inflation rate are extremely sensitive to changes in inflation expectations and substantially to changes in money supply increase. The percentage of currency in circulation and money growth had been steadily rising over time, which put further pressure on the overall price level. The research also shows that, in the short run, economic expansion has a negative impact on inflation. Economic growth lowers inflation if the primary drivers of such growth are noninflationary factors like a rise in output and productivity. But, monetary forces can only account for a portion of Ethiopia's inflation. Virtually, money supply increase caused by public credit expansion has a substantial and considerable impact on inflation since it keeps the country's currency's value from appreciating. Overall, the major policy implication of this study is that, the sensitivity of inflation to changes in monetary growth need to be taken into consideration by both monetary and fiscal policy makers and increased investments in agriculture and other food sectors are required as a result of price shocks related to the real production sector. Since, stronger inflationary expectations may have been the cause of the estimated larger than unit elasticity of the money supply, by guaranteeing credibility in the targeting and announcement of important economic and general policy variables, the influence of expectations on inflation can be also reduced.

Key words: inflation, money supply, economic growth, Ethiopia

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List of Acronyms

GDP: Gross domestic product

NBE: National bank of Ethiopia

CSA: Central statistical authority

WB: World Bank

IMF: International monetary fund

CPI: Consumer price index

VECM: Vector error correction model

SVAR: Structural vector autoregressive model

VAR: Vector autoregressive model

IS-LM: Investment, saving – liquidity and money

QTM: Quantity theory of money

MOFED: Ministry of finance and economic development

MEC: Marginal efficiency of capital

OMO: Open market operation

CD: Certificate of deposit

OLS: Ordinary least square

GLS: Generalized least square

ADF: Augmented Dickey Fuller Test

PP: Philips-Perron Test

KPSS: Kwiatkowski, Phillips, Schmidt, and Shin

MA: Moving average

LR: Likelihood ratio

FPE: Final prediction error

AIC: Akaike Information Criteria

SIC: Schwartz information criterion

HQ: Quinn information criterion

LM: Lagrange Multiplier

CHAPTER ONE

1. INTRODUCTIN

1.1 Background of the Study

For the past forty years, the economy of Ethiopia has been practiced many trails of inflation rate, money supply and real GDP change rate. Until 2004, she was a country of a low economic growth with low level of inflation. At that time, the median inflation rate was 7.5%, a broad money supply of 34.67 billion birr and the median growth rate of real GDP was 2.6% (NBE, 2020). There was no problem with inflation at this time. Prior to this time, the government followed tight fiscal and monetary policies that had been institutionally passed down from earlier regimes. Ethiopia's high inflation rate has been a problem since 2003. The overall inflation rate for the year 2002 was below zero, which is referred to as deflation. However, since 2004, the country has experienced an unheard-of rate of growth, according to some experts. (Alemayehu, and Kibrom, 2008). Inflation in general was 13.7 percent on average in 2006. In 2007 and 2008, the percentage increased to 21 and 39.8 percent, respectively (CSA, 2009). But during the same time period, Ethiopia's economy grew by an average of 10.7%, largely due to state investment in important infrastructure projects (World Bank, 2014). The rate of growth is the highest the nation has ever seen, surpassing that of Sub-Saharan African nations. (World Bank, 2015).

Referencing to NBE, The Ethiopian economy have experienced a real GDP growth rate of 6.3 percent in 2021/22, during and the impact of COVID-19 pandemic and the instability in northern part of the country, which is slightly higher than the 6.1 percent growth 2019/20. (NBE, 2020/21). This increase in real GDP was much higher than the estimated rise of 3.4 percent for Sub-Saharan African nations but was still 3.7 percentage points behind the average growth rate target set in the Ten Years Development Plan. (IMF, 2020).

The focal aim of macroeconomic policies of nations is to attain sustainable growth that have to agree with price stability (Mwakanemel, et.al, 2013). The National Bank of Ethiopia has established a monetary policy framework with inflation as its primary goal in this regard. According to the Consumer Price Index (CPI) published in June 2021 by the Central Statistical Agency (CSA), inflation in Ethiopia reached a record-high 24.5 percent year-over-year in June

2021, marking a new eight-year high. The rise in food item costs is partly blamed for inflationary tendencies. Food inflation rose from 23.7 percent in May to 28.7 percent in June of that year. However, in order to keep inflation below the ten percent barrier, the government continues to strengthen the currently in place monetary and fiscal policies. The soaring cost of meat, dairy products, cereals, oils and fats, and grains is a major factor in the rise in the food index. (CSA, 2021).

Due to a 136 percent increase in domestic credit, the broad money supply (M2), which was at Birr 1.1 trillion at the end of the first quarter of fiscal year 2020–2021, increased by 19.2 percent. Similar to this, the reserve amount at Birr, 261.4 billion, climbed by 39.9% annually, while the excess reserve of commercial banks increased by 109.3% during the same period (NBE, 2020/21). This may indicate that the government's or the bureaucracy's role in the formulation of public policy is essential.

One of the Sub-Saharan African nations with a moderate economic growth in recent years is Ethiopia. Despite a string of setbacks that have put it among Africa's poorest countries, government data show double digit growth over the previous few years. However, according to projections from the International Monetary Fund (IMF), the nation's economic growth rate will be approximately 5% in 2018. Ethiopia has recently seen significant improvements in its development and economic growth. According to a World Bank research from 2019, the nation has had amazing economic growth with an average annual growth rate of 10.6 percent since 2004 that is double the continental norm (Mwanakatwe & Barrow 2018). The analysis found that the growth of the service industry and the agriculture sector contributed more than the industrial sector, which made a far smaller contribution.

1.2 Statement of the problem

The nexus among inflation, economic growth and money supply has long been the subject of scholarly and policy attention and this has been increasing in recent times. The study of their interrelationships has long piqued the interest of economists. Both theoretical literature and empirical evidence disagree on the exact nature of the relationship between the three macroeconomic variables. Simply put, there hasn't been a verifiable conclusion about the nature of the relationships between inflation, growth, and money supply. The ambiguous nature of the correlation between inflation and economic growth was summed up by Friedman (1973).

Ethiopia has continued to record high economic growth averaging 11 percent over the last year and ranked among the ten fastest growing countries of Africa and among the leading growth rate in sub Saharan economies (IMF, 2017). However, this increment in total gross domestic product may be the result of galloping inflation which is also the result of huge money supply. Inflation has been a major topic of discussion in Ethiopian politics and economics for the past ten years. To control inflation and boost exports, the country's supervisory government has routinely raised the money supply and devalued the Ethiopian Birr. It is debatable whether this has actually stabilized inflation and raised export revenues. The discussion of the growth-inflation nexus has also been crucial in determining monetary policy. Long-term economic growth and financial stability are facilitated by monetary policy that keeps inflation at a low rate and constant over time. (Bernanke, 2021).

Since 2004, a number of macroeconomic stabilization initiatives have been tried, most of which have failed. Ethiopia has also had substantial and enduring inflation increases. In 2015, Mwanakatwe and Barrow. Even if there is no debate regarding the sudden shift in the country's inflationary experience (apart from very minor variations in the precise numbers), there are discrepancies regarding the true causes of inflation and the severity of their impacts. According to a number of academics and researchers, there were numerous probable sources. For example, government entities have cited a number of things as the primary causes of the current galloping level of inflation while offering solutions. They firmly think that sustained economic expansion leads to demand-pull inflation. According to the World Bank report from 2018, the country's rising aggregate demand as a result of rising private consumption and public investment (government money is released into the economy to finance it) is the primary cause of inflation, with the latter factor playing a significant role in explaining the recent inflation.

Saying that inflation is a danger to the public is unimpressive because it can affect all facets of society, but the poor are most hard hit. By decreasing the domestic marginal willingness to save, inflation slows down economic growth and negatively impacts public welfare. The negative effects of inflation could be disastrous in nations like Ethiopia where the wage structure is fixed for an extended period of time. It is therefore a major issue in the nation to pinpoint its causes and then implement a solution, but doing so is not a straightforward undertaking. (Minyahil et al. 2016). Accordingly the remedial solutions are context specific in different countries. For instance in Ethiopia the problem have never been remained easy to well understood. Thus the current macroeconomic instability and volatility needs much attention regardless of the serious

effort of government. Exchange rate, which the most controlling factor for the fluctuation of consumer price index (inflation), was missed in the paper. The researcher therefore feels that the available literature at hand is not enough to supply sufficient information for informed decision and flexible policy making. So, the research will try to incorporate interest rate and exchange rate in the estimation to analyze the issue.

It is useful and intriguing to further investigate the nature of the inflation-money supply-growth nexus and the major cause of inflation level in Ethiopia in the context of contentious, complex, and dynamic situations where the existing empirical literatures are far from reaching conclusive agreements and out of date. In addition, to the best of my understanding, Ethiopia's recent growth performance and significant development achievements are threatened by macroeconomic issues including excessive inflation. It would be fascinating to see how they are related in cases where rapid economic expansion is accompanied by high levels of inflation.

In the study by Fitsum et al. (2016), the tri-variate Granger causality with VECM approach of analysis was used to investigate the causal relationship between inflation and economic growth as well as between inflation and money supply in Ethiopia. Their Johansen co integration test demonstrates the co integration of real GDP, money supply, and overall price. Variables are obtained that have an extended equilibrium connection. Following the cointegration finding, the VECM model was built, and the outcome demonstrates that there is a long-term, uni-directional granger causal relationship linking economic growth and inflation. However, there was identification problem in the model (the error terms are correlated each other) and it would be better if we analyze this relationship by another model, which is SVAR approach.

As far as the researcher is aware, there haven't been many empirical investigations on the causal link between inflation, the national economic growth and money supply. By utilizing co-integration and a modified Granger causality test, Wolde Rufael (2008) attempted to determine the causative relationship between inflation, budget deficits, and money supply for the years 1964 to 2003. Fekadu (2012) used the Vector Auto Regression (VAR) model to examine the association between inflation and economic growth for the years 1980–2011. Apart from deterministic regressors, VAR models only use their own history to explain endogenous variables. Contrarily, structural vector autoregressive models permit the explicit modeling of current dependency between variables. To sum up, our study was motivated by the growing importance of inflation, economic growth, and money supply for policymakers in both their

immediate and long-term attempts to promote economic progress and to identify their relationship by employing Structural Vector Autoregression (SVAR) model.

The following are some ways that this study enhances the literature already in existence. Firstly, SVAR model was not used in earlier studies to analyze the link between a tightly managed monetary policy and high inflation rates for the purpose of policy formulation. Secondly, the study will also incorporate significant macroeconomic variables and create Ethiopia's SVAR model in accordance with Cushman and Zha's (1997) technique, which permits the imposition of identification limits and block exogeneity constraints. Third, it will add to the body of literature as a result decision-makers can choose the feasible monetary policy mechanisms because there are differences regarding the relationship between these variables in emerging nations as a whole and inconsistent findings in Ethiopia particularly. Finally, the study will close the time gap because it spans both the relative monetized economy and the relative development of the financial and capital markets.

1.3 Objective of the Study

1.3.1 General objective

The main goal of this study is to empirically investigate the relationship between inflation, money supply, and economic growth in Ethiopia by utilizing up-to-date and pertinent data sets for the given time frame.

1.3.2 Specific objective

Specifically, this research is designed to:

- To investigate whether the current price increase in Ethiopia is the result of true economic growth or other nominal variables like money supply and exchange rate fluctuation.
- To look into how Ethiopia's current inflation, money supply, and economic growth relate to one another.
- To show whether there are a meaningful nexus between the three factors in Ethiopia.

1.4 Research Questions

The paper will answer these questions which have not been answered fully by previous research.

- Is the current price increase in Ethiopia is the result of true economic growth or other nominal variables like exchange rate fluctuation and money supply?
- What connections exist between the current levels of Ethiopia's money supply, inflation, and economic growth?
- Has there been any meaningful correlation between inflation money supply and economic growth of Ethiopia?

1.5 Scope of the Study

This research primarily focuses on the three macroeconomic factors and how they relate to one another. Based on quarterly macroeconomic statistics for Ethiopia for the years between 2007/08 and 2021/22, it will use real GDP, the consumer price index, and the broad money supply as its proxy measures. Furthermore, in order to clearly define factors that mainly affect inflation, exchange rate and interest rate data will also employed. World Bank annual data from 1980 to 2021 will be also used for descriptive analysis. It is because discussing the quantitative nature of variables through descriptive analysis not only confirms the true relationship but also supports the econometric result.

1.6 Significance of the study

The paper will contribute to existing literature on the nexus among inflation, economic growth and money supply. The study will be beneficial to policy makers that are interested in this issue and to officials who are in charge of the macro-economic status of the country. Additionally, by acquainting the researcher with real facts regarding the study topic and associated macroeconomic difficulties, it enhances their practical knowledge and expertise. Additionally, the study generates broad knowledge regarding the connection between the money supply, inflation, and economic growth. Further research on the subject can use it as a foundation and a source of reference.

1.7. Limitation of the study

The central point of the research is monetary variables that cases inflation, but, the real factors that make price hike haven't included. Ethiopia did not have quarterly access to GDP statistics, like other developing nations. In get quarterly GDP data, interpolation was made. This data interpolation might have an impact on the outcome. There is also data inconsistency between World Bank data and NBE.

1.8 Organization of the Study

There will be five chapters in this paper. The problem, the objective, and the significance of the study are all stated in the first chapter's introduction section. Review of the theoretical and empirical literature is covered in the second chapter. The third chapter talks about estimation methods and research methodology. The data's descriptive and econometric analysis is presented in the fourth chapter. This chapter also contains empirical findings and econometric analyses. Fifth and final chapter discusses recommendations for policy and conclusion.

CHAPTER TWO

2. LITRATURE REVIEW

2.1 Definitions and Concepts of Economic Growth

The ability of a nation to produce the goods and services that its resident's desire is what is meant by economic growth (Peterson, 1988). Economic growth, according to Todaro and Smith (2003), is the progressive rise in an economy's capacity through time, which raises the output and income of the nation. Another approach to describe economic growth, according to Gillis et al (1987), is rising income and product per capita, or Gross National Product divided by total population. According to Kuznets (1974), significant structural changes should be a part of economic growth, together with adjustments to the social and institutional settings in which a rise in output or income is attained. He believed that economic growth should not be restricted to only changes in output or income levels. He described economic growth in his well-known book as a long-term increase in a country's capacity to offer its population an ever-widening range of economic goods, based on rising technology and the institutional and ideological reforms needed to sustain it.

Bowden (1992) contends that for any country to advance economically (build more factories, power plants, and other production facilities as well as increase the amount of machinery and equipment it produces or imports), both the development of a better work force (better organization, education, attitudes, skills, etc.) and the acquisition of more and better capital are required. Three forms of economic growth have historically existed. These factors include increases in labor force size, capital accumulation, and technological developments. Contrary to capital accumulation, which is the process of increasing the stock of capital in an economy, labor force growth occurs. The expanding application of new scientific information in the form of innovations and improvements in the fields of physical and human capital, on the other hand, is what is meant by "better technology".

2.2 THEORETICAL LITRATURE REVIEW

Theories play a crucial role in explaining some phenomena that have been seen. The nexus between inflation, economic growth, and money supply are still argumentative in principle as well as in observed results. Models built on theories examine the influence of inflation at growth

centering on the sound impacts of it on the steady state output and investment. There are different outcomes on the nexus among the three macro-economic variables in these hypothetical models. These may be negative, neutral, nonlinear, or positive relationship among the three variables. Positive correlation between economic growth and inflation has been found by Mundell (1963) and Tobin (1965).

The first to claim, using the IS-LM curves, that expected inflation had a real-world impact on the economy was Mundell (1963). During periods of inflation, the real rate of interest declines since it rises by a percentage less than the rate of inflation, according to his discussion. According to Tobin (1965), inflation has a beneficial impact on economic growth since it serves as a store of value in the economy. Money has no any essential function than being a financial assets like tangible capitals. Because capital ratio and money are negatively related with inflation, which clues to greater intensity of capital and supports economic growth, he recommends that inflation reason individuals to have more asset than having the paper note. He also debates that the change in comparative prices at the time of economic growth could be better when price increases due to the downward inflexibility of prices.

A neoclassical growth model was examined by Stockman, 1981. With inflexible supply of labour and he presented that the growth rate of money supply has only temporary effects on the per-capita income growth. He showed that the increment of growth of money has undesirable long run effects if the cash-in-advance limitation applies to investment. His forecast is that when the rate of inflation rises, it decreases the purchasing power of money. This decline constrain firms to reduce their ability to purchases both capital and primary goods, causing in a decline in the steady- state level of output. Therefore, if only consumption is impacted by cash in advance, money is extremely neutral over the long run, according to Stockman (1981). In contrast to Stockman's (1981) contention, Zeria (1991) demonstrates that despite the cash-in-advance constraint is a foundation for consumption, greater inflation rates increase the amount of inflation tax, and in some situations, and businesses hoard money because deposits are hampered. As a result, profitability declines and capital accumulation and expansion are slowed.

Monetarists hold the opinion that inflation is purely a monetary phenomenon. They claimed that an economy's continuous rise in overall prices is a result of an unsustainable rate of money supply expansion. This claim states that the money supply should affect aggregate prices in the causal direction. However, other schools of thought, such as structuralists, disputed the idea that inflation is solely a monetary phenomenon. They claimed that, particularly in developing

nations, an excessive money supply is more of a result of inflation than a contributing factor, meaning that the relationship between the two is reversed (Tang, 2008).

Monetarists believe that the inflation has a neutral effect. Only the nominal variables are affected by it. They believed that if an economy's prices doubled, nominal earnings would do the same while real wages remained unchanged. For all tangibly present (actual) variables, a similar argument is valid. They strengthened the claim that money has no real-world repercussions. In the setting of a fully optimal general equilibrium framework and the inclusion of money in the utility function, monetary growth models by Sidrausky (1967) and Brock (1975) look at a related issue. According to the Sidrausky-Brock model, with elastic labor supply, the supply of labor is not reliant on the growth rate of the money supply, even though capital per worker is. Additionally, they discovered that in steady states, money is neutral and that the stock of capital per worker is unrelated to the pace of expansion of the money supply.

Recently, a large number of economists have come to the conclusion that there is no linear relationship between inflation and economic growth. Using an endogenous growth model with categorical financial intermediation, Espinosa and Yip (1999) investigated their relationship. They base their analysis of the impact of one variable on another on risk inclination. A greater rate of inflation slows down economic growth if agents are generally risk-averse. The relationship between inflation and economic growth is positive when agents' relative risk aversion is low, supporting convectional theories of the Philips curve. Using models with costly state verification issues and adverse selection, Hung (2001) investigates the link between the two variables. According to the conclusion, inflation and economic growth have a positive association if banking expenses do not exhibit externality. The link between the two variables, however, depends on the baseline inflation rates if the banking cost exhibits economies of scale. If the starting inflation rate is high, economic growth is reduced by a rise in inflation and vice versa.

Many endogenous growth models have specified that inflation had an adverse result on growth of the economy. Gregorio (1993) builds the model that demonstrate many ways of explaining the effects of inflation on growth. The first model centers on the role of money in firms' action and its effect on the rate of investment. At this model, firms consumption of money to purchase new equipment. When inflation rises, firms encouraged to economize in real balances. Since increment in transaction costs cases to raise the shadow value of installed capital and will reduce investment, the addition in real balances to economize resources cases to increase transaction

costs. The second model stresses on the consequences of inflation on households' behavior and the productiveness of capital. The perception for the adverse impacts of inflation on labor hiring is that inflation increases labour costs on the firms' side and consequent reduction in employment and dropping labour demand with a much decline in the additional product of capital. On the side households', inflation causes substitution of consumption by leisure and finally reduces labour supply.

The findings of the theoretical simulations outlined above clearly show that they depend on the assumptions made about the economy of the country being studied as well as the way the models were developed. All of the models made an effort to align their findings with economic theories. Accordingly, in these theoretical models, inflation may have a negative, neutral, positive, or no linear connection on economic growth.

2. 2. 1 Economic Growth and monetary policy

It is obvious that the fundamental objective of monetary policy was to maintain exchange rate and price stable in addition to their critical role in long-term growth of the economy and the advancement in the foreign sector. There are ideas that have an impact on the economy on both monetary policy and economic growth. The National Bank of Ethiopia and Federal Ministry of Finance and Economic Development the are two examples of the top monetary authorities with regard to monetary policy that are focused on ensuring adequate control over the overall monetary issues, interest rates, and credit in order to meet good macroeconomic goals of the nation. The link between interest rates and the total money supply is the primary area of concern for monetary policy. It opens up the possibility of using a variety of instruments to manipulate one or both variables in order to affect outcomes like inflation, unemployment, and economic growth.

The macroeconomic variables are impacted by monetary policy since it is a key instrument for putting an economy back on a growth path. The elimination of poverty, the management of income disparity, the decrease of unemployment, etc., are significant problems taken into consideration while discussing economic growth. Many resource managers, including governments, are motivated to employ it first because of how monetary policy has affected economic growth (Chipote and Makhetha-Kosi, 2014). According to classical economics, money has a catalytic effect on the actual economy, which makes it irrelevant to an economy because it only affects prices directly. Money is viewed as a curtain and has no bearing on an economy's real revenue, output, or employment. It serves no purpose in the economic system.

But according to the traditional economist, among other factors, the value of money is controlled by labor, capital, the status of technology, the availability of natural resources, and people's saving habits. Additionally, money's primary purpose is to act as a medium of exchange, which establishes the overall level of prices. Fisher's quantity theory causality allows for the expansion of the assumption. Classical economics believe that a rise in the money supply has an upward influence on prices rather than a negative one on real GDP. This finding demonstrates that changes in the supply of money will not alter the macroeconomic components (Hengan, 2005; Mason, 1996; Anyanwu, 1993). Contrary to what the traditional economists had believed, Keynes claimed that money supply increment does affect prices, but not immediately or proportionally. Keynes emphasizes that the real sector is affected by money, demonstrating how the Keynesian Quantity theory of money allows for money to have a changing role in the economy.

Classical economists follow $MV = PT$ $\uparrow MS \rightarrow \uparrow P$ and $\downarrow MS \rightarrow P\downarrow$, whereas Keynes follow: $\uparrow MS \rightarrow \downarrow r \rightarrow \uparrow I \rightarrow \uparrow YON \rightarrow \uparrow COST \rightarrow \uparrow PRICE$.

As demonstrated, the nexus is indirect, but money supply has an impact on price through a chain of causes. For instance, a rise in money supply will lead to an increase in investment because of capital's marginal efficiency (MEC), which will then raise income, output, and employment thanks to the multiplier effect (k), before raising prices because of elasticity (Keynes, 1936). The portfolio adjustment process is the main subject of modern neo-Keynesian monetary policy theory. When the central bank purchases securities on the open market, substitution and wealth effects are triggered because the public portfolio is made up of a range of assets, including bonds, shares, savings accounts, mortgages, and other financial instruments. If the government purchases securities through an open market operation, it will increase the price of the securities and create a decrease in their yield, meaning that the owner of the securities will sell their assets to the Central Bank since they will make more money. As a consequence, they have more money than they would want, which causes them to change the makeup of their portfolio to hold less money. Due to these substitution and adjustment effects, financial assets, according to the neo-Keynesians, are the closest alternative for money. Therefore, expanding the money supply affects economic activity through boosting the production of the capital goods industry. The monetarists contend that surplus money balances are used to acquire both financial and tangible assets, such as real estate, buildings, and consumer goods. As a result, anytime the Central Bank buys securities, their values increase, their yields decrease, and there is a surge in demand for both financial and physical goods. In turn, rising real asset values drive production, which in

turn raises demand for the resources needed to produce them. As a result, as demand rises, so does their value. In addition, as the price of real estate grows, so does the need for services. Through its substitution impact, an expansionary monetary policy raises consumer demand, pricing, and expenditure on tangible and intangible goods and services.

2.2.2 The Financial Sector and Monetary Policy Development in Ethiopia

Theoretically, there are many possible channels of monetary policy transmission mechanisms that are identified by the many schools of thought that explain how monetary policy is transmitted. The traditional quantity theory of money holds that changes in monetary policy have a direct impact on price fluctuations. Milton Friedman and other monetarists contend that interest rates, exchange rates, or both are effective ways of communicating monetary policy and that money is vital. Because they believed that monetary policy operated through channels like balance sheets and bank lending, Keynesians argued against the effectiveness of the latter. Again, the medium school (Real business cycle) sees money as neutral; that is, they do not believe it is unimportant or dispute the impact of monetary policy on the economy. However, they contend that other significant economic variables, such as asset prices and the money supply, have a reverse causal link (Meltzer, 1995). According to Mishkin (1995), the transmission of monetary policy is influenced by a number of factors, including interest rates, exchange rates, asset prices, and credit channels. Due to this, the National Bank of Ethiopia being established and monetary policy in Ethiopia was initiated that year. The nation was turned into a communist dictatorship when the imperial empire fell (1974-1991). Interest rates and other monetary variables were strictly regulated by the central bank in the past with the goal of reducing the participation of the private sectors in the economy. The political economy of the nation witnessed considerable changes with the 1991 shift in administration.

The central bank's current priorities are to preserve exchange rate and price stability, promote a sound financial system, and carry out other tasks that would advance Ethiopia's economy. The nation's monetary policy framework has three goals in it. The long-term objective is to keep prices and exchange rates stable while fostering the nation's economic expansion; the short-term goal is to maintain the money supply rising at a rate that is equal to the nominal GDP growth rate; and the immediate objective is to keep the money supply growing at a rate that matches the nominal GDP growth rate. Growth of base currency, sometimes referred to as reserve currency, is an operational goal (NBE, 2009). The NBE is now utilizing a range of monetary policy instruments to achieve its objectives. Some of the monetary policy tools used by NBE include

Standing Central Bank Credit Facility, Open Market Operations, Reserve Requirements, Direct Inter-Bank Borrowing or Lending Mechanism, Setting Floor Deposit Rates, Credit Control, and Moral Suasion. Depending on the desired policy outcome, the bank uses either one of these tools alone or a combination of them (NBE, 2009).

2.3 EMPIRICAL LITRATURE REVIEW

Even if there is a strong argument that very high level of inflation is evil for growth, the nexus between inflation-growth and inflation-money supply have been controversial and the empirical results are not conclusive. For example, Kormendi & Meguire (1985), who argue that the traditional empirical findings on the effects of inflation on economic growth should be changed from a positive influence—referred to as the Tobin (1965) effect—to a negative one, as Stockman's (1981) interpretation has been interpreted, have found a significant negative effect of inflation on growth. Using pooled cross-section and time series regressions for numerous countries, Fischer (1993) and De Gregorio (1993) provide evidence for a negative relationship between inflation and growth. Barro (1996) also tested this argument and he found nonlinear relationship among variables. Levine & Zervos (1993) and Sala-i-Martin (1997) advised that the growth the economy was not a major cause inflation increment.

Kesavarajah and Amirthalingam, (2012) employed Granger causality and cointegration test to estimate the long run nexus between inflation and money supply in Sri Lanka within 1978 to 2010. The outcome indicates the existence of long run nexus between these variables and the Granger causality test concludes a substantial causation from money supply to inflation in the country during the period. Whereas, Gunasinghe, (2007) investigated the causative relationship on the same state using Granger causality. The outcome tells that causativeness goes from inflation to economic growth for the period 1960-2005. The long and short time dynamics of the linkage between inflation and economic growth for Pakistan, and India was examined by using error correction and cointegration models by Mallik and Chowdhury, (2001) using yearly data. The outcome concludes there were statistically significant and positive link between inflation and economic growth for the above-mentioned countries.

Chuan-Yeh, (2012) studied the causative nexus between inflation and economic growth to 140 countries over the period 1970-2005 by employing a broad cross-country data. The conclusions from the study was inflation hinders growth, and however, the influence from growth to inflation is positive. Additionally, he segregated the cross-state dataset in to truncated (low), evolving (middle), and high-income countries. According to the result, the destructive impact of

inflation on growth in truncated income states is higher than in evolving and high-income states. He also tried to differentiate the impact of growth on inflation at different level of income in different countries. He concludes that a rise in inflation in high and low-income countries is not the result of advanced economic growth. However, swift economic growth encourages higher inflation in lowest income countries.

The threshold impact of inflation on economic growth is examined by Singh and Kalirajan (2009) using annual data from India for the years 1971–2008. Their findings suggest that any increase in inflation has a detrimental impact on economic growth, and that large gains can be made by focusing monetary policy on maintaining price stability. The long-term link between economic growth and inflation is significantly negative, according to Andres and Hernando (1997). Both the degree of investment and the productivity with which factors are utilised are reduced by inflation. It has a damaging, temporary effect on long-term growth rates, which leads to a long-lasting decline in per capita income. They conclude by stating that the long-term costs of inflation are high and that efforts to control inflation will be rewarded with strong economic growth.

Using data from 140 nations over the years 1960–1998, Khan and Senhadji (2001) investigate the connection between inflation and economic growth. They take into account the relationship between the two factors separately for developing and developed nations. To eliminate the pronounced asymmetry in the inflation distribution, the log inflation model was developed using the conditional least squares estimation process. The empirical findings suggest that there is a point beyond which inflation has a detrimental effect on economic growth. The result also demonstrates the statistical significance of the estimates and the fact that the threshold is lower for affluent countries than for poor ones (1-3 percent and 11–12 percent, respectively).

Hwang and Wu (2011) investigate the potential impact of inflation on economic growth in China using the growth accounting equation as the model's theoretical underpinning. They discovered a very strong and considerable impact of inflation on growth. Every percentage point increase in inflation rate below the 2.50 percent limit promotes economic growth by 0.53 percent while every percentage point increase above this limit slows economic growth by 0.61 percent. This shows that while moderate inflation helps China's growth, high inflation hurts it.

Using the Granger-causality test and Cointegration analysis, African researchers Chimobi and Uche (2010) investigated the connection between output, inflation, and money supply in Nigeria. Their discovery explains why there wasn't a cointegrating vector in the study's series.

They discovered a Granger causal relationship between the money supply, inflation, and output. The result implies that price stability can contribute to monetary stability in the Nigerian economy. According to the study by Umaru and Abdulrahan (2012) on the impact of inflation on economic development in Nigeria between 1970 and 2010, GDP causes inflation and economic growth is unaffected by inflation, according to the Granger causality test of the relationship between GDP and inflation. Additionally, they draw the conclusion that through increasing output and productivity, inflation has a positive impact on economic growth.

Additionally, there has been a flow of in-depth teachings on the rate of inflation in developing nations. Mubarik (2005), for instance, used an annual dataset from 1973 to 2000 to research the threshold level of inflation for Pakistan. The developed model recommends a 9 percent threshold for inflation, above which it is detrimental to economic growth. With the help of the Threshold Autoregressive (TAR) model, Lee and Wong (2005) evaluated the threshold levels of inflation for quarterly data for Japan from 1970 to 2001 and Taiwan from 1965 to 2002. The Threshold Autoregressive models' findings suggest that an inflation rate of more than 7.25% is detrimental to Taiwan's economic expansion. Two inflation thresholds, however, were established for Japan. Which are 2.52% and 9.66% indicating that a reasonable inflation regime is one in which an inflation rate within these two ranges is beneficial for economic growth and one above which is detrimental.

In a few African states, there have also been some country-specific studies. Salami and Kelikume (2010) used annual data from 1970 to 2008 and 1980 to 2008 to calculate Nigeria's inflation threshold level and examine whether there was a significant difference between the threshold levels for the two time periods. For the first and second sample periods, they developed an inflation threshold of 7% and 8%. The latter, meanwhile, did not support the significance test. The study by Phiri (2010) examines the amount of inflation that is least harmful to economic growth and financial activity in South Africa. It found that an inflation level of 8% had the least harmful effects on these activities.

2.4 EMPIRICAL LITERATURE IN ETHIOPIAN CONTEXT

The analysis by Wolde-Rufael (2008) found a long-run cointegrating relationship between the series with a one-direction Granger causation that followed the money supply to inflation and the rate of economic growth to inflation. He uses the limits test technique to cointegration and a modified version of the Granger causality test to investigate the causal relationship between inflation, money supply, and economic growth for the years 1980 to 2007. He also uses the

dynamic ordinary least squares and the completely modified ordinary least squares (FMOLS) tests to assess the boundaries test's resilience. He concluded by saying that one of the most important policy tools for ensuring Ethiopia's long-term macroeconomic stability is managing the money supply.

To calculate the impact of an excess money supply on inflation, shifts in the prices of food and non-food items in the international market, and domestic agricultural supply shocks in Ethiopia, Durevall, Loening, and Birru (2010) use an error correction method that measures deviations from equilibrium in the external sector, money market, and agricultural market. The findings highlight the close connection between Ethiopia's general inflation and the price of food and agriculture, as well as the long-term negative effects of the global food crisis on domestic food costs. In the short term, a disturbance to agricultural supplies affects food inflation. Even though money supply expansion has a significant short-term impact on non-food price inflation, it had little to no direct impact on the rise in food costs.

In Ethiopia from 1980 to 2011, Fekadu (2012) looked into the connection between inflation and economic growth. The Vector Auto regression (VAR) model revealed that while inflation has a minor short-term impact on economic growth, inflation reduces as economic growth increases. According to the Granger Causality test, economic growth has a better predictive ability for inflation than inflation has for economic growth. The Cointegration test indicates that economic growth and inflation in Ethiopia have a long-term relationship. In the near run, inflation significantly lowers economic growth while having no significant impact on it, according to vector error correction estimates.

Muche (2007) employed the structural vector autoregressive model (SVAR) with actual output and CPI as the two independent variables. He attempted to investigate how supply and demand shocks affected real output in order to assess the current inflationary situation. In light of this, he contends that Ethiopia's inflation is the result of supply or demand shocks. He discovered that current inflation is primarily caused by elements of demand.

Using a general equilibrium macroeconomic model, Yohanis (2007) calculated the sources of Ethiopia's present inflation. He discovered that Ethiopia's inflation is stated by a medley of variables including real GDP, money supply, and main consumer price indices exchange rate and trading partners. He highlights the significance of rural growth as well increased access to information.

Teshome (2011) used statistical analysis to show the causes of inflation hike in Ethiopia. He claims that between 2004 and 2008, the country's inflation was caused by stronger spending intentions, higher import prices, and a delayed expansion of the total supply. According to him, restricting the money supply to lower inflation will impede economic expansion because price increase in the country is not a related to money. Additionally, the high velocity of money brought on by the expansion of financial institutions and economic activity in the economy means that stopping the flow of money into the economy will not be able to stop inflation. In the paper, he made reference to the fact that it is challenging to pinpoint the precise nexus between growth and inflation and that instead, it needs look at how government spending is structured and the characteristics of economic growth.

2.5 The Conceptual framework of the research

The below figure illustrates the framework of concepts for this investigation based on the literature review mentioned above. Based on our comprehension of earlier empirical investigations, the relationship between variables can be described by the next figure.

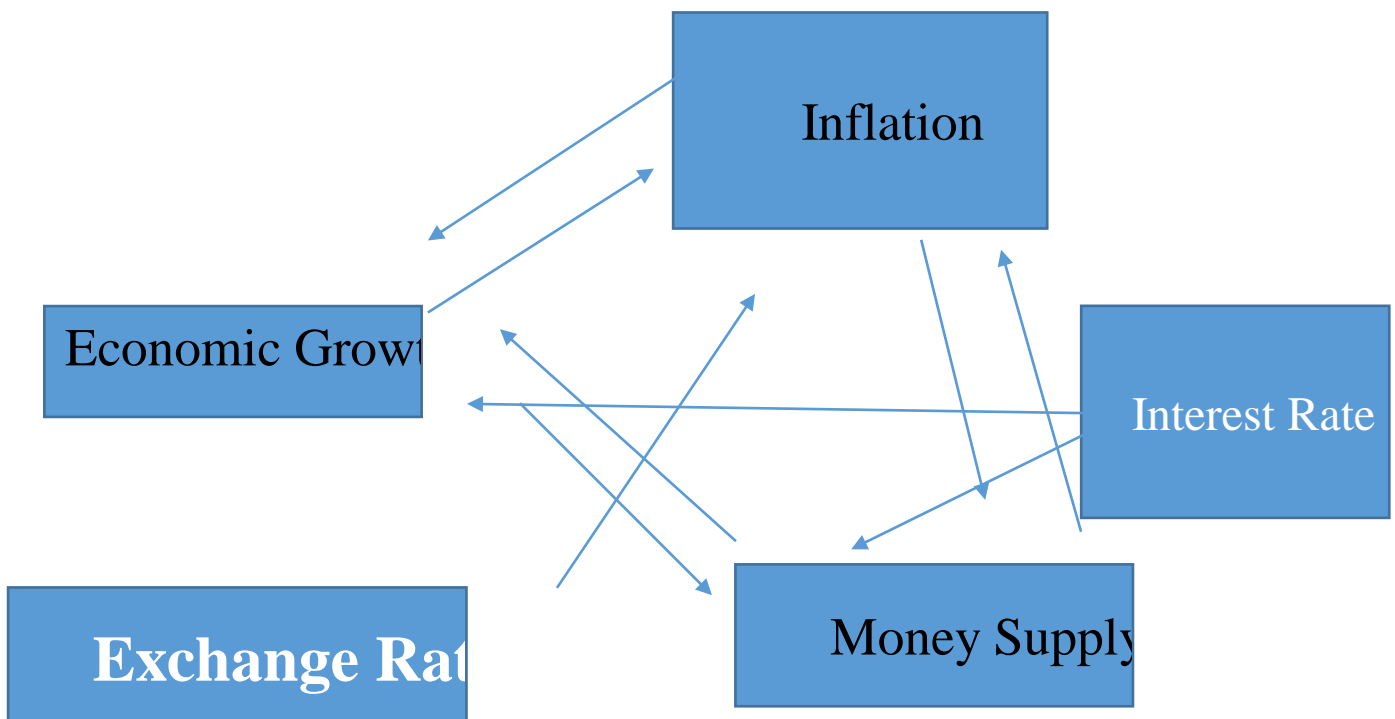


Figure 2.1 conceptual framework of the study

Source: Own drawing based on different literatures

As one can clearly see from the above figure, money supply increase inflation and when there is inflation, large amount of money is on the hand of the public and it in turns increases money supply. Inflation also increase the nominal value of goods and services. This also increase the country's GDP. If GDP increases, per capita income of the peoples increases which in turn increases the purchasing power of consumers and ends up by increasing inflation, given constant level of output. Interest rate also affect economic growth through investment, since investment is highly sensitive to interest rate. Lastly exchange rate have great impact on imported goods and this imported inflation largely affects general inflation.

CHAPTER THREE

3. Methodology of the Study

3.1 Research Design

Utilizing secondary time series data covering the years 1980 through 2021, this analysis will be carried out. It will use the three main macroeconomic factors to examine how they interact with one another. Additionally, econometric analytic techniques and descriptive statistics will be applied to this. We shall employ the Structural Vector Autoregression (SVAR) model in economic analysis. Since our focus is explaining the relationship between macroeconomic variables, the paper uses explanatory research design.

3.2. Data source and Nature

This study will build an empirical model based on the gap in the literature to show the ways of the relationship among the three instruments. A review of significant research papers on the topic will be done for the purpose of this study. Secondary data will be employed for thorough conclusions and this study entirely depends on Ethiopian economic statistics.

Datas will collected from secondary sources. These include, if necessary, the World Bank database, the IMF statistics on the global economic outlook, the Central Statistics Authority, the Ministry of Finance and Economic Cooperation, and the National Bank of Ethiopia. Following a comprehensive examination of their significance in connection to the research objectives, pertinent statistical data for the study will be gathered from various sources.

To understand the nexus of economic growth, inflation, and money supply many researches have been worked. But, the empirical research that is currently available is still far from being definitive. Therefore, the nexus among economic growth, money supply, and inflation will be studied by the estimation of a Structural vector autoregression. The investigation of the monetary transmission mechanism and the causes of business cycle fluctuations is frequently done using structural vector autoregression (SVAR) models. Additionally structural vector autoregression (SVAR) is good at explaining shock and is the main reason why it will be employed for the research. All model estimations and tests will be conducted using Eviews. Additionally, a unit root test and other tests pertinent to this subject will be conducted.

3.3 Model specification

Irving Fisher proposed the quantity theory of money (QTM) in 1911, which states that an economy's money supply and price level are inversely correlated. The price level changes proportionally in response to changes in the money supply and vice versa. I.e. $MV = PT$ (1) where M = money supply V = velocity of money

P = price level, and T = transactions (all the goods and service sold with in an economy)

The Classical Quantity Theory of Money, which suggests an identity-explained equi-proportional link between money supply and inflation, serves as the framework for the study's formulation. We can infer from the equation above that an increase in the money supply can lead to a rise in price. In order to formulate the theory of inflation and because we want to examine how M affects P in the model, equation (1) can be rewritten as follows in terms of price:

$$P = MV/T \text{ (2) but, } MV=Y \text{ (3) because } PT=Y, \text{ So, } MV=PY \text{ and } P=MV/Y \text{ (4)}$$

If we take the natural log of equation (4) it becomes; $\ln P = \ln M + \ln V - \ln Y$ (5).

The variables in the model are taken into account in order for them to be able to display structural impacts like demand-side, supply-side, or cost-side effects, as well as external effects at home side price level. In light of this, the deterministic econometric relationship between variables can be represented as;

$$CPI_t = f(M2_t, RGDP_t) \text{ (6) where;}$$

- The proxy for measuring inflation is the Consumer Price Index (CPI). The CPI can be the best indicator of inflation in Ethiopia because the majority of spending goes toward the consumption of final goods and services.
- Broad money ($M2$) is the sum of cash kept outside of banks, demand deposits other than federal government-issued ones, time, savings, and foreign currency deposits made by non-federal residents, bank and traveler's cheques, and other assets like commercial paper and certificates of deposit. It may also serve as a reflection of how the National Bank of Ethiopia defines the money supply.

- Real GDP (RGDP) is the best to measure the economic growth performance of the country. But, in order to specify more explanatory model, other control variables like exchange rate and interest rate will be added.

Therefore, based on the above formulations(1-6), the econometric model that will lay ground for estimation will be

$$\ln CPI_t = \beta_0 + \beta_1 \ln M2_t + \beta_2 \ln RGDP_t + \beta_3 \ln ER_t + \beta_4 \ln IR_t + \varepsilon_t \quad (7)$$

Where, β_0 is the intercept term, the parameters β_1 and β_2 are the long run elasticities of the independent variables and ε_t is the white noise error term. But, our emphasis is to determine their relationship by using SVAR model, the SVAR model can be formulated as follows.

$$A_0 y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \varepsilon_t \dots \dots \dots (8)$$

$$Y_t = (CPI, M2, RGDP, ER, IR)'$$

Where, y_t is $(N \times 1)$ vector of endogenous variables at time t , A_i is a $(N \times N)$ matrix of parameters for $i=0,1,2,\dots, p$ while ε_t is a $(N \times 1)$ multivariate white noise error process with the following properties:

$$E(\varepsilon_t) = 0 \dots \dots \dots (10)$$

$$E(\varepsilon_t \varepsilon_t') = \begin{cases} \Sigma & t=\tau \\ 0 & \text{otherwise} \end{cases} \quad (11)$$

According to this approach, structural innovations are presumptively orthogonal and structural disruptions are considered to be unrelated. The variance-covariance matrix Σ is diagonal and constant. Each equation in the SVAR system has a corresponding explanatory variable since the matrix A_0 specified in (8) has been normalized across the main diagonal. The SVAR model's parameters are estimated in two steps. The first step is to derive the equations in reduced form, which may be done using formula (8) by first premultiplying both sides of the equation by the inverse of A_0^{-1} . i.e

$$A_0^{-1} (A_0 y_t) = A_0^{-1} (A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \varepsilon_t) \quad (12)$$

$$y_t = A_0^{-1} A_1 y_{t-1} + A_0^{-1} A_2 y_{t-2} + \dots + A_0^{-1} A_p y_{t-p} + A_0^{-1} \varepsilon_t \quad (13)$$

$$y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_p y_{t-p} + V_t \quad (14)$$

Where $\beta_i = A_0^{-1} A_i$ $i=1, 2, 3 \dots p$ and $V_t = A_0^{-1} \varepsilon_t$

The equation expressed in (14) is the reduced form of VAR, and V_t is the innovation vector associated with the reduced form of the equation which has zero mean and constant variance, V_t ; $N(0, \Omega)$. 'N' equations in the model of (14) can be estimated by OLS method and the residuals of the VAR model V_t is obtained in the process. The structural model innovations in (14) are associated with the innovations in reduced forms as follows:

$$E(V_t V_t') = A_0^{-1} (\varepsilon_t \varepsilon_t') A_0^{-1} \quad (15)$$

$$\Omega = A_0^{-1} \Sigma (A_0^{-1})^{-1} \quad (16)$$

The second stage in forecasting the SVAR model is to identify the contemporaneous matrix A_0 and the variance-covariance matrix Σ which maximizes the likelihood function contingent on the parameter estimates of the VAR obtained in the first stage. In order to calculate the log likelihood function, Newton-Raphson analytic derivatives are used. In the SVAR model A_0 has N^2 parameters and Ω has only $N(N+1)/2$ distinct values, which causes an identification problem as the structural model requires $2N^2 - (N+1)/2$ number of restrictions to be imposed on the system and in order to form exact identification conditions. In the absence of proper identification, the system becomes underidentified¹. Additionally, rather than relying on the widely utilized Choleski's decomposition method, the residuals from the reduced VAR are converted into a system of structural equations by applying limits based on prior ideas and empirical discoveries about policy reaction functions. As stated by, one approach to retrieve the underlying shocks is to orthogonalize the reduced form residuals (Bernanke, 1986; Sims, 1986; Blanchard and Watson, 1986).

3.3.1 Stationarity and unit roots

The mean and auto-covariances of a series are deemed stationary (weakly or covariance) if they are finite and independent of time. Non-stationary series are outside the scope of this attribute. Random walk series, like the following, are examples of non-stationary series:

$$y_t = y_{t-1} + \varepsilon_t \quad (3.3.1) \quad \text{Where } \varepsilon_t \text{ denotes white noise}$$

The anticipated value based on the prior series is obviously time sensitive. In addition, the series' variance increases over time. But by différenciating the aforementioned series, a stationary process is produced, as illustrated below.

$$y_t - y_{t-1} = \Delta y_t = \varepsilon_t \quad (3.3.2)$$

Since ε_t is white noise, Δy_t must also be white noise since y_t became stationary after t was distinguished. When a variable becomes stationary after differencing d times, it is said to be in a difference stationary series, which is represented by the symbol $I(d)$. Where d stands for the integration order. The number of differencing operations necessary to make a nonstationary series stationary is indicated by the order of integration. Because the random walk series above has only one unit root, it is an $I(1)$ series that is stationary at the initial difference. A series can also be stable and flat or not differencing, $I(0)$. Economic theory suggests that the $I(0)$ series has a limited memory of its prior behavior, but the $I(1)$ series has an extensive recollection of its previous conduct. In the $I(0)$ and $I(1)$ series, individual random shocks have temporary and permanent consequences, respectively (Verbeek, 2008).

When non-stationary data is used to estimate a model, misleading regression can arise. In such cases, the estimated regression has a high coefficient of determination (R^2) and significant t -values but no economic relationship between the variables, and any existing association may instead be the product of correlated time trends (Granger and Newbold, 1974). Therefore, a variety of stationarity tests are provided to prevent the misleading regression findings that appear to be nice. The various tests that are available are the GLS detrended Dickey-Fuller (Elliot, Rothenberg, and Stock, 1996), the Augmented Dickey-Fuller Test (1979) (ADF), the Phillips-Perron (1988) test (PP), the Kwiatkowski, Phillips, Schmidt, and Shin (1992) tests, the Elliott, Rothenberg, and Stock Point Optimal (ERS, 1996) tests, and the Ng and Per (NP, 2001). As a means of testing stationarity in this study will employ the ADF, PP, and KPSS. Given the first-order autoregressive model, $AR(1)$, consider the following:

$$y_t = \theta y_{t-1} + \varepsilon_t \quad (3.3.3) \quad \text{When } |\theta| \geq 1, \text{ the series is said to be non-stationary.}$$

A well-known non-stationarity test for the $AR(1)$ model looks at whether the series is non-stationary, or not. The fundamental equation is equation (3.3.3), and three more equations are derived from it to account for various non-stationarity scenarios.

$\delta = \theta - 1$ Therefore, we define the unit root null hypothesis as $\delta = 0$. The three equations are formatted as follows:

$$\Delta y_t = \delta y_{t-1} + \varepsilon_t$$

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \varepsilon_t$$

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \varepsilon_t$$

All scenarios share the unit root null hypothesis, which is $\delta = 0$, whereas the alternative is smaller than zero, suggesting that the series is stationary. Under the null hypothesis, which rules out any sort of pattern, the first case is a plain random walk. When compared to the third specification, the series in the second situation exhibits both deterministic and stochastic trend.

Dickey and Fuller (1979) claim that the τ (tau) statistic is used to estimate the value of δ and Monte Carlo simulations are used to determine the critical values. The model was revised by Said and Dickey (1984) to take into account the possibility of serial correlation in the earlier specifications as:

$$\Delta y_t = \beta_1 + t\beta_2 + \delta y_{t-1} + \sum_{i=0}^m \alpha_i \Delta y_{t-1} + \varepsilon_t \quad (3.3.4)$$

Where $\Delta y_{t-1} = \Delta y_{t-1} - \Delta y_{t-2}$, $\Delta y_{t-2} = \Delta y_{t-2} - \Delta y_{t-3}$ and extra.

Since the assumption of an uncorrelated error term is unreliable, the ADF test based on (3.3d) is highly significant. Without adding delayed changes like the ADF test, Phillips and Perron (1988) utilized a non-parametric statistical technique that considers the existence of serial correlation in the error term, ε_t . The ADF test and the Phillips-Perron (PP) test have almost identical asymptotic distributions (Gujarati, 2004).

Simply put, failing to reject the null hypothesis of a unit root means that there is insufficient data to do so (Verbeek, 2008). Kwiatkowski et al. (1992) created the KPSS test as a substitute to address the issue of the test's low power. This testing scheme treats stationarity as the null hypothesis and treats the presence of a unit root as the alternative. This test breaks down a given time series into three components: the deterministic time trend, the random walk, and the error term (not necessarily a white noise). As a result, trend stationarity is examined under the null hypothesis that the random walk component has no variance. Lagrange Multiplier (LM) testing

is what this test entails. The test statistic is calculated by regressing the series against the temporal trend. The next test statistic is calculated from the residual.

$KPSS = \sum_{t=1}^T S_t^2 / \sigma^2$ ---- (3.3.5) where $S_t = \sum_{i=1}^t e_i$ is the partial addition of the residual calculated from the OLS regression of the series on intercept and time trend and σ^2 is an estimator of the error variance. If the calculated value is less than the given critical value, then the series is stationary and vice versa.

3.3.2 Identification and restriction of the model

The generally utilized method in the literature (e.g., Christiano et al., 1992; Dungey and Pagan, 2000) calls for limits that are consistent with economic theory and earlier empirical research findings when applying identification restrictions. The findings of the Ethiopian VAR studies and the SVAR studies of other countries play a significant role in helping us determine the proper limitations to be placed on the contemporaneous structure of this SVAR model when establishing the identification conditions. Let's assume other variables are exogenous to the model and they do not granger cases them, excluding all variables from the block of equations in the contemporaneous structure of the reduced form VAR results in the imposition of a block exogeneity.

Identification strategy

As stated in (Blanchard & Perotti, 2002), the following is the identification strategy. Denoting the vector of endogenous variables by y_t and the vectors of reduced form residuals by u_t , the VAR representation is provided as follows:

$$Y_t = A_1 y_{t-1} + A_2 y_{t-2} \dots + A_p y_{t-p} + u_t$$

Where y_t is a vector of endogenous variables and $(N \times N)$ coefficient matrices and u_t is $(N \times 1)$ vector of the reduced form innovation, which is supposed to have an identity matrix and covariance matrix that are equal for the sole purpose of identification. These are the variables that make up the benchmark specification's y_t and u_t .

$$Y_t = (CPI^t, M2^t, RGDP^t, ER^t, IR^t) \text{ and } u_t = (u_t^{CPI}, u_t^{M2}, u_t^{RGDP}, u_t^{ER}, u_t^{IR})$$

Using lag operator L, $y_t = A(L)y_{t-1} + u_t$

Where y_t is $(N \times 1)$ vector of endogenous variables $A(L)$ is $(N \times N)$ matrix lag polynomial and u_t is $(N \times 1)$ is vector of reduced form innovations, which are distributed independently and identically with variance covariance matrix $\Sigma u = E(u_t u_t')$

In order to say the model is identified or not, the number of unknown variables must be less than or equal to known parameters.

$$e_t = AV_t, \Sigma e = A \Sigma v A', \Sigma e = A^{-1} \Sigma v A^{-1}$$

$$\text{Where } \Sigma v = \begin{cases} \sigma_{211} & \sigma_{12} & \sigma_{13} & \sigma_{14} & \sigma_{15} \\ \sigma_{21} & \sigma_{222} & \sigma_{23} & \sigma_{24} & \sigma_{25} \\ \sigma_{231} & \sigma_{32} & \sigma_{233} & \sigma_{34} & \sigma_{35} \\ \sigma_{241} & \sigma_{42} & \sigma_{43} & \sigma_{244} & \sigma_{45} \\ \sigma_{251} & \sigma_{52} & \sigma_{53} & \sigma_{54} & \sigma_{255} \end{cases}$$

But, since variables are uncorrelated to each other, the covariance's of structural shocks are known and equal to zero. Due to this, the unknown parameters are

$$e_t \sim [0, \Sigma e], E(ee') = \Sigma e \begin{cases} \sigma_{2} & \text{cpi} & 0 & 0 & 0 & 0 \\ 0 & \sigma_{2m2} & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma_{2rgdp} & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma_{2ir} & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma_{2er} & 0 \end{cases}$$

The variables are listed above in the following order: Consumer price index is listed first, broad money supply is second, real gross domestic product is third, interest rate is fourth, and exchange rate is listed last. The following effects result from this particular variable ordering. When other system variables are shocked, the interest rate does not respond immediately. due to the national bank of Ethiopia setting the interest rate in advance. Consequently, it has little immediate impact on how the business cycle moves.

The total number of unknowns are n^2 . We have to impose $n^2 - n / 2$ restrictions. Since, five variables are used in this paper, ten restrictions are required. If we impose greater than ten restrictions, the model becomes over identified. The SVAR model requires $2N^2 - N(N+1)$ number of restrictions in order to just identified. So, since we have five variables, we need to impose 35 restrictions.

3.4 Impulse Responses and Variance Decomposition

The reactions of the target variables to unexpected shocks may be used to determine the effectiveness of monetary policies such as board money supply and the roles of different transmission mechanisms in propagating the policy shocks like inflation. By computing the impulse response functions and forecast variance decompositions, the estimated SVAR system is utilized to look at the dynamics of the model. Below is a quick explanation of how these empirical methodologies were developed.

3.4.1 Impulse Response Functions

The dynamic reactions of the variables to different shocks within the SVAR system are examined using the Impulse response function. Equation (14) is written as follows using the lag operator L:

$$B(L)y_t = V_t \quad (3.4.1)$$

Where $B(L) = I - B_1L - B_2L^2 - \dots - B_pL^p$

Any shock provided by V_t (the reduced form innovations) in (3.4.1) will eventually lose its influence on a covariance stationary VAR. In this situation, it is possible to re-parameterize (3.4.1) to represent the endogenous variables in y_t as a function of the present and previous values of V_t . The vector moving average (VMA) is represented as follows:

$$y_t = V_t + C_1V_{t-1} + C_2V_{t-2} + \dots = C(L)V_t \quad (3.4.2)$$

Where $C(L) = (L - B_1L - B_2L^2 - \dots - B_pL^p)^{-1} = I + C_1L + C_2L^2 + \dots + C_pL^p$

The impulse response function produced from the VMA follows an innovation to V_t from the j^{th} variable and plots the response for the i^{th} variable through time, retaining constant all other reduced form innovations. However, because V_t by design represents the sum of all the basic economic shocks and does not just correspond to one shock, the MA model in (3.4.2) may not have the inclination to assign the reaction of a specific variable to an economically intuitive shock. The set of orthogonal structural innovations t specified in the original SVAR model can be recovered by transforming innovations V_t in order to solve this issue (12).

According to the SVAR method, the structural innovations ϵ_t are assumed to be orthogonal, meaning that the structural disturbances are uncorrelated. Model (3.4.2) can be changed into:

$$y_t = C^*(L) \epsilon_t \quad (3.4.3)$$

Where $C^*(L) = C(L)A^{-1}_0$ generates the impulse response functions of y_t to the structural shocks ϵ_t . By computing the initial impulse response function presented in, the impacts of broad money supply on the other variables, particularly on the goal variables of inflation and economic growth, may be captured more effectively. The impulse response functions may be perceived intuitively since the disruptions ϵ_t have economic significance (Raghavan and Silvapulle, 2015). For instance, by watching how other variables in the system react to a large amount of money, one might examine the transmission mechanism of monetary policy.

3.4.2 Variance decomposition

The forecast error variance decomposition identifies the fraction of a shock to a particular variable that is attributable to either its own innovations or those connected to other dependent variables at various projected time horizons in the system. As follows is the expression for the s -period-ahead prediction error.

$$y_{t+s} - \hat{y}_{t+s/t} = U_{t+s} + C_1 U_{t+s-1} + C_2 U_{t+s-2} + \dots + C_{s-1} U_{t+1} \quad (3.5.1)$$

The mean squared error of the s -period forecast is:

$$MSE(\hat{y}_{t+s/t}) = \Omega + C_1 \Omega C_1' + C_2 \Omega C_2' + \dots + C_{s-1} \Omega C_{s-1}' \quad (3.5.1a)$$

$$MSE(\hat{y}_{t+s/t}) = A^{-1}_0 \sum (A^{-1}_0)' + C_1 A^{-1}_0 \sum (A^{-1}_0)' C_1' + \dots + C_{s-1} A^{-1}_0 \sum (A^{-1}_0)' C_{s-1}' \quad (3.5.1b)$$

Where $\Omega = A^{-1}_0 \sum (A^{-1}_0)'$ The contribution of the orthogonal innovation to the MSE of the s -period-ahead projections of variables in y_t is described by expression (3.5.1b).

3.5 Pre-estimation and Post-estimation Diagnostic Tests of the VAR Model

3.5.1 Lag Length Selection Criteria

It is crucial to select a set of lags that results in a strong model and a precise forecast before actually estimating the VAR model. The lag order of the VAR model may be used to determine

the ideal number of delays to include. This suggests that choosing an order of lag length that is greater than the genuine lag length tends to raise the mean square prediction error of the VAR, and that choosing an order of lag length that is lower than the true lag length commonly leads to autocorrelated errors (Lütkepohl, 2005).

The best latency may be chosen using a variety of tests and informational factors. The likelihood ratio (LR) test, the Akaike information criterion (AIC), the Hannan and Quinn information criterion (HQ), the final prediction error (FPE), and the Schwartz information criterion (SIC) are a few examples of information criteria. The ideal lag duration is determined by choosing the information criterion that has the lowest value out of all criteria.

3.5.2 Stability of VAR Model

The other post estimation test used to determine if the current value residual is connected with any of its lagged values is residual autocorrelation. For this, the Lagrange Multiplier test is utilized. In order to do this, one must indicate the serial correlation order that was used to estimate the VAR model. The LM test for autocorrelation's null hypothesis is that the residuals are serially uncorrelated; the alternative is that they are serially correlated. If the P-value is less than 0.05, we can rule out the null hypothesis (Harris, 2005).

3.5.3 Multivariate Normality of the Residuals

To determine if the residuals are normally distributed, another post estimation diagnostic test is utilized. In order to determine up prediction intervals, it is helpful to test this distributional assumption.

The test for a normal distribution is created using the third and fourth central moments (skewness and kurtosis). In this work, the multivariate version of the Jarque-Bera test is used, which more technically has a test statistic that follows a Chi-Square distribution under the null hypothesis of normally distributed errors. We can thus reject the null hypothesis of normality at the 5% level of significance if the significance of the Jarque-Bera statistic or p-value is less than 5% (Lutkepohl, 2005).

3.5.4 Heteroscedasticity Test

This test determines whether the variance of the errors is constant. It is claimed that there is no misspecification problem and that the residuals are homoscedastic and independent of the regressors by the null hypothesis in the White (1980) test for heteroscedasticity. If either the test statistic or P-value is less than 0.05, the homoscedasticity null hypothesis is rejected.

Chapter Four

4. Analysis of Data, Results and Discussion

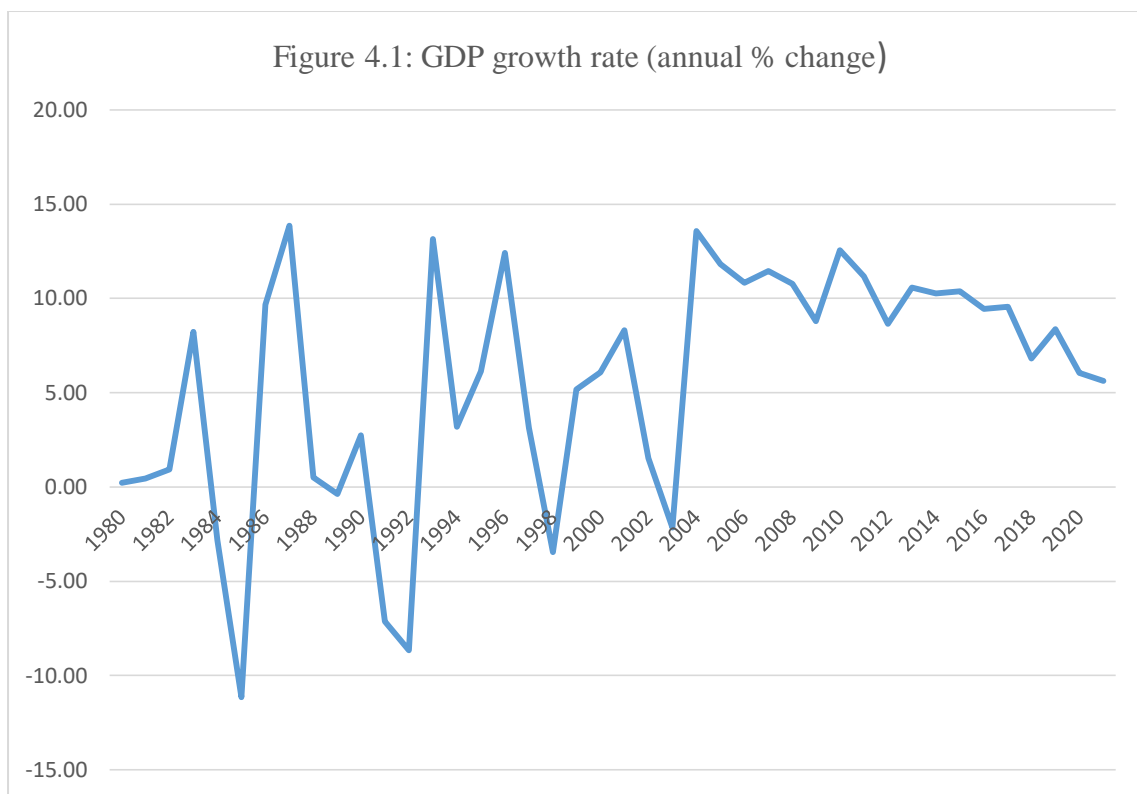
4.1 Descriptive analysis of Data

4.1.1 Trends of economic Growth in Ethiopia

Ethiopia went through three periods of change in its political system: the imperial rule until to 1974, the Derg (communist) rule after that, and the EPRDF rule from 1991 onward. Each of the three regimes has distinct economic principles and political viewpoints that have a different effect on the macroeconomic health of the nation (NBE, 2015).

Emperor Hailesillassie I's "Imperial Regime," which spanned the years 1930–1974, made an effort to modernize the nation by building new schools and hospitals, promulgating a constitution, building infrastructure, and starting medium-term planning. The political system of the dictatorship was unpredictably violent, followed a market-based economic policy, and had a negative/harmful effect on the overall macroeconomic performance of the nation. Derg's centralized economic system was in place from 1974–1975 to 1990–1991. Government interference in all economic activity during the socialist rule and the nationalization of all sorts of property resulted in the breakdown of the whole economy. The new administration (EPRDF) liberalized the economic system following the fall of the Derg regime in 1991/92. Despite experiencing oscillations, the economy performed rather well during the EPRDF government (NBE, 2015).

The pattern of Ethiopia's economic growth is flexible and diverse. Given that the bulk of the population depends on primitive agriculture that is reliant on rain, an analysis of economic growth trends reveals a very visible irregularity that is the result of successive natural and external shocks.



Source: Own computation using World Bank data

GDP increased by 8.9 percent in fiscal year 2004/05 when measured at constant prices. Agriculture outperformed all other sectors in terms of economic growth, increasing by 12.0 percent on its own and accounting for around 6 percent of the 8.8% increase in GDP as a whole. Additionally, the sectors of industry and services experienced absolute growth rates of 6.6 and 5.8 percent, respectively (NBE, 2014).

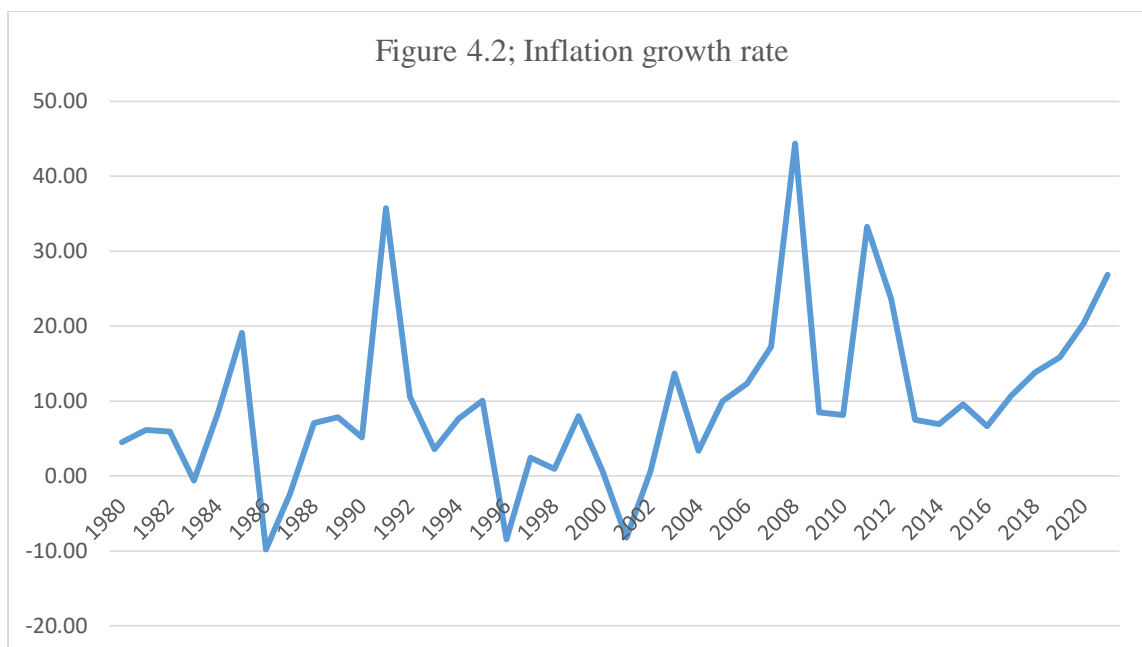
Real GDP increased by 11.4 percent in the 2006–2007 fiscal year. Ethiopia is one of the best-performing economies in Sub-Saharan Africa as a result of the fourth consecutive year of high growth (11.7 percent in 2003/04, 12.6 percent in 2004/05, and 11.6 percent in 2005/06). this was due to the growth of Agriculture (grew by 9.4%), accounting for around 45.9% of the overall 11.4 percent real GDP growth, even though all sectors contributed to this comparatively high economic growth performance. Sector growth in the industrial and service sectors was 11.0 and 11.5 percent, respectively. 10.8% real GDP growth is anticipated in 2007–2008. According to figure (1.1), Ethiopia's economy fared reasonably well between 2004 and 2015, with average GDP growth rates of 13.59 percent in 2004 and 10.39% in 2015. The highest growth rate over that time was 13.86% in 1987, and the lowest was -11.14% in 1985. Low inflation, strong agricultural growth, and the negative growth in 1985, which acted as a lower base or recovery,

all contributed to 1987's high growth rate. Although policies may have played a little role, it is most likely that natural forces like drought and rain availability contributed to the output level's variability. Ethiopia's GDP growth rate in 2017 was 9.56%, up 0.13% from 2016, and it was 9.57% in 2018. This high degree of growth rate is due to high rate of money supply, which reduce the cost of investment, and higher level of inflation. After reaching the peak at 2004, the growth rate of real GDP is falling, especially after 2019, may be due to the corona virus pandemic and civil wars in most part of the country.

4.1.2 Ethiopia's consumer price index and its components

Fisher (1996) asserts that macroeconomic stability can be measured using inflation. This may be because it is very difficult to maintain macroeconomic stability in a setting where the overall level of prices is constantly growing. Price increases in Ethiopia were typically correlated with declines in productivity (especially agricultural harvest), and years of high production were followed by price declines.

The headline inflation rate in OECD countries peaked at 4.8 percent in July 2008, driven up by soaring food and energy prices, but quickly started to decline, settling at about 0.5 percent in spring 2009. As a result of the global decline in economic activity, there was a sharp downward correction in commodity prices that was reflected in the quick decline in inflation as well as an increase in spare capacity. Due to large base effects from commodity prices, OECD inflation actually started to turn somewhat negative in the middle of the year. Measures of long-term inflation expectations, which remained in positive territory, show that most people believed the low inflation rates to be a temporary phenomenon. Due to the fading of these base effects and a recovery in commodity prices in October 2009, headline inflation returned to positive territory and increased to 1.9 percent in the year to December 2009, up from 3.6 percent the previous year. Inflation was 1.6 percent in the 12 months leading up to December 2009 when food and energy were excluded. The average annual decrease in the CPI in the USA for 2009 was -0.4%, down from 3.8% the year prior. Early in 2009, headline inflation began to decline, reflecting significant base effects brought on by falling commodity prices (CSA, 2018).



Source: Own computation using World Bank data

Ethiopia has had low inflation for a very long time in Sub-Saharan Africa. This was previously due to a strong currency, responsible fiscal and monetary policies (1960s–1973), widespread price control (1974–1992), and the implementation of economic reform and stabilization measures (1992–2004). The severe drought that had the greatest impact on agricultural production and the lack of peace in the nation in 1991/92 caused inflation to reach its all-time high of 21%. On the other hand, a notable deflation was seen during the fiscal year 2001/02 (-7.2%), primarily as a result of the drop in food prices linked to a bumper crop of agricultural output following the favorable meteorological conditions of the time (CSA, 2017).

After October 2002, prices continued to rise significantly at a rapid rate, reaching 15.1 percent by the conclusion of the fiscal year 2002/03. The deflationary condition that was present during fiscal year 2001/02 had lasted until that point. A peak of 18.6 percent was attained in October 2013 as the rise kept going. At the national level, overall inflation has been steadily declining since November 2003, though, and at the end of 2003–04, it had fallen to 8.6 percent. The price fall persisted through November 2004 despite the comparatively favorable weather and stronger harvest in 2004–2005. Prices, however, have been steadily rising since December 2002. Such changes in 2004–05 were extremely exceptional because they saw price increases notwithstanding high-quality agricultural output. Furthermore, unexpectedly strong growth in non-food inflation, which accounts for 40% of the country's General CPI, has had an impact on

how the general price level is moving. As a result, from their respective levels of 8.6, 11.8 and 5.2 percent in 2003/04, overall inflation at the end of fiscal year 2018/19 reached 21.3 percent, food inflation 24.1 percent, and core inflation (proxied by non-food costs) 18.3 percent. The rise in housing rent, construction material prices, water, fuel, and electricity sub-groups of the CPI in combination with the rise in import costs of fuel and building supplies were the main causes of the increase in core inflation. Additionally, rising costs for locally manufactured building materials like cement have put significant pressure on the inflation rates of non-food products (NBE, 2021)

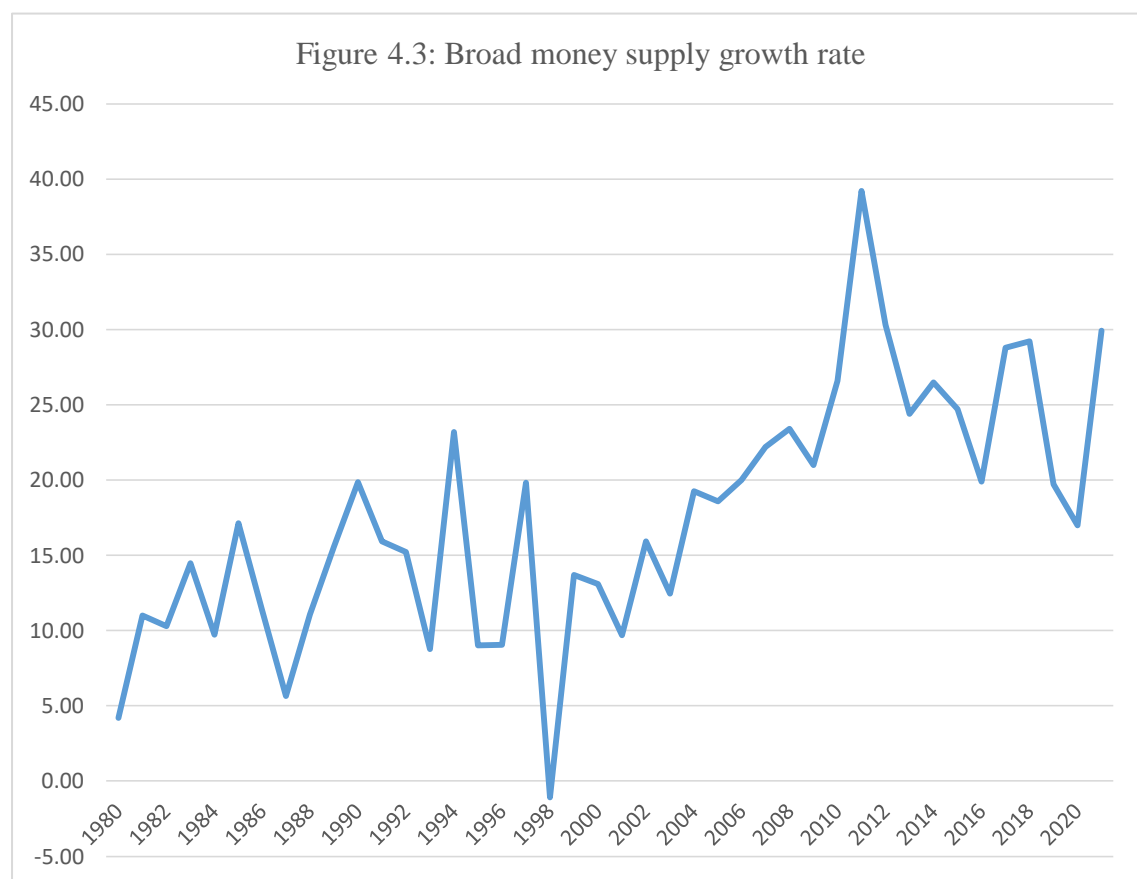
4.1.3 Monetary developments and broad money supply

Governments primarily use the money supply as a tool to implement stabilization measures. Growth, unemployment, and inflation are all impacted by changes in the money supply. Because the money market is underdeveloped and there isn't really a financial market, the government has little control over the amount of money in circulation. However, commercial banks and the general public do have some impact (WB, 2019).

Since the creation of the state bank during the imperial era, Ethiopia has maintained an economic and monetary policy. The Ethiopian National Bank was created in 1963 pursuant to Proclamation No. 206. The bank, on the other hand, was reinstated by Proclamation No. 99 in 1976 with a monetary and banking role consistent with the nation's socialist economic ideals. More than 20 years of Ethiopia's government were spent in a centrally planned command system (1974-1991). The price of significant goods and other macroeconomic factors like interest rates, currency rates, and inflation were closely regulated by the government during this time. This led to a macroeconomic imbalance and poor economic performance. After the Derge government was overthrown in 1991, the EPRDF instituted a liberal economic system. Broad money expanded at a rate that was significantly faster than the yearly nominal GDP growth from 1989 to 1991/92. Although there was a negative interest rate on deposits, quasi-money (deposits that earned interest) grew on average, demonstrating that the private sector was forced to save as a result of regulations that reorganized private expenditure (NBE, 2016).

Liquidity in the economy increased by 28.9% in the 2017–18 fiscal year, reaching 573.4 billion Birr. Increases in domestic credit and foreign assets have fostered broad money expansion. In comparison to the prior fiscal year, domestic credit increased by 28.7%. Demand deposits and the number of active currencies have each increased by 10.8 and 27.6%, respectively. Thus,

narrow money has increased by 21.4%. Time deposits and savings both saw increases of 35.2% and 27.3%. Both the commercial banks and the National Bank of Ethiopia observed an increase in foreign assets during this fiscal year. Foreign assets now have a 76.7% increase in value. However, it was an improvement over the sharp decline in the previous two years (NBE, 2017/18). As the central component of the monetary transmission system, broad money is crucial in determining the level of inflationary pressures.



Source: Own computation using NBE data

As shown in the above graph, broad money supply in Ethiopia consistently grows up until 1984 and shows a large decrease on 1987. Between 1987 and 1997, it shows a constant ups and downs but it was reached at a trough on 1998. Broad money supply (M2) reached Birr 56.7 billion at the end of 2006/07, representing a growth rate of 22.2 percent over the same time the previous year. This growth was may cause by increases in domestic credit and net foreign assets.

Domestic liquidity, which is defined as the total amount of money in circulation, increased by 19.6 percent to Birr 40.2 billion in 2004–05. This was due to growth rates of the banking system's net foreign assets of 6.7 percent and domestic credit of 29.5%, respectively. Net claims

on the government increased by 12.9%, and credit to non-government sectors increased by 56.1%. The growth in domestic liquidity was somewhat restrained by other things net's 32.9 percent increase. Broad money to GDP ratio, which tracks financial deepening, showed substantial growth during the fiscal year, rising from 39.8 percent to 41.5 percent.

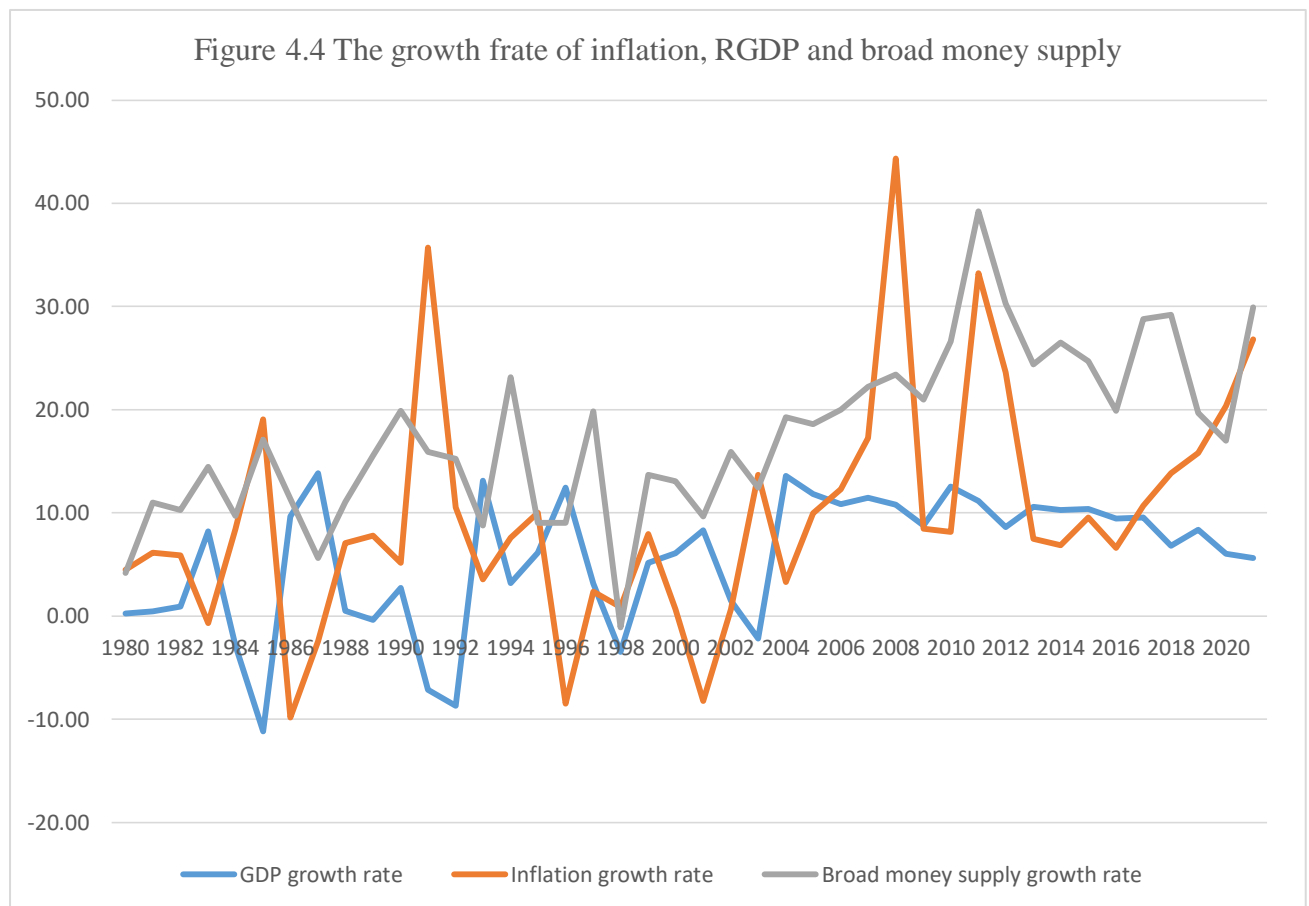
At the end of 2004/05, narrow money had increased 18.0 percent in value to reach 21.3 billion Birr. Demand deposits increased by 10.5 percent while currency outside of banks increased by approximately 27.8 percent throughout this period. Similar to money, quasi-money, which includes savings and time deposits, increased by 21.4%. Time deposits increased by 32.1% while savings deposits increased by 20.5%. It is significant to note that, despite a decrease in the minimum deposit interest rate in March 2004 and an average interest rate paid on demand deposits of less than 1%, there has been no discernible decline in the level of deposits over the past three years, partially indicating that interest rate is not the only factor affecting deposit levels.

Broad money supply (M2), a measure of domestic liquidity, reached Birr 104.4 billion at the end of 2009–2010, representing a 22.2 percent increase over the same period the previous year. This growth was primarily driven by increases in net foreign assets and domestic credit of 51.2 and 17.1 percent, respectively. While net credit to the government only slightly increased by less than one percent, credit to the non-government sector grew dramatically by 26.6 percent to reach Birr 71.4 billion. All broad money components increased during the fiscal year 2009–2010. Due to increasing demand deposits and currency outside of banks, narrow money increased by 24.5 percent, reflecting an increase in economic activity and better transaction demand (NBE, 2018).

In 2015–16, Ethiopia's monetary policy stayed at one percent. The National Bank of Ethiopia adopted reserve money as the cornerstone of its monetary policy in order to achieve this, and it closely monitored fluctuations in monetary aggregates. As a result, domestic liquidity surged to Birr 445.3, as measured by the broad money supply (M2), mostly due to an increase in domestic credit of 24.6 percent. Credit to the central government increased by 54.7 percent, and credit to non-central government increased by 22.1 percent, which is what is responsible for the increase in domestic credit (NBE, 2016).

Broad money supply peaked at Birr 886.8 billion at the end of 2018–19, representing a 19.7% annual rise. This was mostly owing to a 22.8 percent increase in domestic credit, which balanced out the banking system's net foreign asset decline of 63.2 percent. Credit to the central

government increased by 7.6 percent, and credit to non-central government increased by 25.1 percent, which was the cause of the strong growth in domestic credit. All aspects of broad money have increased in 2018–19. The growth in demand deposits and currency outside of banks, which reflects the expansion of economic activity and improvements in the demand for money for transactions, is what drove the 9.9% increase in narrow money. As a result of commercial banks' improved ability to mobilize deposits by building additional branches, quasimoney, which includes savings and time deposits, climbed by 25.8% and reached Birr 577.8 billion (NBE, 2019).



Source: Own computation using World Bank data

The three variables are all moving in the same direction, as seen in figure 4.4, even though their degree of change may vary. So, one can infer that the nexus among them is strong and positive.

4.2 Econometric analysis of data

4.2.1 Test results of Stationarity

We used the ADF, PP, and KPSS techniques to test stationarity before moving on to the estimate phase, and the results are shown below.

Table 4.1 Stationarity test result

H0:Variable has unit roots	ADF Test P-values				PPerron Test P values			
	Level	1 st diff.	intercept	Trend	level	1 st diff.	intercept	Trend
CPI	0.0000*	0.0000	✓		0.0000*	0.0001	✓	
M2	1.0000	0.0498**	✓		1.0000	0.0484**	✓	
RGDP	0.9962	0.0098**	✓		0.9974	0.0083**	✓	
IR	0.8911	0.0000**	✓		0.8911	0.0000**	✓	
ER	1.0000	0.0022**	✓		1.0000	0.0035**	✓	

Source: Own computation using EViews -12 software

*indicates stationarity at level

** indicates stationarity at 1st difference

The numbers in table indicates P- values associated with the order of integration

The null hypothesis of non stationarity is rejected for P-values less than 0.05

Table 4.2 stationarity test using KPSS

H0:Variable has unit roots	Kwiatkowski, Phillips, Schmidt and Shin LM Test statistic			
	Level	1 st diff.	Intercept	Trend
CPI	0.471563	0.03554	yes	
M2	0.961707	0.049614	yes	
RGDP	1.053419	0.036142	yes	
IR	0.650021	0.049694	yes	
ER	1.074149	0.033649	yes	

Source: Own computation using EViews -12 software

We used the KPSS test, which is primarily based on the LM test, to examine the possibility of low test power. The KPSS result indicates that all of parameters are stationary at first difference, which suggests that the ADF and PP test findings are likewise accurate and dependable.

It is questionable if a VAR needs constant variables, though. Whether or not the variables have a unit root, Sims et al.'s (1990) recommendation against differencing stands. They claimed that a VAR analysis' goal is to discover relationships between the variables rather than to establish parameter estimations. Stationarity of the variables is not a significant issue in this study because the aim is to assess policies using forecast error variance decomposition and impulse response functions.

Furthermore, Sims et al. (1990) contend that the Cholesky decomposition method, which imposes recursive structure on the model, can be used to identify shocks in level VAR models with nonstationary variables if the ultimate objective is to estimate the impulse response function in order to capture the dynamic responses of non-policy variables brought on by unanticipated shocks in the policy variables.

4.2.2 Lag Length and VAR stability Test Results

The maximum lag length k was selected for the VAR model prior to the cointegration test because it is crucial to select the right lag length since too little or too much K might invalidate the test results or lower their power.

The study employs several lag-length selection criteria, including LR, FPE, AIC, SIC, and HQ, to establish the reduced form VAR's ideal lag length. We demonstrated the ideal lag length Eviews-12 result.

Table 4.3 Lag order selection

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-3175.221	NA	7.29e+23	69.13523	69.27228	69.19055
1	-2447.635	1360.269	1.70e+17	53.86162	54.68394	54.19352
2	-2381.709	116.0867	7.01e+16	52.97193	54.47952*	53.58041

Source: Own computation using EViews -12 software

Except for LR the lag length selection criteria, which suggests six (6), other test suggests us to be four (4) and less. But, since our sample data size is not too large, it will be better that the lag length to be two (2). The VAR stability using AR roots must be verified before moving on to estimate the SVAR's parameters and the associated impulse response functions. The presented findings show that almost all of the eigenvalues' moduli reside in the unit circle. The VAR/SVAR model therefore meets the necessary stability criteria.

The results shown in the table below show that all of the eigenvalues for both models have moduli that fall within the unit circle. Therefore, the VAR/SVAR model satisfies the necessary stability criteria.

Table: 4.4 Roots of characteristic polynomial

Roots	Modulus
0.9999968	0.9999998
0.971323	0.971323
0.920416 – 0.147381i	0.932141
0.920416 + 0.147381i	0.923141
0.873574	0.873574
0.340479	0.340479
0.082077 – 0.296813i	0.307952
0.082077 + 0.296813i	0.307952
0.143547	0.143547
-0.051174	0.051174

Source: Own computation using EViews -12 software

4.2.3 Impulse response function

The main focus of VAR and SVAR models is the analysis of shocks, which are the main cause of stochastic variation in the vector of variables that are all possibly endogenous. In this approach, a number of distinct and important shocks are found by making use of useful theoretical and economic constraints. Following the identification of structural shocks of interest, impulse response analysis, forecasting error variance decomposition, and historical decomposition are used to illustrate the features of VAR models (Favero, 2001). Therefore, this

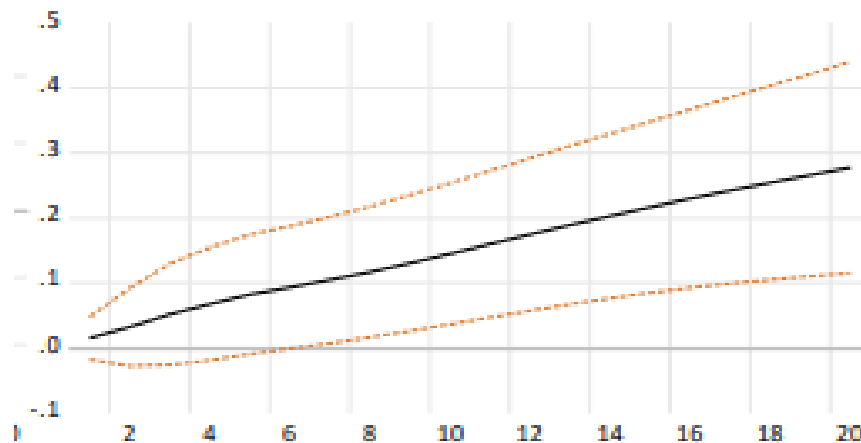
study use impulse response analysis to characterize how the system's variables react to the relevant shocks.

One standard deviation shocks are represented in the column, while reactions to those shocks are shown in the row. The researcher looks at how inflation responds to changes in the overall monetary supply, real GDP, interest rate, and exchange rate using four lag lengths. As clearly shown from the below graph, consumer price index is highly sensitive to other shocks which are mentioned as investigation variables. Their growth rate is highly follows the same pattern and their movements is also similar.

Response of CPI supply to exchange rate

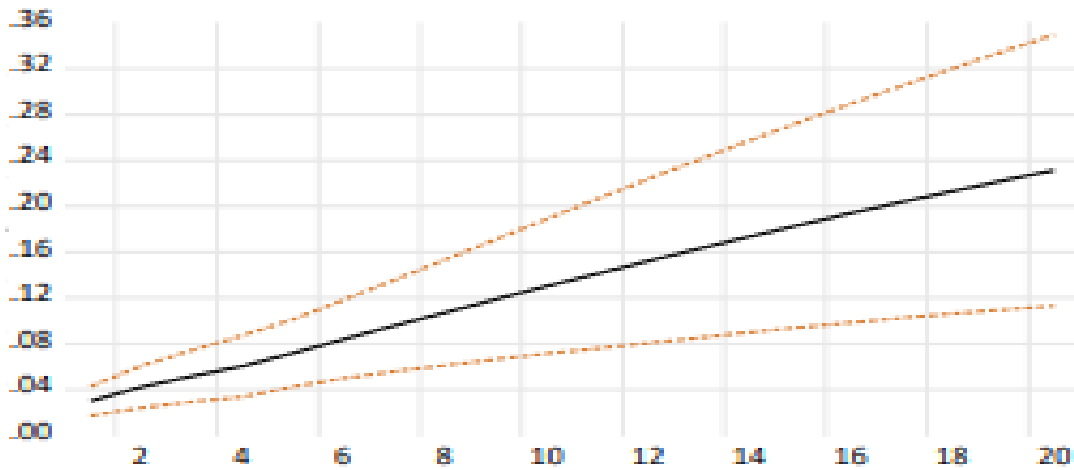
As clearly seen from the below figure, as exchange rate increases, consumer price index will increase. This is due to the increment of price of imported goods and services as well as the raw materials for domestic production. This makes domestic production more expensive (if raw materials are from import) and the final product as well.

Figure 4.5: Response of consumer price index to exchange rate



Source: Own computation using EViews -12 software

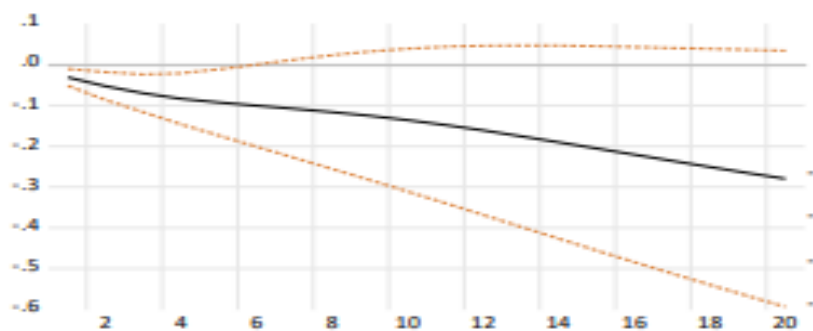
Figure 4.6: Response of CPI to Broad money supply



Source: Own computation using EViews -12 software

As clearly seen from the above figure, one standard deviation shock on Broad money supply increases consumer price index constantly. This shows the response of inflation to BMS is positive and significant. As there is more money in the hands of the public, everyone has the purchasing power, inflation increases for the given amount of goods.

Figure 4.7: Response of RGDP to interest rate



Source: Own computation using EViews -12 software

As interest rate increases, real gross domestic product constantly decreases even if their relationship is minimal at the initial periods. This is due to the contractionary effect of highest interest rate via investment due to monetary transmission mechanisms.

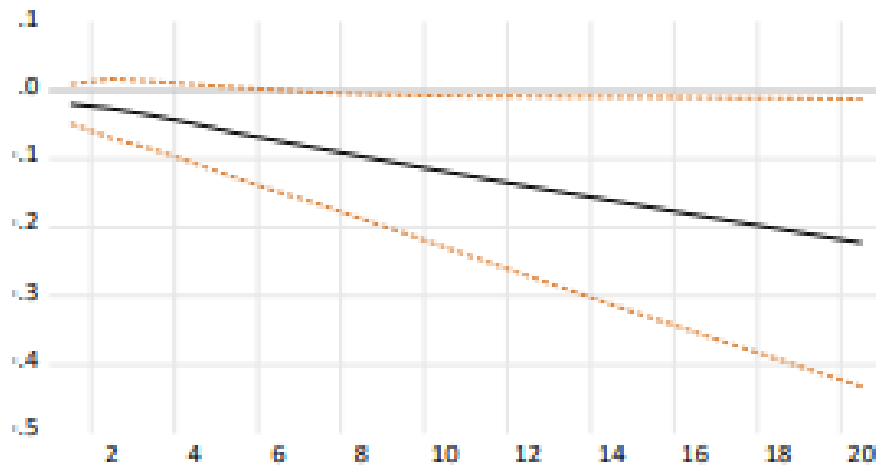


Figure 4.8: Response of CPI to IR

Source: Own computation using EViews -12 software

With the use of the SVAR model, we may examine how one variables react in an impulse to a single shock from other model variables. The above graphs illustrates how inflation reacts abruptly to shocks that are found to affect economic growth and vice versa. Additionally, it demonstrates how a single shock to one of the inventions will affect both the present and future values of the variable. The graph makes it obvious that any stimulus from the money supply has a positive impact on inflation. Up to a few years into the future, each variable's response to its own shocks still works.

4.2.4 Variance decomposition

While impulse response functions monitor the effects of a shock to an endogenous variable on the variables in the VAR, variation decomposition breaks down variation in an endogenous variable into the component shocks to the endogenous variables in the VAR. It focuses on the percentage of changes in dependent variables that are brought on by their own shocks as opposed to shocks from other variables in more detail. The breakdown of the prediction error quantifies the variation of the forecast error and the contribution of each kind of shock. It is useful to calculate the percentage of changes in the volatility of the other variables that may be attributed to the overall variance of one variable.

Table 4.5 variance decomposition of CPI

period	S.E	BMS	CPI	ER	IR	RGDP
1	4.562323	0.726177	99.27382	0.834900	2.8436702	0.004370
2	4.749913	3.236009	92.54614	0.853417	3.293388	0.071130
3	4.809139	3.349186	90.53921	1.887611	4.081867	0.142129
4	4.836132	3.312138	89.55513	2.207057	4.696097	0.229580
5	4.855728	3.296462	88.83529	2.322977	5.200229	0.345043
6	4.872347	3.311455	88.23558	2.402197	5.567377	0.483394
7	4.886894	3.378011	87.71822	2.467633	5.836271	0.637116
8	4.899822	3.378011	87.26122	2.520067	6.040082	0.800623
9	4.911499	3.423690	86.85017	2.560961	6.196134	0.969044
10	4.922163	3.478322	86.47651	2.592357	6.315106	1.137701

Source: Own computation using EViews -12 software

The above table shows that inflation shock explains more than 83.4% of forecast error variance at first period by exchange rate. However, after the tenth period, this proportion falls and reaches 34.7%. Broad money supply shock also explains 0.73% in the first period, consistently increases and reaches 3.48% at the tenth period. The proportion of forecast error variance of consumer price index due to exchange rate, interest rate and RGDP persists and increases from 0.0% to 2.59%, 6.32 and 1.14 % respectively when we move from period one to ten.

Table 4.6: variance decomposition of BMS

Period	S.E	BMS	CPI	ER	IR	RGDP
1	0.958866	100.0000	1.044565	1.986974	0.137348	0.004370
2	0.154357	96.21707	1.055194	2.472287	0.240595	0.014856
3	0.240167	93.20391	1.484409	5.089698	0.200595	0.018052
4	0.279412	91.02532	1.510699	7.308614	0.141835	0.013536
5	0.279412	89.10355	1.440154	9.284472	0.117414	0.054410
6	0.319200	87.19642	1.44477	11.12208	0.128998	0.208023
7	0.360400	85.23643	1.232833	12.83343	0.166316	0.530982
8	0.403684	83.21728	1.110346	14.39561	0.219686	1.057082
9	0.449601	81.16036	0.983978	15.78203	0.280605	1.793021
10	0.498588	79.10349	0.860201	16.97337	0.342284	2.720650

Source: Own computation using EViews -12 software

Broad money supply explains 100% of their forecast error variance at the first period and this slightly falls and reaches at 79.1% at the tenth period.

4.2.5 Post-estimation diagnostic test results (robustness checks)

There are a few diagnostic tests that must be performed after the SVAR model has run in order to guarantee that the results of the SVAR estimation may be used for forecasting or policy analysis. The LM test for residual autocorrelation, the Jarque Bera test for residual multivariate normality, and the White test for the presence of heteroscedasticity are significant post-estimation tests that are frequently run on the residual of the SVAR model.

Finding any correlations between the present values of the regression residuals and any of its lagged values can be aided by testing for autocorrelation (Brooks, 2019). The LM test for autocorrelation's null hypothesis is that the residuals are not serially correlated. As a result, at a 5% level of confidence, the two lag model showed no evidence of autocorrelation at lags one or two.

Under the null hypothesis of normally distributed errors, the Jarque-Bera normality test is performed to evaluate if the regression errors are distributed normally. As a result, at the 5% level of significance, the null hypothesis of normality is rejected if the Jarque-Bera statistic is significant, which occurs when the P-value is less than 0.05 (Brooks, 2019). The joint hypothesis of the JB test indicates that the variables in this study are not normally distributed because the P-values for these tests were less than 0.05.

Additionally, the test for heteroscedasticity looks into whether or not the variance of errors in the model is constant. According to White (1980), if the P-value for the White test statistic is larger than 0.05 and the residuals are homoskedastic and independent of the regressors. As a result, the heteroscedasticity test of this study reveals that the variances of errors are constant .

Finally, if the system is to be used for forecasting and policy analysis, the test for VAR stability is crucial. Therefore, the test for stability determines if the roots of the autoregressive characteristic polynomial are contained within the unit circle. The autoregressive polynomial's inverse roots are thought to be stable and can be utilized for policy analysis if all of them fall inside the unit circle. The unit root circle contains all of the inverse roots of the autoregressive character polynomial.

CHAPTER FIVE

5. CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusions

For more than 20 years, Ethiopia has endured phases of very unstable and unheard-of inflation. According to regional, national, and international sources, the country's inflation rate has risen above the continental norm. Up until recently, many authors and scholars gave the high unpredictability and volatility nature their whole focus. The emphasis placed on fiscal and monetary policy as a means of attaining macroeconomic stabilization has gradually increased in recent years. Using quarterly data, this study used a Structural Vector Autoregressive model to analyze the link between inflation, money supply, and economic growth in Ethiopia. It was motivated by this renewed recognition for its impact on the overall economy and the paucity of previous literature on it in Ethiopia. This research employed descriptive analysis to supplement the econometric findings, primarily to characterize the trend, development, and performance of the consumer price index, broad money supply, and real gross domestic product. According to the descriptive result, there was a significant positive nexus among the three variables, and the money supply in particular had a significant positive influence on the consumer price index.

Our research demonstrates that fluctuations in the average inflation rate are highly sensitive to changes in inflation expectations and significantly sensitive to changes in the growth of the money supply. In Ethiopia, inertial factors continue to be substantially operational because of the positive and extremely significant reaction of inflation to its own shock. Money's ability to represent wealth has significantly lost its credibility. As money growth and the amount of Currency in circulation increased throughout time, the general price level came under even more pressure. In this situation, the NBE and commercial banks must make a substantial effort to build their public image through the implementation of credible monetary policy and fiscal stances that are necessary to combat the growing threat of inflation anticipation. The research shows that Ethiopian inflation is caused by the money supply, supporting the monetarist theory. The monetarist believed that the amount of money available will directly affect inflation to the degree that monetary expansion is not matched by increase in the output sector of the economy.

The research also states that, in the short run, economic expansion has a adverse effect on inflation. Economic growth lowers inflation if the primary drivers of such growth are

noninflationary factors like a rise in output and productivity. When there is an imbalance between the amount of goods available and the amount of money in circulation, inflation results. This occurs when there is an increase in the number of goods available relative to the amount of money in circulation. The rate of inflation and economic growth both exhibit the same link between output and price levels. If the rate of real GDP growth increases while the rates of money supply and money velocity growth are fixed, the growth rate of the price level must decline. However, the inflation rate is simply another name for the price level growth rate, hence inflation must decrease. Since there are more things to chase after as a result of a rise in economic growth, the inflation rate is under pressure to decline. This is only true if supply or productivity increase is the primary driver of economic expansion.

In conclusion, monetary forces can only account for a portion of Ethiopia's inflation. Virtually, money supply increase caused by the current public credit expansion has a substantial and considerable impact on inflation since it keeps the country's currency's value from appreciating. By virtue of the pass-through effect of the currency rate, external shocks also have a negative impact on domestic prices. Through imports, the exchange rate component quickens inflation. The macroeconomic stability has been severely impacted by the expanding trade imbalances caused by the significant foreign price shock through imported price inflation. Exchange rate depreciation's influence strongly provokes the external shock transmission mechanism. Therefore, properly thought-out exchange-rate and monetary policies can quickly enhance trade balance, allowing for the management of price shock at domestic level. Aside from that, a misbehaving oligopolistic market, poor fiscal management, and monetization of the budget deficit could all simultaneously affect inflation.

5.2 Recommendations and Policy implications

The process of sustaining stable prices and, consequently, the health of Ethiopia's macroeconomic environment would be supported by taking note of the following:

- The enhanced sensitivity of inflation to changes in growth of money should be taken into consideration by both monetary and fiscal policy makers. Controlling the expansion of the money supply might result in situational tightening of monetary policy, which can be a significant solution. In addition, it is preferable for the government to rely more on non-seigniorage means of funding its deficits. Increasing domestic capability and making use of resources at home might have a significant stabilizing impact over time.

- The actual production sector (where a larger share of output is derived) is experiencing price shocks, which calls for more investments in agriculture and other food-related industries. Consequently, increasing local and foreign investment initiatives in these sectors could support the process of general growth and price stability, in addition to the government's efforts to support Ethiopia's manufacturing sector.
- According to Keynes's interpretation of QTM, stronger inflationary expectations may have been the cause of the forecasted larger than unit elasticity of the money supply. Thus, by guaranteeing credibility in important economic and general policy parameters, the influence of expectations can be reduced.
- However, if long-term stabilization initiatives are not put in place, inflation feeds on itself. It is best to operate independently since the National Bank of Ethiopia could be political and is under pressure from the ruling party. Consider also that it is immune to political demands to tighten its monetary policy, such as examining financial institutions to enforce reserve requirements or compelling banks to engage in cautious lending practices. However, because monetary policy and fiscal policy are intertwined, offering a central bank legal independence is insufficient to maintain its efficacy. Given the strong correlation between inflation and the money supply, a substantial reduction in the money supply together with a reduction in government spending may be part of the stabilization program. One long-term strategy for reducing inflation and raising employment in Ethiopia is to strike a balance between long-term aggregate supply and demand, as a significant amount of Ethiopia's inflation is caused by a price spike in food and finished goods. The price level and real production at which the money and commodities markets are both in equilibrium are combined to form aggregate demand.

To sum up, our findings strongly suggested that, in order to successfully address the current inflation in Ethiopia, the aforementioned multimodal strategy must be used. But, since other area of interest is only on the monetary sides of inflation, it doesn't mean that there is no other means of inflation and demand pull as well as supply shock (structural righties) are not contributing for the current price hike. They may account for the lion share of it even if it needs empirical investigation.

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APPENDIXES

APPENDIXES A: Diagnostic tests

A1: Optimal lag length selection criteria

VAR Lag Order Selection Criteria

Endogenous variables: BMS CPI ER IR RGDP

Exogenous variables: C

Date: 05/20/23 Time: 18:11

Sample: 1 100

Included observations: 92

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3175.221	NA	7.29e+23	69.13523	69.27228	69.19055
1	-2447.635	1360.269	1.70e+17	53.86162	54.68394	54.19352
2	-2381.709	116.0867	7.01e+16	52.97193	54.47952*	53.58041
3	-2331.526	82.91150	4.10e+16	52.42447	54.61733	53.30952*
4	-2294.942	56.46583	3.26e+16*	52.17265*	55.05078	53.33429
5	-2278.822	23.12878	4.11e+16	52.36569	55.92909	53.80391
6	-2247.623	41.37278*	3.81e+16	52.23093	56.47960	53.94573
7	-2223.093	29.86293	4.18e+16	52.24114	57.17508	54.23252
8	-2197.620	28.24094	4.65e+16	52.23088	57.85008	54.49883

* 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

A2 Autocorrelation test

VAR Residual Serial Correlation LM Tests

Date: 06/12/23 Time: 14:20

Sample: 1 100

Included observations: 98

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	75.79897	25	0.0000	3.314396	(25, 291.3)	0.6234
2	35.79893	25	0.0747	1.462316	(25, 291.3)	0.1632

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	75.79897	25	0.0000	3.314396	(25, 291.3)	0.8283
2	121.9298	50	0.0000	2.708685	(50, 336.3)	0.3124

*Edgeworth expansion corrected likelihood ratio statistic.

A3: VAR residual normality test

VAR Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: Residuals are multivariate normal

Date: 06/12/23 Time: 14:09

Sample: 1 100

Included observations: 98

Component	Skewness	Chi-sq	df	Prob.*
1	-0.941814	14.48789	1	0.0001
2	-0.033387	0.018207	1	0.8927
3	3.037674	150.7153	1	0.0000
4	-2.626098	112.6411	1	0.7832
5	1.262703	26.04217	1	0.0064
Joint		303.9046	5	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	9.342971	164.2859	1	0.2356
2	11.86867	321.1680	1	0.0000
3	18.97311	1041.823	1	0.7205
4	32.23317	3489.527	1	0.7853
5	9.601757	177.9647	1	0.0000
Joint		5194.769	5	0.0000

Component	Jarque-Bera	df	Prob.
1	178.7738	2	0.9015
2	321.1862	2	0.0000
3	1192.538	2	0.4450
4	3602.168	2	0.0000
5	204.0069	2	0.4420
Joint	5498.674	10	0.0000

*Approximate p-values do not account for coefficient estimation

A4: VAR Residual Heteroscedasticity Test

VAR Residual Heteroskedasticity Tests (Includes Cross Terms)

Date: 06/12/23 Time: 14:15

Sample: 1 100

Included observations: 98

Joint test:

Chi-sq	df	Prob.
1259.475	945	0.1534

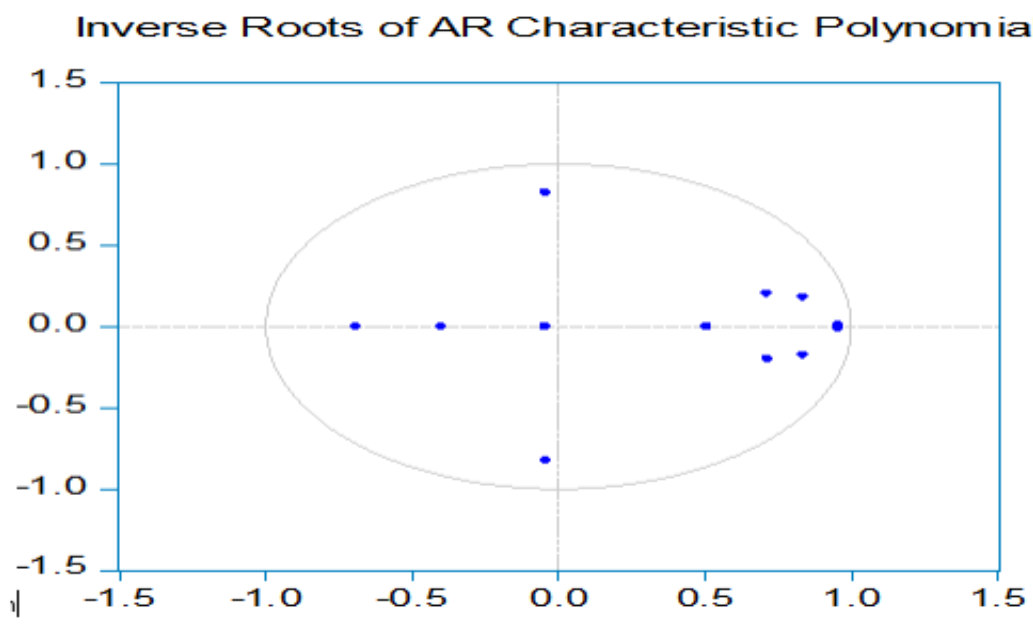
Individual components:

Dependent	R-squared	F(63,34)	Prob.	Chi-sq(63)	Prob.
res1*res1	0.993279	79.75564	0.0000	97.34132	0.0036
res2*res2	0.870348	3.622876	0.0001	85.29414	0.0323
res3*res3	0.839470	2.822198	0.0007	82.26806	0.0520
res4*res4	0.721080	1.395219	0.1467	70.66585	0.2370
res5*res5	0.977942	23.92664	0.0000	95.83830	0.0048
res2*res1	0.961025	13.30725	0.0000	94.18046	0.0066
res3*res1	0.882566	4.055933	0.0000	86.49145	0.0265
res3*res2	0.808556	2.279332	0.0053	79.23852	0.0813
res4*res1	0.962996	14.04493	0.0000	94.37365	0.0064
res4*res2	0.814792	2.374236	0.0037	79.84957	0.0745
res4*res3	0.819719	2.453886	0.0028	80.33250	0.0695
res5*res1	0.936087	7.904364	0.0000	91.73655	0.0105
res5*res2	0.860983	3.342458	0.0001	84.37636	0.0374
res5*res3	0.857633	3.251089	0.0002	84.04799	0.0394
res5*res4	0.832962	2.691213	0.0012	81.63027	0.0573

A5: model stability test

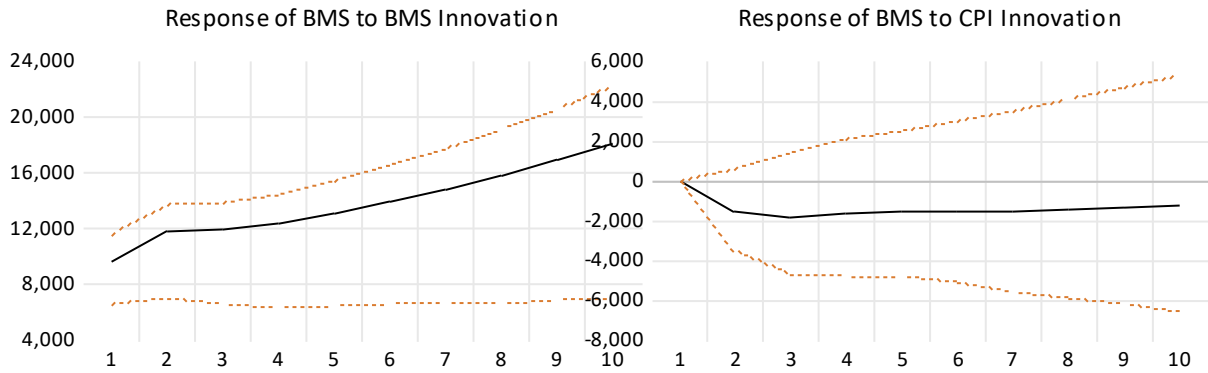
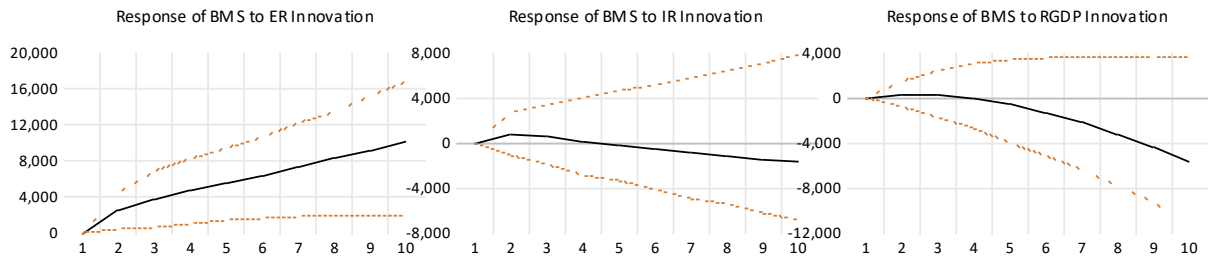
Roots of Characteristic Polynomial
 Endogenous variables: BMS CPI ER IR
 RGDP
 Exogenous variables: C
 Lag specification: 1 2
 Date: 05/21/23 Time: 10:05

Root	Modulus
0.999996	0.999996
0.971323	0.971323
0.920416 - 0.147381i	0.932141
0.920416 + 0.147381i	0.932141
0.873574	0.873574
0.340479	0.340479
0.082077 - 0.296813i	0.307952
0.082077 + 0.296813i	0.307952
0.143547	0.143547
-0.051174	0.051174

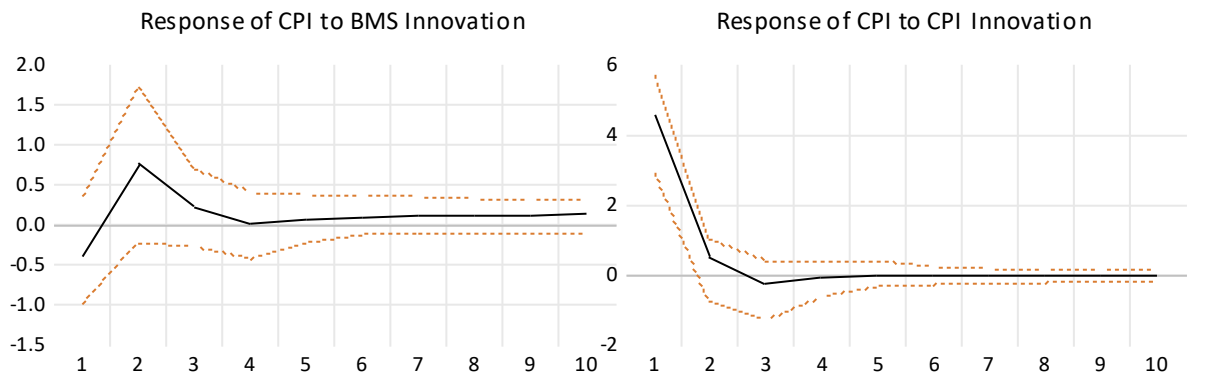
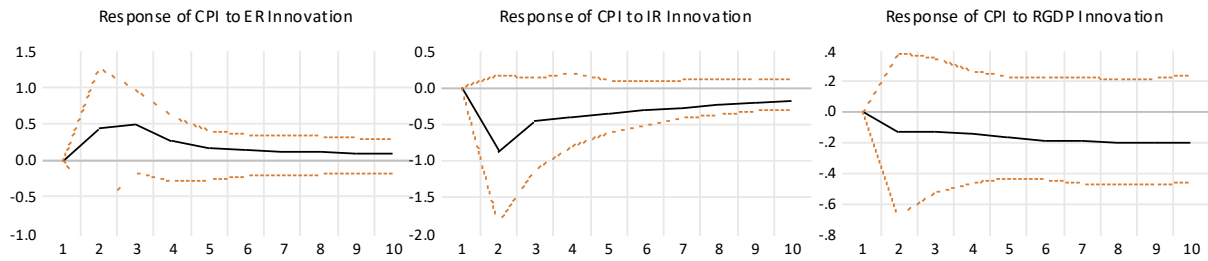


Appendix B: Impulse response function

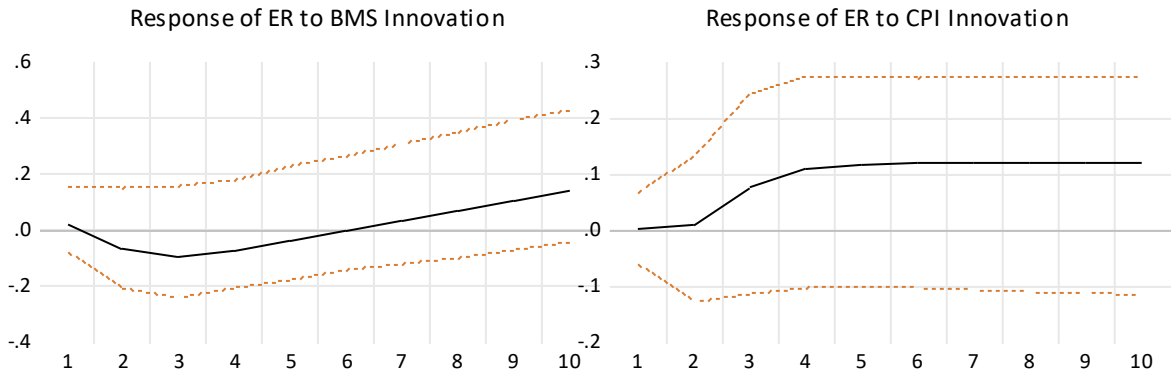
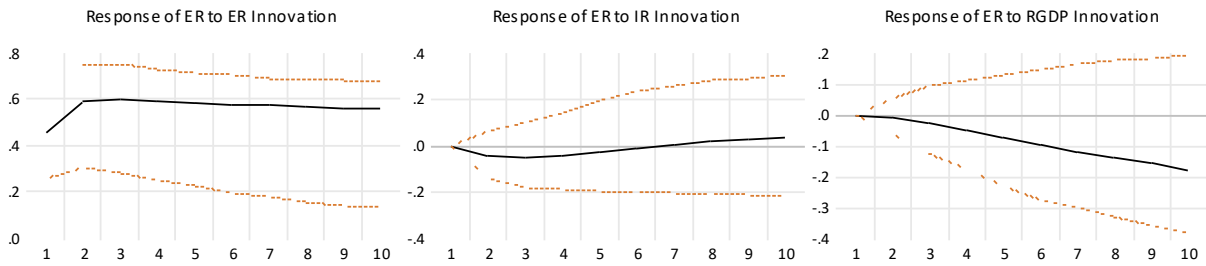
Response of BMS to innovations



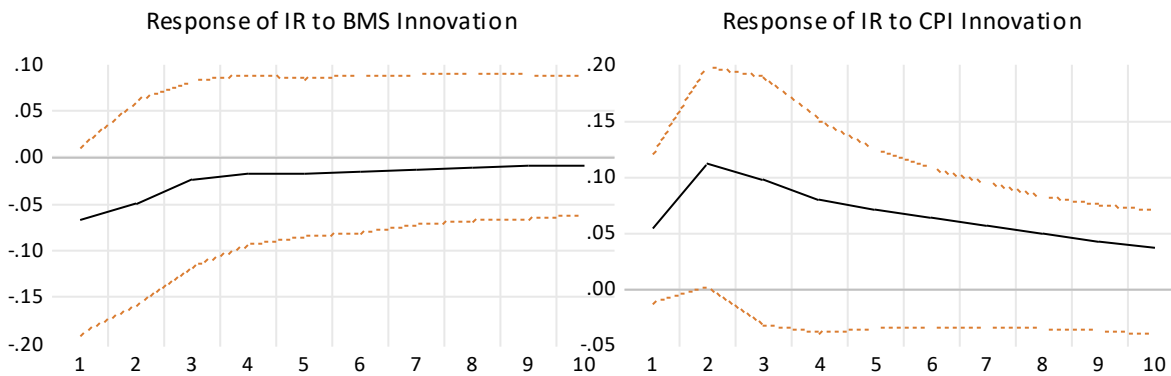
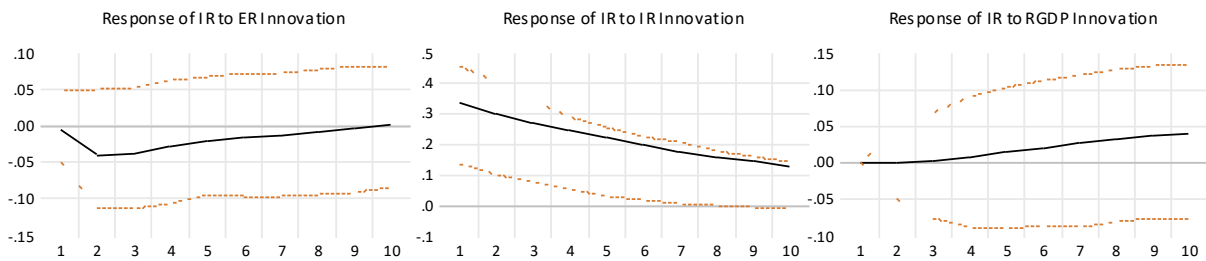
Response of CPI to innovations



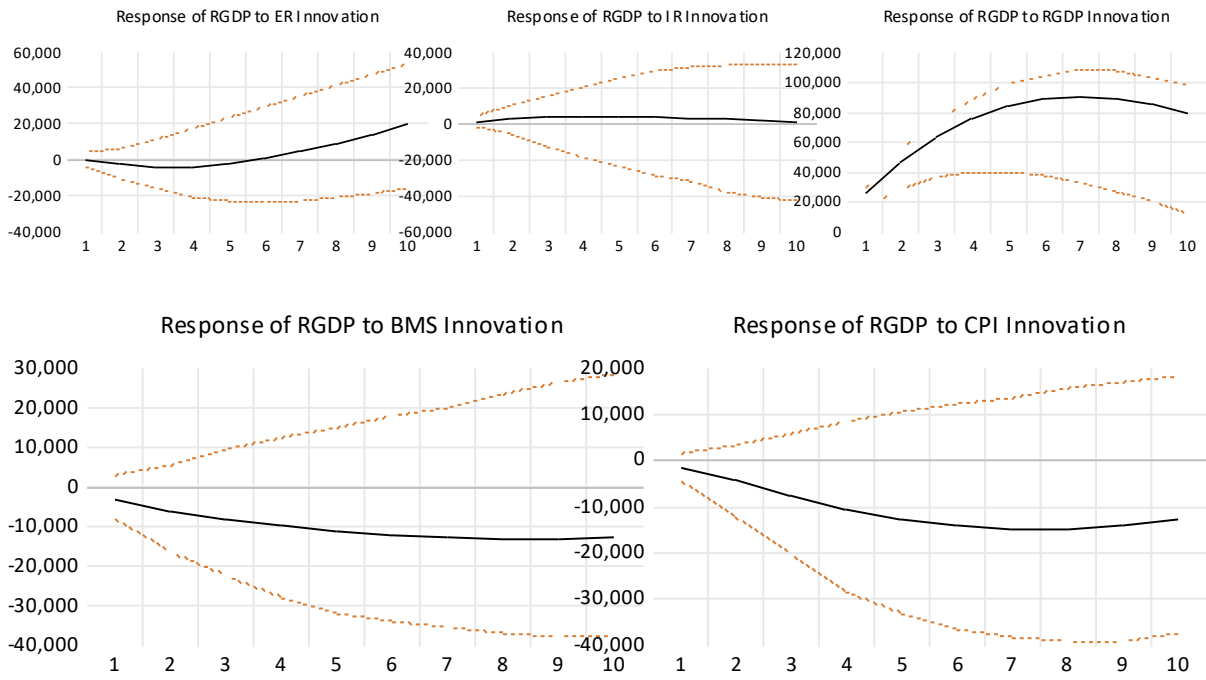
Response of ER to innovations



Response of IR to innovations



Response of RGDP to innovations



Appendix C: Variance decomposition

Variance Decomposition of BMS:

Period	S.E.	BMS	CPI	ER	IR	RGDP
1	0.958866868	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.154357323	96.21707	1.055194	2.472287	0.240595	0.014856
3	0.199834798	93.20391	1.484409	5.089698	0.203927	0.018052
4	0.240167089	91.02532	1.510699	7.308614	0.141835	0.013536
5	0.279412506	89.10355	1.440154	9.284472	0.117414	0.054410
6	0.319200084	87.19642	1.344477	11.12208	0.128998	0.208023
7	0.360408579	85.23643	1.232833	12.83343	0.166316	0.530982
8	0.403684068	83.21728	1.110346	14.39561	0.219686	1.057082
9	0.449601129	81.16036	0.983978	15.78203	0.280605	1.793021
10	0.498588389	79.10349	0.860201	16.97337	0.342284	2.720650

Variance Decomposition of CPI:

Period	S.E.	BMS	CPI	ER	IR	RGDP
1	4.562323	0.726177	99.27382	0.000000	0.000000	0.000000
2	4.749913	3.236009	92.54614	0.853417	3.293308	0.071130
3	4.809139	3.349186	90.53921	1.887611	4.081867	0.142129
4	4.836132	3.312138	89.55513	2.207057	4.696097	0.229580
5	4.855728	3.296462	88.83529	2.322977	5.200229	0.345043
6	4.872347	3.311455	88.23558	2.402197	5.567377	0.483394
7	4.886894	3.340761	87.71822	2.467633	5.836271	0.637116
8	4.899822	3.378011	87.26122	2.520067	6.040082	0.800623
9	4.911499	3.423690	86.85017	2.560961	6.196134	0.969044
10	4.922163	3.478322	86.47651	2.592357	6.315106	1.137701

Variance Decomposition of ER:

Period	S.E.	BMS	CPI	ER	IR	RGDP
1	0.461703	0.161707	0.000480	99.83781	0.000000	0.000000
2	0.755162	0.813499	0.019854	98.79783	0.351883	0.016934
3	0.976216	1.419737	0.630788	97.38040	0.474005	0.095068
4	1.152423	1.404507	1.319253	96.53851	0.469859	0.267869
5	1.301570	1.186175	1.815334	96.05160	0.405559	0.541335
6	1.433281	0.979155	2.174491	95.59915	0.338037	0.909164
7	1.553147	0.870212	2.450233	95.02884	0.289210	1.361501
8	1.664959	0.909729	2.663187	94.27812	0.262889	1.886080
9	1.771500	1.133144	2.821959	93.31969	0.256335	2.468869
10	1.874917	1.565981	2.932064	92.14211	0.264615	3.095231

Variance Decomposition of IR:

Period	S.E.	BMS	CPI	ER	IR	RGDP
1	0.345478	3.730083	2.517577	0.025041	93.72730	0.000000
2	0.475602	3.062984	6.805132	0.710403	89.42147	1.36E-05
3	0.557728	2.416765	8.030198	0.941833	88.60903	0.002169
4	0.615588	2.063638	8.294411	0.965666	88.65898	0.017301
5	0.658617	1.864892	8.388987	0.943533	88.74315	0.059438
6	0.691466	1.738849	8.435727	0.910850	88.77463	0.139942
7	0.717012	1.650174	8.443211	0.873967	88.76599	0.266657
8	0.737191	1.583667	8.420640	0.836473	88.71631	0.442908
9	0.753349	1.531316	8.378645	0.802260	88.62114	0.666635
10	0.766444	1.488360	8.325265	0.775739	88.48015	0.930483

Variance Decomposition of RGDP:

Period	S.E.	BMS	CPI	ER	IR	RGDP
1	0.25900468	1.524965	0.433553	0.000537	0.230447	97.81050
2	0.54030236	1.682514	0.724611	0.175201	0.297187	97.12049
3	0.84134085	1.647001	1.096375	0.271750	0.323110	96.66176
4	0.11424345	1.621806	1.444705	0.252552	0.326178	96.35476
5	0.14300519	1.632419	1.726501	0.183437	0.310796	96.14685
6	0.16951989	1.670812	1.937393	0.132384	0.284320	95.97509
7	0.19324022	1.726222	2.085526	0.158761	0.253488	95.77600
8	0.21389741	1.789408	2.180350	0.315983	0.223124	95.49113
9	0.23144506	1.852283	2.230165	0.654052	0.196285	95.06721
10	0.24601395	1.907444	2.242239	1.220333	0.174684	94.45530

Cholesky One S.D. (d.f. adjusted)

Cholesky ordering: BMS CPI ER IR RGDP

Declaration

I, the undersigned, hereby state that this thesis is my own unique work, written using our own knowledge and expertise for the first time. Additionally, the sources and data utilized in this essay are all dutifully cited. I further affirm that the thesis has not been submitted, in whole or in part, to any other institution of higher learning with the intention of obtaining a degree.

Name

Signature