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Monetary Policy Transmission Mechanism in Developing and Emerging Market Economies
The case of Ethiopia and India

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Monetary Policy Transmission Mechanism in Developing and Emerging Market Economies: The case of Ethiopia and India

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Abstract

The study examined effectiveness and challenges of monetary policy transmission channels of India and Ethiopia using quarterly data from 1982Q1 to 2019Q4. To do so SVAR is used to examine the sign and duration of response of output and price to monetary policy shocks and channels of monetary policy for both Ethiopia and India. Exchange rate channel is important channel in India and explains about 12.95% and 13.14% of variation in GDP and price respectively. Whereas asset price channel is found as a weak monetary policy transmission channel and private credit channel is also statistically insignificant at 95% confidence interval. Low banking sectors' efficiency level, prevalence of bad loans, high stock market volatility and lower stock market depth, high government interference in the form of big borrower and low status of central bank independence are some of the challenging factors for effectiveness of monetary policy transmission channels in India. Money supply affects price, exchange rate and credit positively in Ethiopia. Exchange rate is an important channel in Ethiopia and explains about 20% of variation in price. Lending interest rate and private credit by banks are found insignificant at 95% confidence interval in Ethiopia. Different factors are responsible for the effectiveness of monetary policy transmission channels such as higher bank costs, volatility of commercial banks' banking system, less usage of banking services among the people and low habit of using electronics machines.

Key Words: Monetary Policy Transmission Channel, SVRA, Impulse Response

1. Introduction

Monetary policy is implemented to achieve macroeconomic objectives of sustained economic growth, full employment, stable price and equilibrium balance of payment (Sulaiman, 2014). Central bank controls money supply to regulate aggregate demand so as to attend the stated objectives (Evans, 2018). At the time of economic recession an easy monetary policy help to stimulate aggregate demand and employment. However, when there exists an inflationary pressure, central bank will use a tight monetary policy to control aggregate demand (Chipote, 2014).

In this regard monetary policy is powerful to promote economic growth in developing and emerging economies. For instance, monetary policy is effective in affecting economic growth in Nigeria (Adefeso, 2010) and (Adeolu, 2012). Monetary Policy measures are effective in controlling unemployment and economic growth in Nigeria (Nwoko, 2016). The work of (Rakic, 2013) and (Ayşe, 2015) revealed that Monetary policy is crucial in stimulating economic growth in Serbia and Turkey. Monetary policy contributes a significant role for economic growth in Ghana and Jordan (Havi, 2014) and (Awad, 2017). Monetary policy is powerful in enhancing economic growth in south Asian economies (Shahid Ali, 2009).

However, effectiveness level of monetary policy is challenged in developing countries by existence of non-formal financial institutions, lower money bank deposits, macroeconomic uncertainty and low bank services usage of the people (Iyaji, 2012) , (Fasanya, 2013), (Robe, 2003) and (Bloom, 2014).

Monetary policy to be effective there should be a significant transmission mechanism to the real economic variables (Nielsen, 2020). Theoretically, monetary policy was assumed to have different channels. For instance, according to Keynesians monetary policy can influence economic activities through interest rate channel[1]. Whereas monetarists believe that monetary policy can regulate money supply to influence decision making behavior of agents in which agents are allowed to have access to different portfolio alternatives in the short run[2].

The most important transmission channels of monetary policy presented in literatures are the interest rate, asset price, exchange rate and the credit channels (Gottschalk, 2014).

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[1] https://www.microeconomicsnotes.com/monetary-policy/classical-keynesian-and-modern-views-on-monetary-policy/1549
[2] https://www.economicsdiscussion.net/keynesian-economics/keynesian-and-monetarist-views-on-monetary-policy/14753

The timing and efficacy level of monetary policy transmission mechanism depends on financial market development and integration, macroeconomic uncertainty, degree of central bank independency, payment systems and currency convertibility (Bhoi, 2017), (Carranza, 2010), (Bandi, 2020) and (Nielsen, 2020).

Accordingly, monetary policy transmission channels varies across countries. For example, credit channel is the most important transmission channel in Japan (Bayoumi, 2001). However, in Asian countries short term interest rate is an effective channel (Unsal, 2014). Given that bank finance system is dominating the financial market in emerging economies, interest rate channel is the most important channel (Marques, 2020).

Interest rate channel is the most effective channel in Malaysia (Tang, 2006); the credit channel is the most essential channel in India (Aleem, 2010). Interest rate, credit and asset prices channels are the most important channels whereas exchange rate channel is insignificant in India (Khundrakpam, 2012). Policy rate, exchange rate and credit are effective but the asset price channel is weak in India (Kamaiah, 2014) and (Sengupta, 2014). (Barendra, 2015) found that interest rate channel is the most important transmission channels in India.

Moreover, credit channel is the most effective channel in East African countries (Davoodi, 2013) while the bank lending channel is the most relevant in Eritrea (Mengesha, 2013).

Monetary aggregate and credit channels are effective channels but the exchange rate channel is ineffective in Ethiopia (Alemayehu, 2011). However, (Nuru, 2013) found that exchange rate channel is effective while the credit and interest rate channels are weak in Ethiopia. Moreover, in the work of (Yesigat, 2020), credits and nominal effective exchange rate channels are effective whereas interest rate channel is less effective in Ethiopia.

Thus, the mechanism that monetary policy transmitted to the economy is heterogeneous across countries. Therefore, the following issues take my attention and indicates existence of literature gap, 1), there is inconsistency of findings about effectiveness of monetary policy transmission channels among different studies in emerging and developing countries overtime, 2), majority of researches such as (Alemayehu, 2011), (Nuru, 2013), (Mengesha, 2013), (Kamaiah, 2014), Unsal, (2014), Barendra, (2015) and Marques, (2020) do not consider external factors into account while studing the transmision channels. However, external market for goods and services and financial assets potencially affect the domestic demand and domestic financial systems. Moroever, developing countries are more likely influenced by foreign economic conditions and hence in this study foreign macroeconomic variables like US GDP and the US market interest rate are

considered. Moreover, 3), as to the best of my knowledge I could not find literatures showing the challenges that are responsible for ineffectiveness of some of monetary policy transmission mechanisms.

In general studying effectiveness of alternative monetary policy transmission mechanisms in developing and emerging economies is intuitive because of the following rationalities. Firstly, the financial system in emerging and developing countries are bank dominated financing system because the financial market is not well developed (Das, 2015) and (Schanz, 2020). Moreover developing countries has undertaken policy measures such as liberalization of financial markets, but there exist less organized security and equity markets. Thus, it is intuitive to examine the efficacy of alternative monetary policy transmission mechanisms in developing and emerging economies.

Second, developing countries' macro economy is highly exposed to foreign financial shocks that could influence effectiveness of monetary policy implementations (Buteau, 2011). However, literatures such as (Alemayehu, 2011), (Mengesha, 2013) and (Nuru, 2013) did not consider external factors while studying the transmission channels of monetary policy.

Third, mostly literatures also focus on single transmission channel. For instance (Das, 2015), (Ndubuisi, 2015) and (Yanamandra, 2016) studied monetary policy transmission mechanism in India using the interest rate channel. However, in less organized financial market the interest rate channel is not an important transmission channel (Prachi, 2012).

Credit channel is also studied by (Chakravarty, 2005), (Rajan, 2010), (Jeevan, 2011) and (Dang, 2011). However, taking single transmission channel couldn't show the effectiveness of monetary policy. Since monetary transmission channels are interdependent to one another in some extent, taking only one channel might led to biasedness in the statistical output. Moreover, taking all the necessary transmission channels help us to understand the relative importance of those channels. In this regard this paper considered three transmission channels which are exchange rate, credit and asset price channels for Indian case. lending rate, credit and exchange rate channels are also considered for Ethiopian case.

In the fourth place, pointing out the possible challenges that affect the efficacy level of monetary policy transmission channels is helpful for policy makers.

Thus, studying how changes in monetary policy tools are transmitted to real variables like output and price is intuitive in a financially underdeveloped economies. Accordingly, I considered

Ethiopia and India to study the effectiveness of existing major monetary policy transmissions channels and the possible challenging factors. These countries are deliberately chosen because of the following facts. 1), Ethiopia is one of fast growing economy with under developed financial market, 2), Ethiopian government has undertaken policy measures that allowed Ethiopian born diasporas to buy shares and open banks since 2019 in the country which was not allowed before, 3), currently the country is also opening capital market. Thus, it is essential to analyze the possible transmission channels and challenges of monetary policy in Ethiopia. Whereas India is an emerging economy with moderate central bank independence and financial development. The two countries are at different stages of financial development stages. However, these countries follow federal administrative structures with ethnic diversity and hence there may be lessons that developing countries like Ethiopia could gain from India.

This study is organized as follows; in section2 research objectives are presented, section 3 deals with theoretical backgrounds and review of literatures, section 4 provides detail information about monetary policy frameworks of Ethiopia and India cases, in section 5 empirical estimation models are developed, in section 6 and 7, I present major findings and conclusions respectively and in section 8 some recommendations are forwarded.

2. Objectives of the Study

2.1. General Objective of the Study

This paper investigates the effectiveness of monetary transmission channels of monetary policy in the case of Ethiopia and Indian.

2.2. Specific Objectives

- ➢ To evaluate the existing monetary policy transmissions channels
- ➢ To analyze factors that influence monetary policy transmission channels
- ➢ To discuss the major challenges that might hinder effectiveness of transmission channels

3. Theoretical Background and Literature Review

This part deals with theoretical and empirical literature reviews. Accordingly, majority of the theories are related to effectiveness and transmission channels of monetary policy. Different theories argued different transmission channels since the 19th century. Their argument mostly relies on assumption made regarding price and output in long run and short run horizons.

Monetary policy transmission mechanism deals with the impact of policy induced change in policy rate on aggregate demand (Ireland, 2005).

3.1. Theoretical Background

This part contains theories associated with effectiveness of monetary policy and possible transmission mechanisms.

The Classical Theory of Monetary Policy

The classical theory of monetary policy is explained using the quantity theory of money. This theory is on the basis of a simple accounting identity function of; $MV = PY$ where M stands for money stock, V represents velocity of money and P and Y stands for general price and output level respectively. Classical economists believe existence of stable velocity of money and output. Consequently, an exogenous change in money supply will lead to the same proportion change in price level (Tsoulfidis L. , 2008).

Keynesian Theory of Monetary Policy

According to Keynesian view monetary policy can have impact on real economic variables through interest rate channel in the short run. They reject idea of quantity theory of money and believe that money supply and price can be related indirectly through interest rate. Accordingly, an expansionary monetary policy can lower interest rate via increasing loanable funds in the banking system and hence investment and output will be improved (Vane, 2005).

However, a successive expansionary monetary policy may result in liquidity trap. It is a situation where interest rate is at minimum and change in money supply may not have any impact on interest rate further. In such cases change in money supply can be absorbed by velocity of money since Keynesian assume that velocity of money is variable (Tadesse, 2020).

In the long run expansionary monetary policy will result in inflation. Consequently Changes in the supply of money will not have effect on output level in the long run (Tsoulfidis L. , 2008).

The New Classical and New Keynesians

The new classicals believe that unexpected monetary policy shock is effective in the short run (Palley, 2021). Moreover, the new Keynesian asserting that monetary policy has not long run impact on output and employment since in the long run the economy is at natural rate of unemployment (Niehans, 1987).

The Monetarist View of Monetary Policy

Monetarists argue that monetary policy is effective and hence money supply is crucial for wellbeing of an economy. They advocate a stable growth rate of money supply to observe a sustainable economic growth. For them the economy may not at full employment at least in the short run and

hence expansionary monetary policy can boost aggregate demand in short run. But in the long run the economy will be at full employment, expansionary monetary policy may lead to inflation (Niehans, 1987).

Monetary Policy Transmission Channels

It's a mechanism that shows how unexpected monetary policy impulse transmitted to real economic variables. The transmission channels are viewed in different perspectives among economic theorists. Generally, economists reach in consensus that monetary policy instruments can be transmitted to real economic variables through four channels; interest rate, exchange rate, credit and asset price channels.

The Interest Rate Channel

This channel works following monetary policy shocks that affect money supply (reserve changes). Accordingly, a change in money supply will affect real interest rate so that interest rate sensitive variables, like consumption and investment, will be influenced. For instance, a raise in interest rate, following tight monetary policy measures, results in increase opportunity cost of investment. Consequently, it will lead to reduction in investment (Steven Kamin, 2001), (Kamaiah, 2014) and (Marques, 2020).

Moreover, central banks can also use the short term interest rate (policy rate) to affect the lending, deposit rates and inter-bank rates (market interest rate). A change in market interest rate will influence the decision making behavior of households and firms ((BIS), 2008). However, interest rate channel is weak in emerging and developing countries because of different challenging factors such as less developed money and bond markets and interest rate controls ((BIS), 2008).

The Exchange Rate Channel

Secondly monetary policy can be transmitted through exchange rate channel. When Central bank changes the short term interest rate (policy rate), there will be capital inflows or out flows so that currency will be appreciated or depreciated. For instance expansionary monetary policy (reduction in policy rate) leads to capital outflows and depreciation of domestic currency against foreign currency which boost net export and aggregate demand (Kamaiah, 2014). In the other way round depreciation of domestic currency, following expansionary monetary policy, may increase the liabilities of firms if their liabilities are denominated in foreign currency forms. Thus balance sheet of firms will be badly affected and hence ability of borrowing and credit extension of firms will be

deteriorated thereby investment will be declined (Marques, 2020). Marques showed that exchange rate channel is effective in emerging economies.

However, nature of exchange rate regime and capital market status determine the effectiveness of exchange rate channel (Khundrakpam, 2012). Exchange rate channel is effective in small open economy if the country follows flexible exchange rate regime.

The Credit Channel

The credit channel is also the third transmission mechanism. This channel can be seen in two perspectives, the bank lending and the balance sheet channels (Gertler J. , 1995) and (Rosen, 2007). According to the bank lending channel, expansionary monetary policy leads to an increase in bank deposits and hence loan disbursement to households and investors will rise so that consumption and investment will be enhanced. The monetary policy also affects real variables by influencing balance sheet position of firms (Stein, 1994). For instance expansionary monetary policy leads to rise in equity price of firms and hence their balance sheet will be improved. Thus, improvement in net worth of firms will reduce the adverse selection problem faced by banks so that bank's credit to investors will rise so that investment and aggregate demand will be appreciated.

However, the credit channel to be effective banks should be as main sources of financing for private sectors. Moreover, non-performing loans and reduction in balance sheet position of borrowers have strong impact on the effectiveness of credit channel (Khundrakpam, 2012).

The Asset Price Channel

Asset price channel can be considered as the fourth transmission channel. This channel affects real economic variables through wealth and Tobin's Q effects (Turner, 2008) and (Horatiu, 2013). Accordingly, expansionary monetary policy enables households to value their equity at higher amount and perceives wealthier so that their consumption will be boost. Moreover, expansionary monetary policy will have a positive effect on investment through Tobin's Q channel. That is expansionary monetary policy leads to an increase in market value of firms relative to replacement cost of capital and hence resulted in improvement of private investment.

In summary, to show how the transmission channels work, here I adopt a chart that is developed by (Davoodi H. , 2013) which shows the mechanisms how monetary policy transmitted to price (inflation) and output (GDP). It links the policy variables and real variables through four intermediate channels. For instance when the central bank changes its policy rate, its effect will transmitted to market and interbank interest rates, deposit and lending rates. Economic agents will

revisit their consumption and saving decisions so that aggregate demand will be influenced. Finally the effected will be reflected on price and output (GDP).

Chart 1, monetary policy transmission channels

```
Monetary policy → Reserve policy rate →
    → Interest rate → Domestic demand →
    → Asset price →
    → Exchange rate → Net external demand →
    → Credit → Loan & balance sheet →
    Domestic demand, Net external demand → Aggregate demand →
    Loan & balance sheet → Aggregate supply →
    Aggregate demand, Aggregate supply → Price / Output
```

Sources: modified from Davoodi
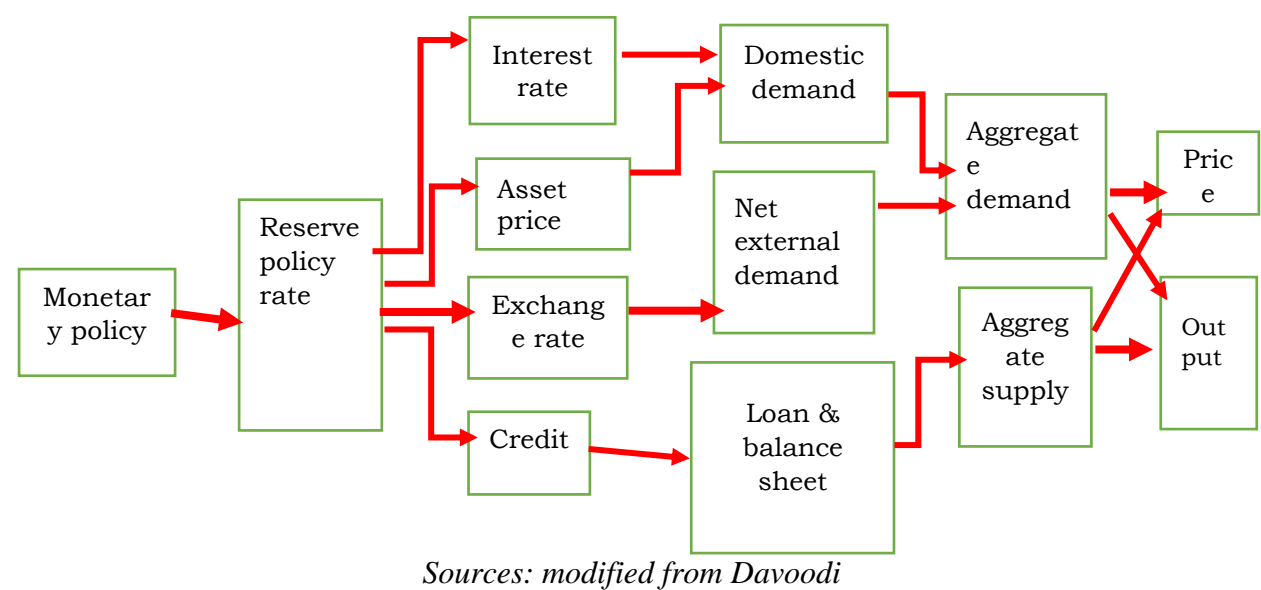
3.2. Empirical Review of Literature

In this part research works in relation to transmission mechanisms of monetary policy is reviewed both in developing and emerging economies.

Monetary Policy Transmission Channels and Associated Factors

Monetary policy transmission channels are heterogeneous among economic theories. For instance, the classical quantity theory of money argued that monetary policy is transmitted directly into price level. According to monetarists, monetary policy can be transmitted through interest rate and exchange rate channels. Whereas the Keynesians belief that monetary policy is effective through interest rate, bank lending and balance sheet channels (Mishkin F. , 1995).

Literatures show that the transmission channels are also heterogeneous among different countries. The structure of the financial system and the response of household and firms towards monetary policy shocks influenced the effectiveness of monetary policy transmission channels (Turner, 2008).

Turner found that if government's involvement in the financial system is lower, the interest rate channel become more effective than the credit channel. Thus, degree of government interference in the financial system has a strong impact on effectiveness of transmission channels.

Development level of financial systems in emerging economies affects the effectiveness of asset price channel. Thus, depth, accessibility and efficiency level of financial intermediaries and financial markets have a significant effect on effectiveness of the channels (Turner, 2008).

Interest rate channel is the most effective channel in advanced economies because financial markets are well developed in advanced economies. Whereas in emerging economies the bank lending and exchange rate channels are the most effective monetary policy transmission channels. While in small open economy exchange rate channel is more important transmission channel (Cevik S. , 2015).

Presence of underdeveloped financial market adversely affects security markets in developing countries. Consequently, interest rate and asset price channels are not effective. Moreover, huge intervention of central bank in the foreign exchange market makes the exchange rate channel ineffective (Mishra, 2012).

Effectiveness of Monetary policy channels depends on the type of monetary policy shocks in India. For instance, the bank lending channel is more effective in a tight monetary policy than in an expansionary monetary policy (Kumar S. , 2011).

This is because of behavior of economic agents following monetary policy measures. For instance, if the central bank used tight monetary policy via increasing policy rate. The rise in policy rate will transmitted to money market and other interest rates in an economy. Thus, commercial banks will boost lending interest rates too. However, an increase in lending rate could rise the probability of default. Therefore, commercial banks will limit the amount of credit during tight monetary policy periods (rise in interest rate). Thus, credit rationing for economic agents will lead to a stronger negative impact on investment and output so that it will amplify the effect of tight monetary policy. However, expansionary monetary policy will not necessarily rise credit and investment. There is an statement that '*one could lead a horse to water but no one can't make it drink*' (Barnichon, 2017).

Moreover, according to the arguments of Barnichon price and wage are downward rigid which makes tight monetary policy more effective to affect output than expansionary policy. For example following tight monetary policy aggregate demand will decline but price is sticky downward and hence firms will respond by reducing production and will end with lower output but non-significant impact on output. However, following expansionary monetary policy, aggregate demand will rise and price and wage are less sticky for upward direction and hence firms will adjust wage and price

so that output will not be affected. Therefore, unlike to tight policy, expansionary monetary policy is less effective to influence output.

Unexpected monetary policy shock can be transmitted to GDP and price level through short term interest rates in India. Whereas the asset price channel is weak following monetary policy shocks. The exchange rate channel is also important channel in India (Aleem, 2010).

Monetary policy is effective to influence private consumption and investment through interest rate channel in emerging economies. However, domestic financial market development matters for the effectiveness of the transmission channel (Mukherjee, 2011).

The interest rate channel is an effective and more important channel than the credit channel in emerging economies. However, globalization has a strong impact on interest channels through foreign interest rates (BIS, 2008).

Accordingly, globalization in financial market will weaken the power of domestic central bank so that the interest rate become ineffective. But the following premiss have to meet. 1), if the long term interest rate is determined by expected future short term rates, 2), if the domestic risk premia is sensitive to the foreign risk premia and 3), domestic assets are a close substitute to foreign financial assets (BIS, 2008).

Moreover, globalization leads to locational competition among countries in the world. Such competition leads to reduction in price of goods and services. This implies that the role of monetary policy to stabilize price level will be reduced (Wagner, 2001).

Inflation is also influenced by regional areas. For instance about 50% of inflation dynamics is determined by globally in euro area which makes the monetary authority unable to control inflation fully (Blot, 2016).

However, an argument by (Bank for International Settlements, 2005) indicates that monetary policy could be effective with globalization because domestic and foreign assets could not perfect substitutes.

Summary of literatures

Some of empirical literatures are summarized as follows which help the writer to choose the most widely used methodology while estimating the monetary policy transmission channels.

Author	Scope	Method	Findings
Aleem (2010)	1996Q4-2007Q4	VAR	✓ credit channel is an important channel in India
Kamaiah(2014)	1992Q2-2012Q4	SVAR	✓ exchange rate channel is the most important channel in India
Adefeso (2010)	1970-2007	ECM	✓ monetary policy is much stronger than fiscal policy in Nigeria
Sengupta (2014)	1993Q2-2012Q1	VAR	✓ Bank lending, exchange rate and Interest rate channels are effective transmission channels. Whereas, the asset price channel is week in India
Khundrakpam (2012)	1997Q1-2012Q1	SVAR	✓ interest rate channel, credit channel and asset prices channel are found to be important, while exchange rate channel is weak in India
Turner, M. S. (2008)	1990-2006	Narration	✓ exchange rate channel is very important channel in developing countries
Mengesha (2013)	1996Q1–2008Q4	SVAR	✓ interest rate and official exchange rate channels are inactive ✓ effective exchange rate and credit channels are effective in Eritrea
Yesigat (2020)	1995Q1-2018Q4	SVAR	✓ monetary aggregate, exchange rate and credit to the private sector are effective in Ethiopia ✓ while the interest rate channel is weak
Bayoumi (2001)	1980Q1-1998Q3	VAR	✓ Credit channels is important transmission channels in Japan
Barendra (2017)	1997Q1-2014Q4	VAR	✓ The interest rate channel is the most dominant in India
Unsal (2014)	2000Q1-2010Q4	SVAR	✓ Short term interest rates is the most important channel in Asia

4. Monetary Policy Frameworks

In this section detail discussion of monetary frameworks of Ethiopian and Indian economies is made.

4.1. Monetary Policy Framework in Ethiopia

In Ethiopia monetary policy is under supervision of the National Bank of Ethiopia (NBE) but directed by the prime minister's office. National Bank of Ethiopia (NBE) is established in 1963 to act as monetary authority of the country.

Monetary policy experienced different targeting approaches through time. For instance, the central bank adopted exchange rate targeting monetary policy framework from 1970 to 1992. However, following the downfall of the military government in 1992, the country followed managed floating exchange regime. Monetary policy framework also changed into multiple indicator approach from 1992 to 2008. The major macroeconomic variables that had been considered were price, exchange rate, foreign exchange reserve position, real sector indicators, and balance of payments and fiscal trends. National bank of Ethiopia adopted exchange rate and price stability approach since 2008. Accordingly NBE used single digit inflation targeting monetary policy framework starting from 2008. Broad money supply (M2) and reserve money have been set as intermediate and operational targets respectively (NBE, 2021).

Monetary Policy Instruments in Ethiopia

The main aim of monetary policy in Ethiopia is price stabilization (Haile, 2016). Ethiopia is suffering from high inflation which is driven by supply side inflation due to bad weather condition and backward agricultural practices. In addition fiscal budget deficit and presence of oligopolistic prices worsen inflation (Alemu, 2016). A persistent higher inflation results in serious problems especially on urban households. Thus, the government targets a single digit inflation rate and used different monetary policy measures such as reserve requirement adjustment, increasing interest rate and OMO (Bessie, 2016) and (Tadesse G. , 2020). The country continually implementing a tight monetary policy approach and strengthen it since 2018.

However, usage of monetary policy instruments is limited in Ethiopia because of underdeveloped capital markets. The first instrument is open market operation. National bank of Ethiopia (NBE) undertakes sales and purchase of government securities. The second monetary policy tool is standing facility. It is a credit facility guaranteed by the central bank when commercial banks face problem of financial shortfall in the absence of inter-bank immediate fund raisings.

Reserve requirement is also another tools of the central bank of Ethiopia. Reserve required ratio declined from 28.7% in 2017 to 15.8% in 2019 while Treasury bill is stable since 2017. Bond holdings by commercial banks and non-bank institutions showed a 19.7% growth rate in 2019. Moreover, National bank of Ethiopia uses instruments like setting deposit and lending interest rates' floor, repo and inverse repo operations and moral suasion (NBE, 2021). Government's treasury bill and reserve money are the most important instruments of monetary policy in Ethiopia. The following figure (Figure 1) indicates trends of some of policy instruments overtime in the country.

Public institutions are dominant agents that participate in treasury Bill markets because return on treasury bills is lower than the banking deposit rate so that private sectors could not attracted into the market. In the early of 2000 the supply of T-Bills improved and the yield reaches minimum in 2005. However, since 2012 treasury bill yield is stable though supply and demand for government security increases steadily except in 2019. This implies that the bond market improved overtime in Ethiopia.

However, in 2019 supply of treasury bill drops because economic growth is observed to be slow so that monetary policy followed accommodative approach to improve liquidity in circulation.

Reserve money is higher during in the early of 1990s. it was transition period in the Ethiopian political environment. The government raised reserve money to control inflation but inflation was above 15%. Generally, figure 1 reveals the country adopted tight monetary policy.

Figure 1 Evolution of monetary policy instruments

in Million Birr

change in reserve money
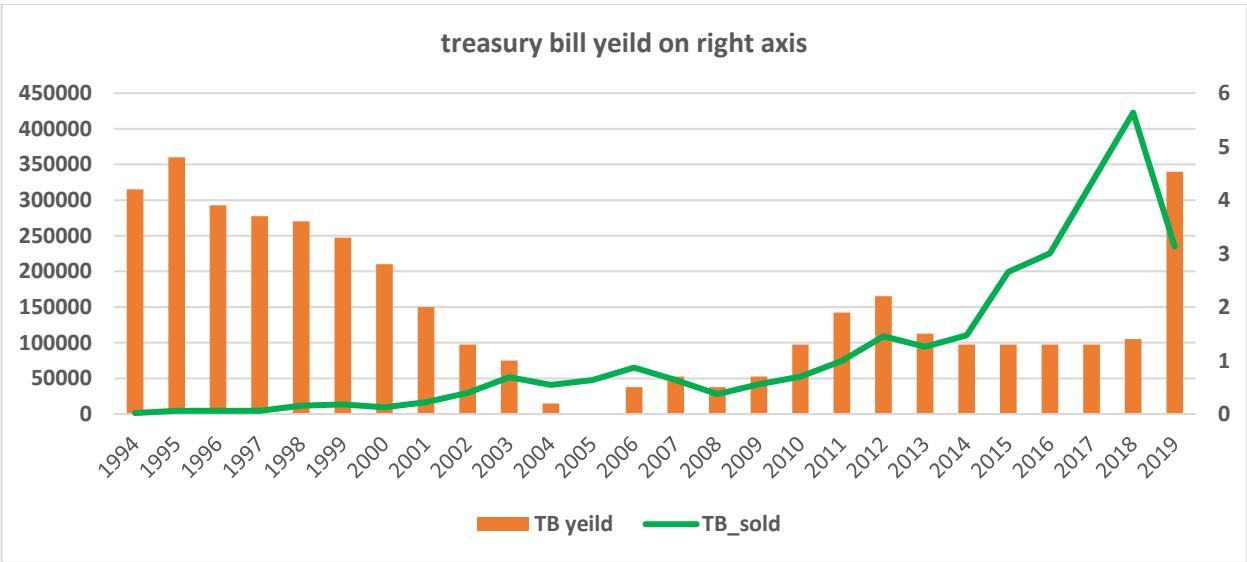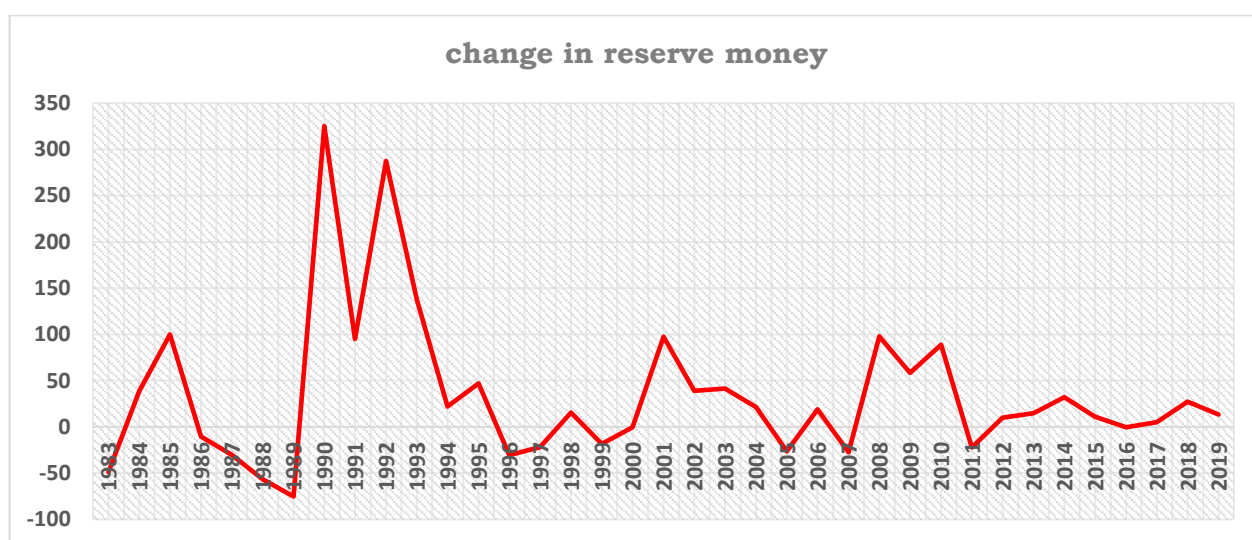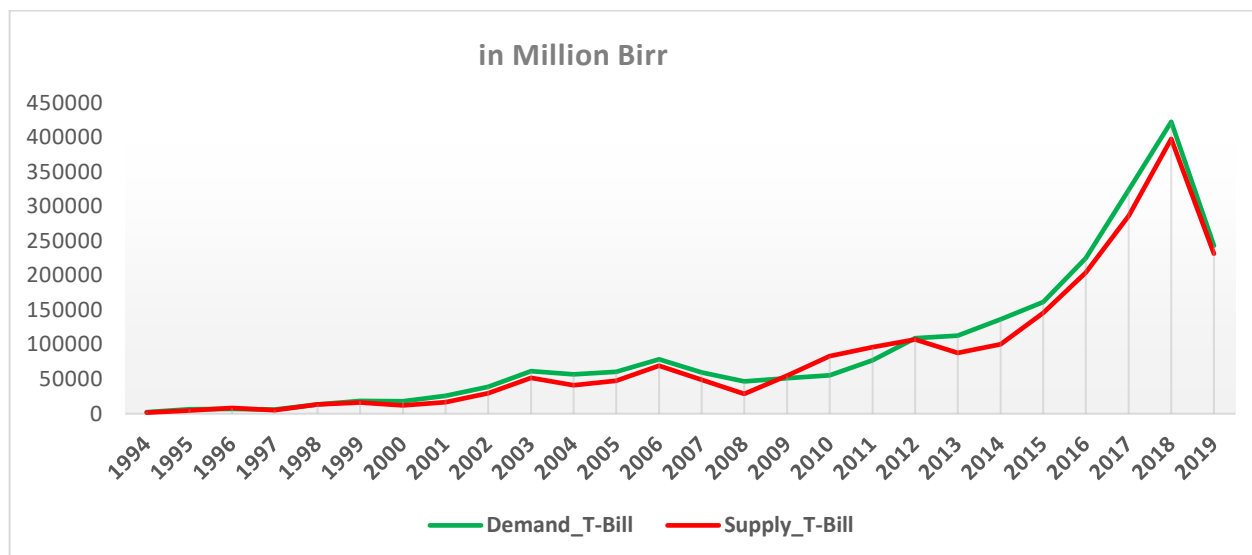
Sources of data, NBE 2021

Trends of Selected Macroeconomic Variables in Ethiopia

In this section evolution of interest variables are presented to diagnose the trends and co-movements of real economic variables and monetary policy variables. Interpreting and analyzing the correlation between such macroeconomic series is used as supplementary to empirical model results.

Trends of Inflation, Lending Interest Rates and money supply in Ethiopia

On average inflation remains above 10% for long periods because of supply push and demand pull inflation drivers. Literatures show that inflation arise due to an amalgam of factors such as rise in money supply, government expenditure, exchange rate, interest rate, oil price, wages and agricultural supply shocks in Ethiopia (Geda, 2009), (Menji, 2008), (Durevall, 2012) (Desta, 2016) and (Melaku, 2020).

For instance, even though the country follows a tight monetary policy (figure 2), domestic money supply (M2) grows at higher rate because deposits and domestic credit was raised at higher rate too. This would have a positive effect on consumption of durable and non-durable goods so that price would move upwards unless supply met the growing demand. In this regard tight monetary policy measures seems ineffective and higher inflation persists.

Figure 2 confirms that money supply and inflation have systematic relationship overtime. Inflation rate move upward following a positive growth in money supply. Moreover, a supernormal inflation is observed whenever growth rate of money supply is at the highest level. In this regard those literatures seems confirmed which states money supply has an inflationary pressure. Thus, money supply can be seen as an important policy variable in Ethiopia. Inflation remains higher than the target of central bank of Ethiopia.

A higher inflation lowers real interest rate so that creditors would be negatively influenced. Interest rate and inflation are expected to move in opposite directions. However, figure 2 did not show a systematic relationship between lending rate and inflation rate trends. Following the over through of the military regime, the transition government raised lending interest rate until 1995. Moreover, during the 2008 financial crisis lending rate is observed at higher value so as to control inflation but the country is unable to achieve its inflation target. The pairwise correlation matrix (table 1) indicates that lending rate and inflation are positively related but it is very weak. This implies that economic agents are less responsive for change in interest rate. It may also has another implication that large portion of households don't have account in commercial banks (only 34.83% of population, whose age is above 15, has account in financial institutions: World Bank, 2019) so that their consumption behavior is independent of the interest rate movements.

Figure 2 also shows that lower growth rate of money supply is associated with higher lending rate and vice versa. Thus the figure reflects that lending rate is counter-cyclical to money supply growth rate. It is in line economic theory that an expansionary monetary policy leads to a lower lending rates or conversely reducing lending rate is symptom of expansionary monetary policy in an economy. Thus, the figure supports my expectation that money supply is inversely related with lending rate so that money supply is counter-cyclical to lending rate in Ethiopia.

Figure 2 trends of inflation and lending interest rates in Ethiopia

inflation and lending rate (lending rate on right axis)

lending rate on right axis
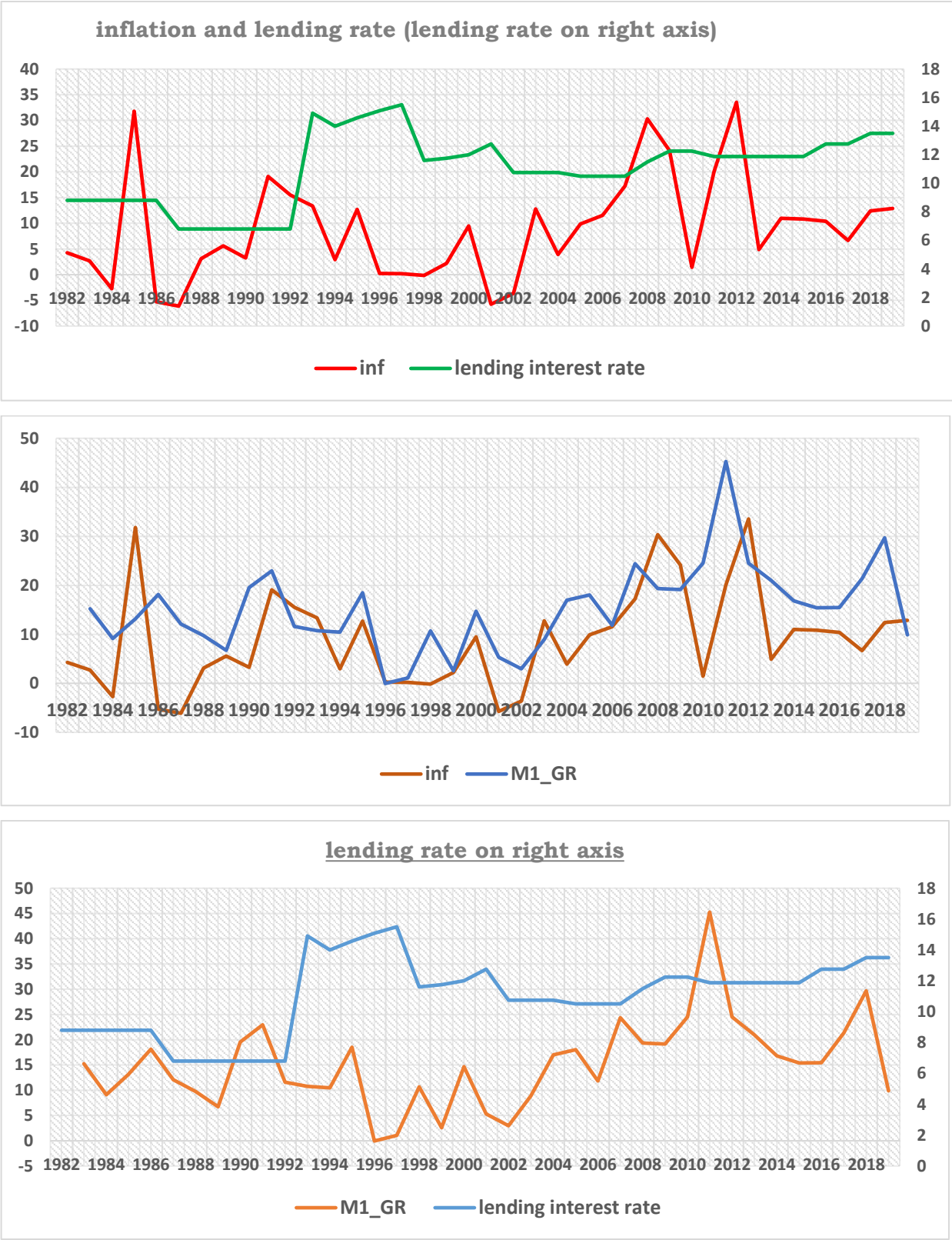
Sources, world Bank, 2020

Trends of GDP Growth, Money Supply Growth Rates, exchange rate and private credit in Ethiopia

Money supply and economic growth have similar trend in Ethiopia (figure 3). In the short run money supply is expected to have a positive role for growth but in the long run output and velocity of money are supposed to be stable and hence the effect of money supply may be proportionally transmitted to price level. Even though money supply and GDP growth have similar trend, it couldn't be a guarantee that rise in money supply fasten GDP growth rate. In the other way round excess money supply lead to rise in investment on alternative business portfolios because opportunity cost of money will decline following an ease monetary policy in the short run. Empirical literatures also confirm the positive role of money supply for economic growth. However, the statistical significance contribution of money supply for growth is still shall be addressed using a more standard quantitative approach which is dealt in section six (findings and discussions).

Ethiopia is adopting a managed floating exchange rate regime. The Ethiopian exchange rate raised from 2.5 Ethiopian Birr (ETB) per US dollar in 1970 to 29.1 ETB per us dollar in 2019 (world bank, 2020). Following the downfall of the military government in 1992, the transition government switched from fixed exchange rate to managed floating exchange rate regime and hence greater currency depreciation had been observed since 1993. Figure 3 reveals that higher currency depression had been undertaken in 1993, 2011 and 2017 however, GDP growth became stable since 2004.

In theory, depreciation of exchange rate is an incentive to firms to improve their competitiveness in international markets so that their export capacity will be enhanced. However, on the other round business enterprises import capital inputs and other industry raw materials and hence depreciation of domestic currency against foreign currency results in appreciation of cost of production. To obtain the adequate compensation firms will want to charge higher price and their competitiveness may be offset.

Moreover, if producing units' liabilities are foreign currency denominated, their repayment amount will rise so that their debt sustainability and balance sheet position of enterprises will be badly affected. However, figure 3 does not confirm existence of systematic relationship between GDP growth and exchange rate in the country. Therefore, the impact of exchange rate shock on real GDP is an empirical issue which is discussed in section six in detail.
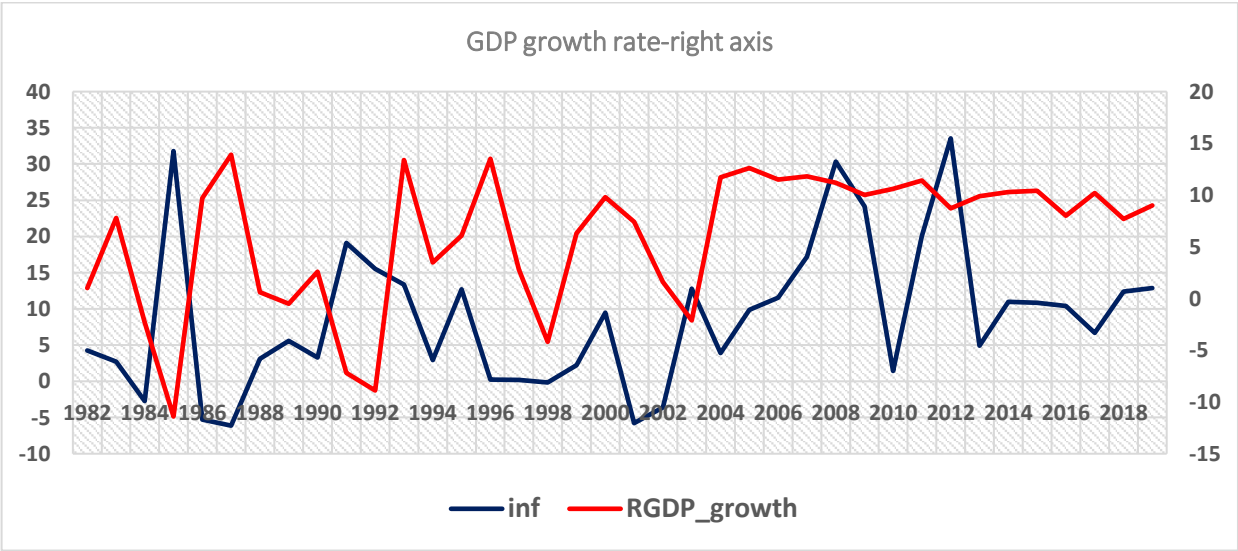
Figure 3 also indicates existence of positive co-movement between private credit and real GDP. Credit to private sectors by banks is an important means of solving financial constraints of firms and households. One aim of financial institutions is helping the smooth pass of an economy and reducing unemployment by providing adequate loans to investors and entrepreneurs. The a quote by Robert T. Kiyosaki '*money is only an idea, if you want more money simply change your thinking*' implies that if financial institutions are able to provide loans to entrepreneurs, a business can start its operation with insufficient initial endowments of owners what matters is an innovative business idea. Thorofare, with the help of financial institutions business operations will be expanded and new ways of production become realized which would have been assumed impossible in the absence of credit access.

Consequently, Private credit is expected to boost economic growth and pro-cyclical to real GDP in Ethiopia. In this regard figure 3 reveals that private credit follows similar trend with real GDP. The figure confirms that when percentage change in private credit reaches at pick, a highest GDP growth rate is also observed and also at minimum credit, GDP growth rate is witnessed to be low. Thus, such systematic relationship between percentage change in credit and GDP growth rate confirms the importance of private credit for expansion of an economy.

Figure 3 shows that trends of inflation and growth rate of GDP are moving in opposite direction. The inflation-output gap theory seems violated in this regard. This implies that the aggregate supply shock outweighs the aggregate demand shock in the economy so that output and price will move in an opposite direction.

Figure 3 GDP growth rate, money supply growth, and exchange rate

percentage change in credit on right axis

GDP_Growth — percentage change in credit

GDP growth rate- right axis

percentage change in exchange rate — RGDP_growth

GDP growth rate-right axis

inf — RGDP_growth
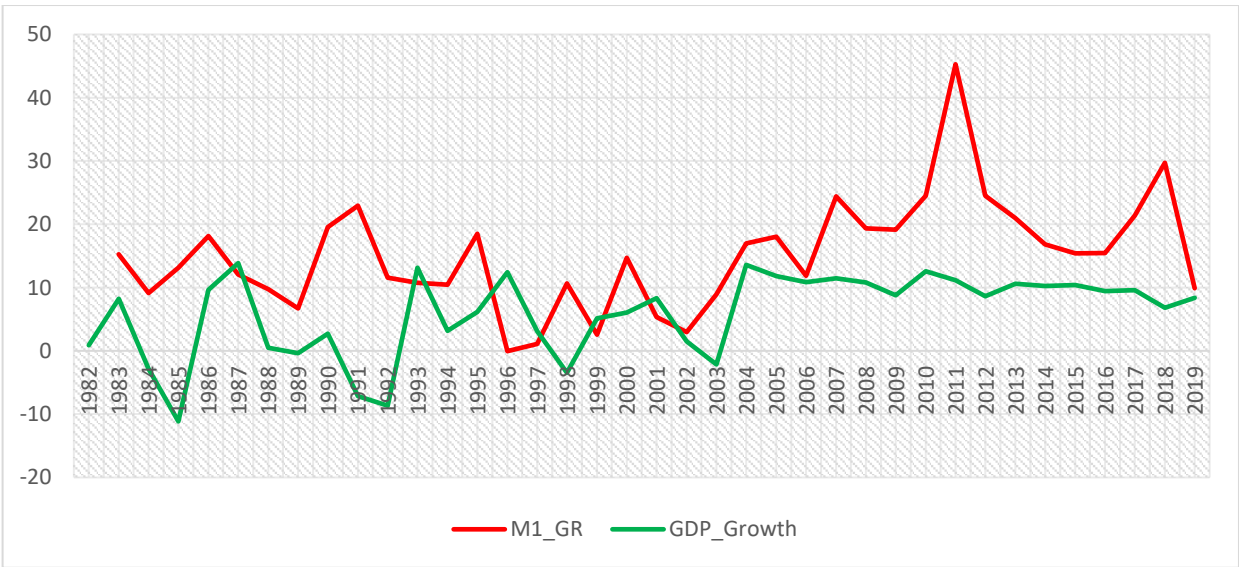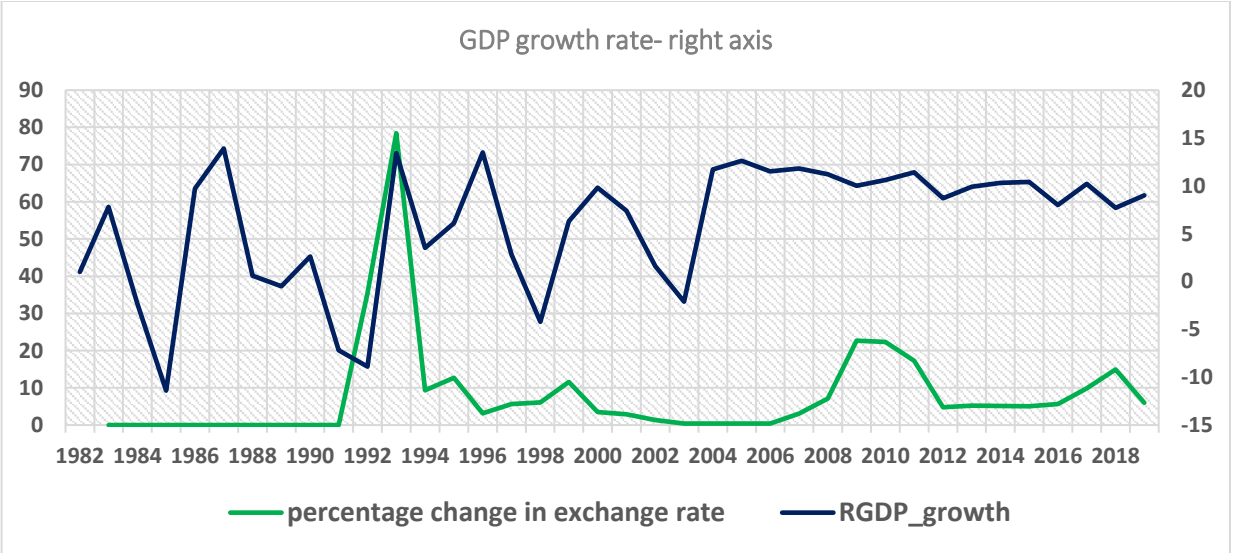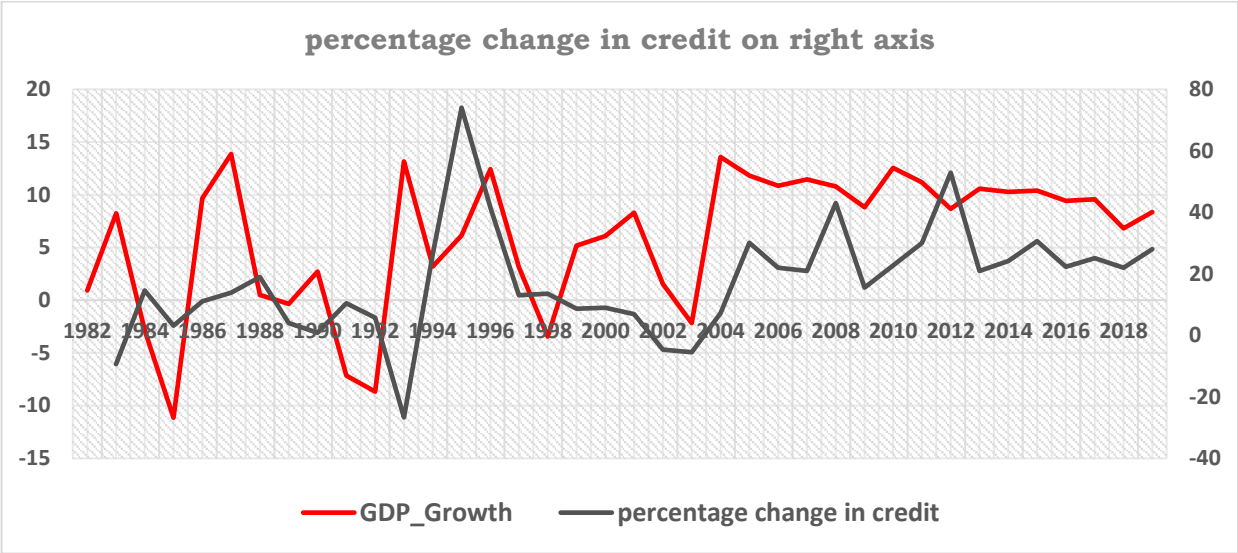
Sources, world Bank, 2020

Scatter Plots

Moreover, to confirm trend of monetary policy variables, output, inflation and channels of monetary policy, scatter plots and correlation matrix is designed as follows.

Figure 4 reveals existence of positive relationship between Inflation and Money supply (m2). It confirms the quantity theory of money supply. Output and velocity of money stability results in transmission of money supply to price level at least in the short run. In this circumstance expansionary monetary policy will bring rise in general price level. Therefore, observing an upward curve in the space of inflation and money supply confirms that money supply is one of the driving forces of inflation in Ethiopia. But the wide disbursement of actual series indicates the relationship is weak and hence the significant impact of money supply in determining inflation is tested in section six.

Moreover, the negatively sloped lending rate against money supply confirms the negative relationship between interest rate and money supply though it is weak. It confirms figure 2 which confirms that money supply is countercyclical to lending rate in Ethiopia. Real GDP is positively correlate with money supply. It is also in line with figure 3 in which money supply is expected to be act as a catalyst of economic growth in the country at least in the short run.

Figure 4 RGDP growth rate, lending rate, inflation money supply (M2) scatter plot
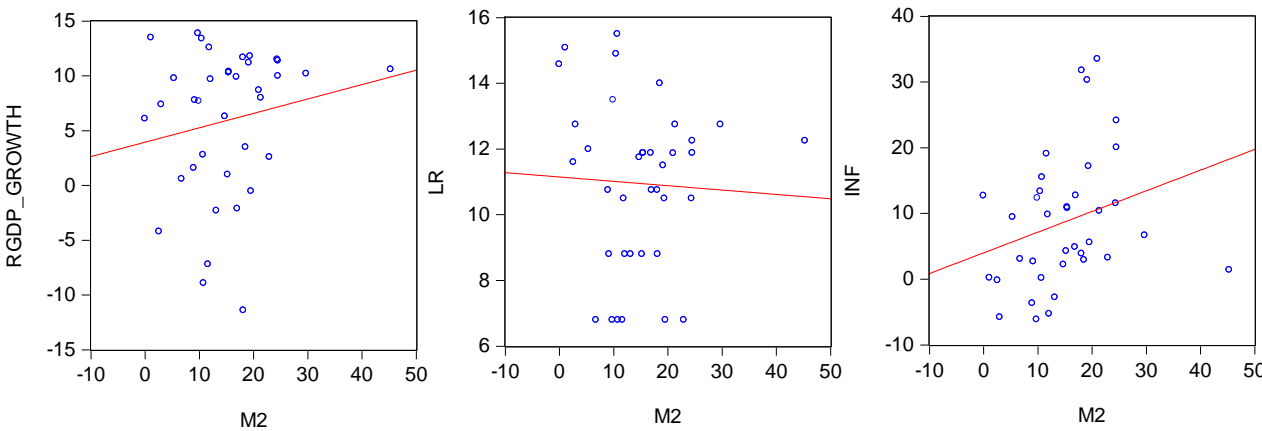
Sources, own estimation

Both credit to private sectors and exchange rate are positively related with money supply (M2) (figure 5). Following expansionary monetary policy (rise in M2) domestic currency become less attractive so that capital outflow leads to depreciation of domestic currency against the foreign currency. Therefore, figure 5 confirms such premises since exchange rate and money supply are positively related. Moreover, rise in money supply will lower opportunity cost of borrowing in one way and loanable accounts in financial institutions in the other way round. Thus, it will be a good

fortune for firms and households to have access for borrowing at lower interest rate (opportunity cost of borrowing). Therefore. Total private credit by banks will improve following an increase in money supply. Consequently, figure 5 reveals a positive association between money supply, credit and exchange rate depreciation in Ethiopia.

Figure 5 private credit, exchange rate and money supply (M2) scatter plot
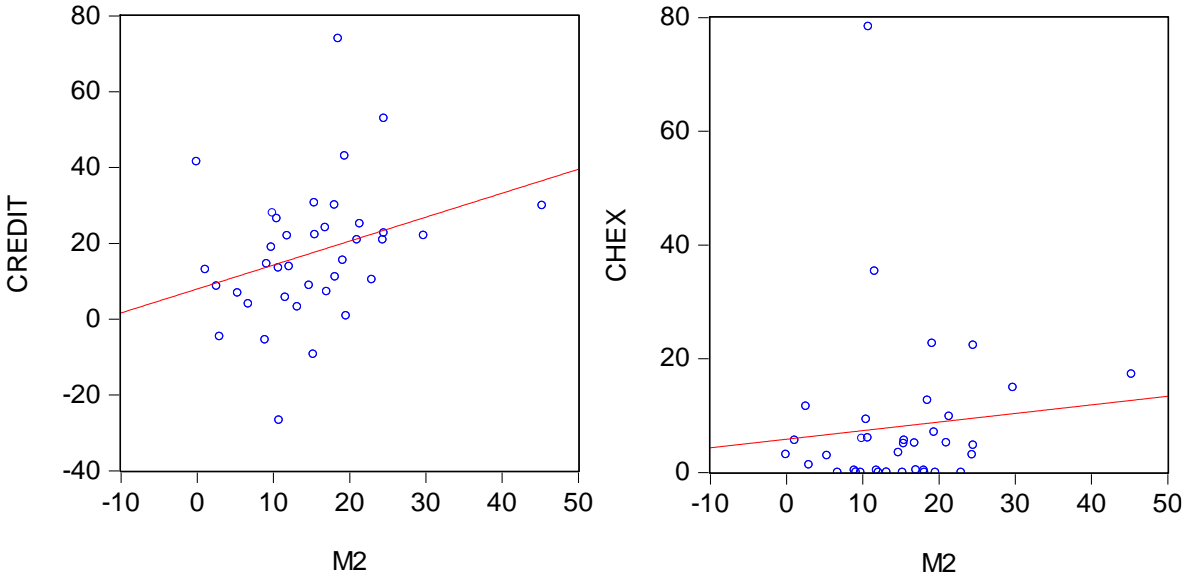
Sources. Owen estimation

Pairwise Correlation Matrix

The pairwise correlation matrix confirms the scatter plots presented on figure 4 and 5. Real GDP has a strong correlation with lending rate and exchange rate and weak relationship with inflation rate in Ethiopia. However, inflation is highly correlated with money supply which implies money supply has a strong share in determining inflation in the economy. Inflation is unlikely affected by banks' lending rate.

The correlation matrix does not support the output gap and inflation relationship. A negative correlation between inflation and real GDP implying the violation of the output gap and inflation relationship theory. A supply side shock dominates in developing countries. For instance demand side shock is important in the short run whereas supply side shock is most important both in the short run and in the long run (Krehlik, 2017). Moreover, labor supply and oil price shocks take a lion share in determining output shock while aggregate demand side shock accounts only 40% of the output variation (Shapiro, 2018). Thus, in situations where supply shock dominates the demand shock, the output gap theory may not holds true given that aggregate supply shock and price are inversely related. In such circumstance the effectiveness of monetary policy will be affected.

This is because of the fact that monetary policy is transmitted through aggregate demand channel and hence if the supply shock is dominating in an economy the transmission channels of monetary policy may not functional and became ineffective.

Table 1 pairwise correlations in Ethiopia

Corr	RGDP	Inflation (inf)	M2	Lending rate (Le-rate)	Exchange rate (ex)	Credit
RGDP	1.00					
inf	-0.09039	1.00				
M2	0.255	0.469	1.00			
Le-rate	0.459	0.047	-0.042	1.00		
ex	0.417	0.2409	0.389	0.523	1.00	
Credit	0.294	0.288	0.3068	0.347	0.370	1.00

Sources, own estimation

4.2. Monetary Policy Framework In India

Monetary policy is the responsibility of Reserve Bank of India (RBI). RBI is established in 1935. RBI is using Open market operation (OMO), repo rate, reverse repo rate, bank rate, cash reserve ratio (CRR) and statutory liquidity ratio (SLR) as tools of monetary policy. Historically India experienced different forms of monetary policy frameworks. For example, RBI followed monetary aggregate (M3) targeting approach in 1985. RBI shifted to multiple indicator approach in 1998 and from 2016 to 2021 India has adopted flexible inflation targeting approach (Agarwal, 2017). Indian monetary policy targets inflation to be within the range of 2% to 6% (Dua P. , 2020). Inflation targeting framework enabled the country to reduce uncertainty, to stabilize price and to anchor inflation expectation. Moreover, inflation targeting framework improved transparency, credibility and accountability of central bank (Asbe, 2018). He also argued that inflation targeting has a positive contribution for economic growth. Central bank of India continued to use weighted average call rate as an operating target to meet the inflation targeting framework.

In addition India has made some monetary policy reforms such as rising open market operation (OMO) for state development loans and improvement in payment and settlement systems in 2018. Moreover, the country reviewed the monetary policy regulation to enhance financial inclusion. For instance housing finance companies are allowed to collaborate with banks and non-banking financial intermediaries since 2018, which were not allowed before, as co-originations (Dua P. , 2020).

Monetary Policy Instruments in India

Reserve bank of India (RBI) has implemented a number of monetary policy instruments which are categorized as quantities and qualitative instruments (Bansal, 2017).

Under the category of quantitative instruments, policy rate is one of the tools that the central bank has used to control credit. As shown on figure 6 policy rate is higher from 1989 to 1995 and from 2011 to 2015 because inflation was higher and greater than 8%. To control inflation rate reserve bank of India used tight monetary policy approach during high inflation periods.

The second quantitative tool is open market operation (OMO). This tool can influence money in circulation via trading government securities. Changing the reserve ratio (RR) is another form of quantitative instruments of RB (Bansal, 2017).

Following the financial crisis of 2008 RBI took different measures to counteract the liquidity tightening. For instance, RBI reduced the repo and reverse repo rates from 9% and 6% in 2008 to 4.75% and 3.25% in 2009 respectively (figure 6). In addition in 2020, period of covid 19, RBI reduced both repo and reverse repo rates to stimulate the economy.

Moreover, the monetary authority reduced cash reserve ratio (CRR) during the financial crisis and the covid 19 crisis (figure 6). RBI raised CRR in the 1990s which is period of high inflation rate in the country. The government of India also used treasury bill as means of policy tools. However, treasury bill rate is declining overtime.

Reserve bank of India also has been using qualitative monetary policy instruments. It is a means to allocate credit for priority sectors in the economy in accordance with the country's policy. For instance discrimination in credit access for export firms rather than import firms is one indicator. Accordingly, there are some tools such as fixing the margin requirements which is the portion of loans which the borrowers have to raise to get loans from the banks. Thus, RBI will encourage (discourage) the priority sectors and (non-priority one) by changing the margin requirements (Bansal, 2017).

Figure 6 trends of monetary policy instruments in India

Cash Reserve Ratio (CRR)

Policy Rates-Bank Rate

Treasury bill rate
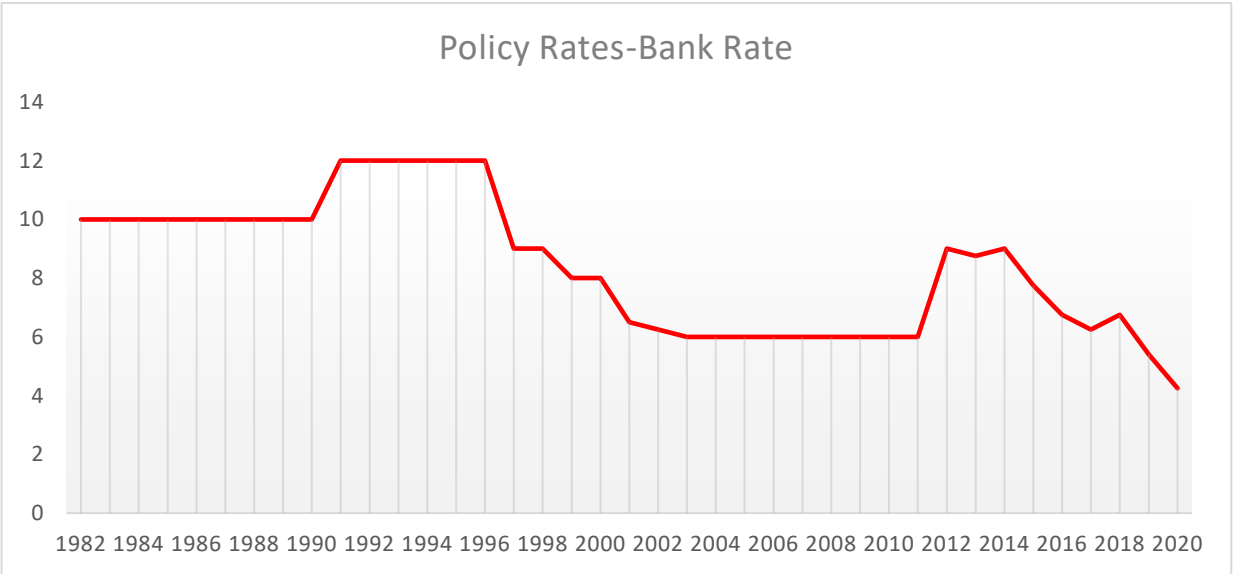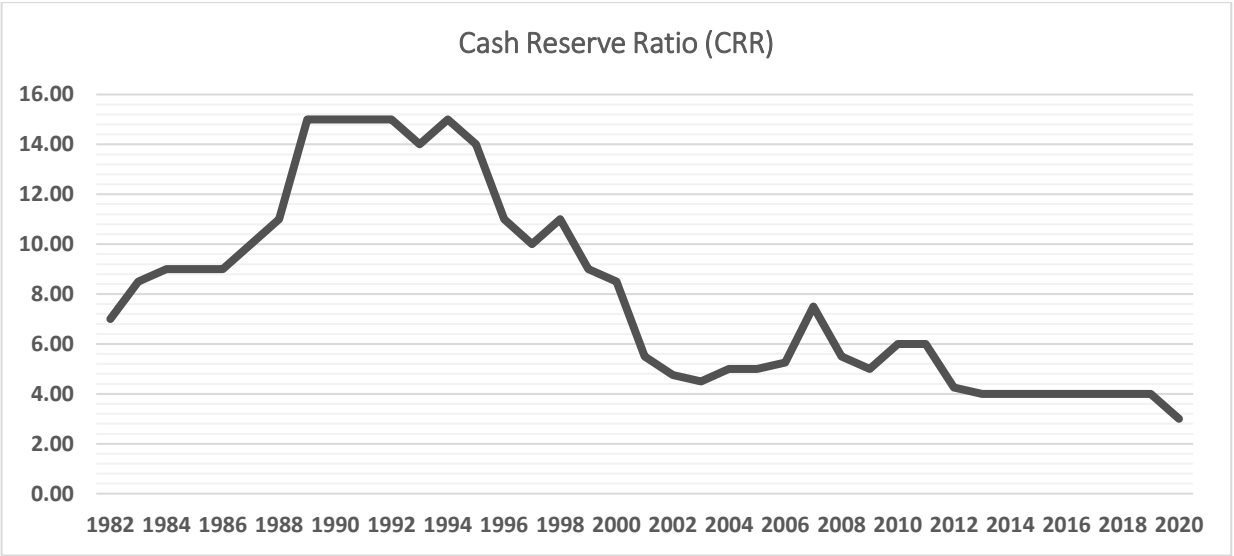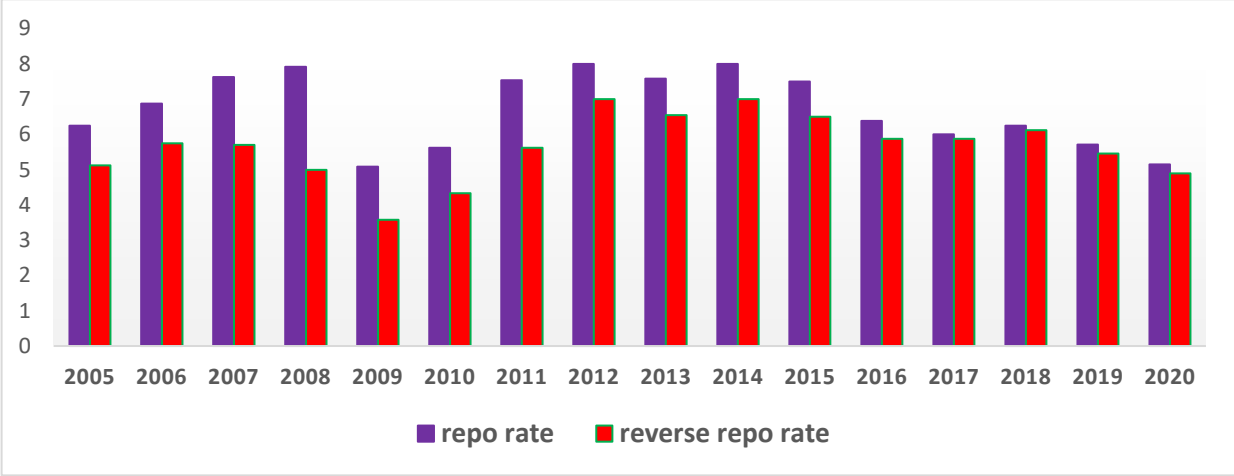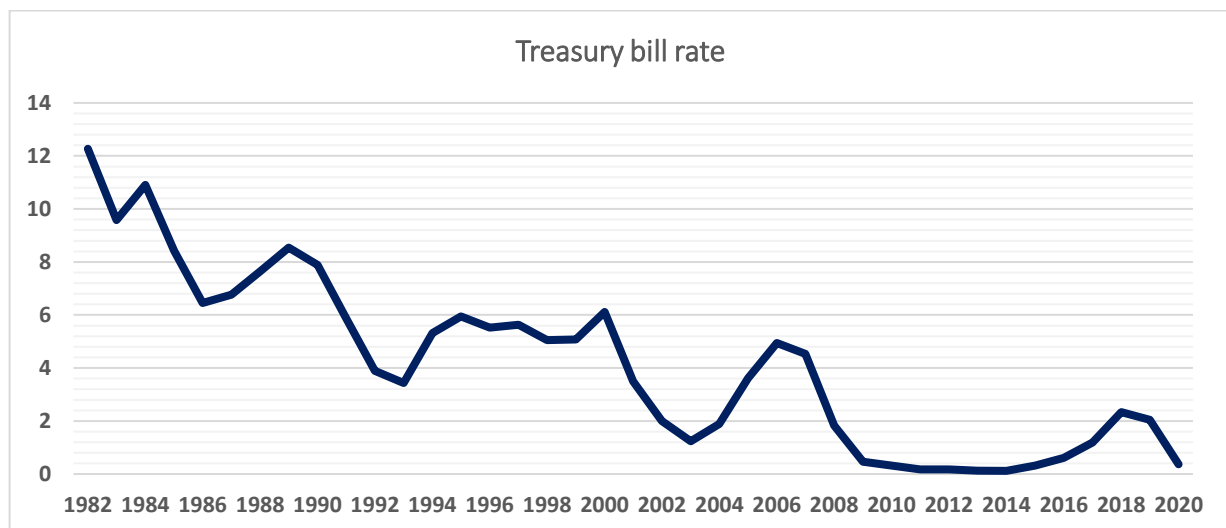
Trends of policy variable, inflation and GDP growth rate

In this section (figure 7) trends of monetary policy variables and real variables is presented. Accordingly policy rate and GDP growth did not follow systematic trend through time. However, at time of high policy rate the economy grew at very low rate (from 1991 to 1997). Policy rate and market interest rate (market_r) have similar trend overtime. Both have a downward trend overtime on average. This implies that the policy interest rate has a strong possibility to be transmitted to market interest rates and hence to real variables in the economy. Therefore, RBI could indirectly influence market interest rate and economic activities.

RGDP growth rate is counter-cyclical to real interest rate. It is line with economic theory in which investment and consumption are a decreasing function of real interest rate. A higher interest rate lead to a higher opportunity cost of investment and hence lead to lower investment and aggregate demand.

The argument of inverse relationship between investment and interest rate is that if the central bank reduced the policy rate, commercial banks' interest burden with the RBI will be declined so that their cash holdings will improve. Thus, the lending rate will be lowered and hence amounts of loan to households and enterprises will rise at least in the short run. Moreover, saving become less attractive and encourages consumption and aggregate demand. However, the situation might be changed in case of the long run horizon. Because in the long run economic growth is highly influenced by innovation, technology and institutional setup of the country. Moreover decision making behavior of agents matters in allocating their income for saving-consumption expenses.

Thus, reduction in lending interest rate may not result in improvement in GDP growth rate in the long run.

Figure 7 shows that market interest rate is counter cyclical to inflation. For instance when interest rate is higher in the early of 2000 inflation is observed very low level. From 1989 to 1995 and from 2001 to 2011 market interest rate is relatively low while inflation rate is observed at higher level. It is in line with theory that a lower interest rate implies rise in household consumption, investment and lower unemployment rate. Thus if the demand shock is outweigh the aggregate supply shock, improvement in aggregate demand results in inflationary pressure in the economy. The pairwise correlation matrix (table 2) and figure 7 confirms the positive correlation between price and GDP and thus, the demand shock is the dominant shock in India. Consequently, interest rate and inflation have inverse relationship (table 2).

Inflation is lower than 6% since 2013 and thus can we make sure that monetary policy is effective to meet its target? However, literatures argued that deriving forces of Inflation in India are money supply, rise in input price, output gap, fiscal deficit, exchange rate, crude oil price and aggregate supply shocks (Alam, 2016), (Gupta, 2015), (Bhattacharya, 2017), (Kaur, 2019) and (Chakraborty, 2018). Agricultural wage is also derivers of food inflation in India (Mohanty, 2015). Moreover, from 2013 to 2015 inflation was controlled and below 4% in India. Different reasons were mentioned such as lower historical inflation, future low inflation expectation and oil price reduction (Mohan, 2018).

The slope of the yield curve is sources of information about the bond market. An upward and steep yield curve implies that the long run rate is greater than the short run rates so that commercial banks become profitable by lending and borrowing long term and short term loans respectively. Thus, a steep yield curve leads to rise in interest margin between the long term interest and short term interest rates. This leads to improvement in domestic credits and rise in investment and economic activities. The last panel of figure 7 indicates the yield curve as of May 2021. In addition, the 10-year bond yield curve with policy rate for the last seven years is plotted to show the trends of policy rate and the yield curve.

The yield curve shows existence of inverted in some extent. It may have an implication of liquidity constraint in the financial markets which may result in credit rationing and investment reduction. This lead to rise in uncertainty on investors' perspective so that they will perceive that future policy interest rate will be lower than the current policy interest rate. The inverted yield curve in 2021 may occurred due to economic slowdown in the country in 2020 following the covid 19 crisis.

For instance growth rate of GDP was -7.97 in 2020. Thus, RBI reduces the policy rate in response to contraction in GDP growth rate and hence the anticipation of business investors will be realized. However, the yield curve inversion occurred that the 10-years yield is lower than the 7, 8 and 9-years yields and hence it may not be a serious and feared inversion. Thus, on average the bond market is in good performance and hence it will contribute for the effectiveness of monetary policy.

Policy rate and the 10-year yield curve shares similar trend. It is in line with theory that is a reduction in interest rate results in an increase in bond price and in turn bond price is negatively related with bond yield. Thus, bond yield will decline. Consequently, a fall in policy rate ends with fall in bond yields. The figure confirms this relationship and hence monetary policy could be effective through financial market. The figure also shows the 10-years bond yield was reached minimum in 2020. It indicates economic activities was slowdown due to the covid 19 epidemic and the policy rate was set lower too. Therefore, in a more formal and quantitative way, the effectiveness of monetary policy transmission channels is examined in this study in section six.

Figure 7 trends of monetary policy variables and macroeconomic variables
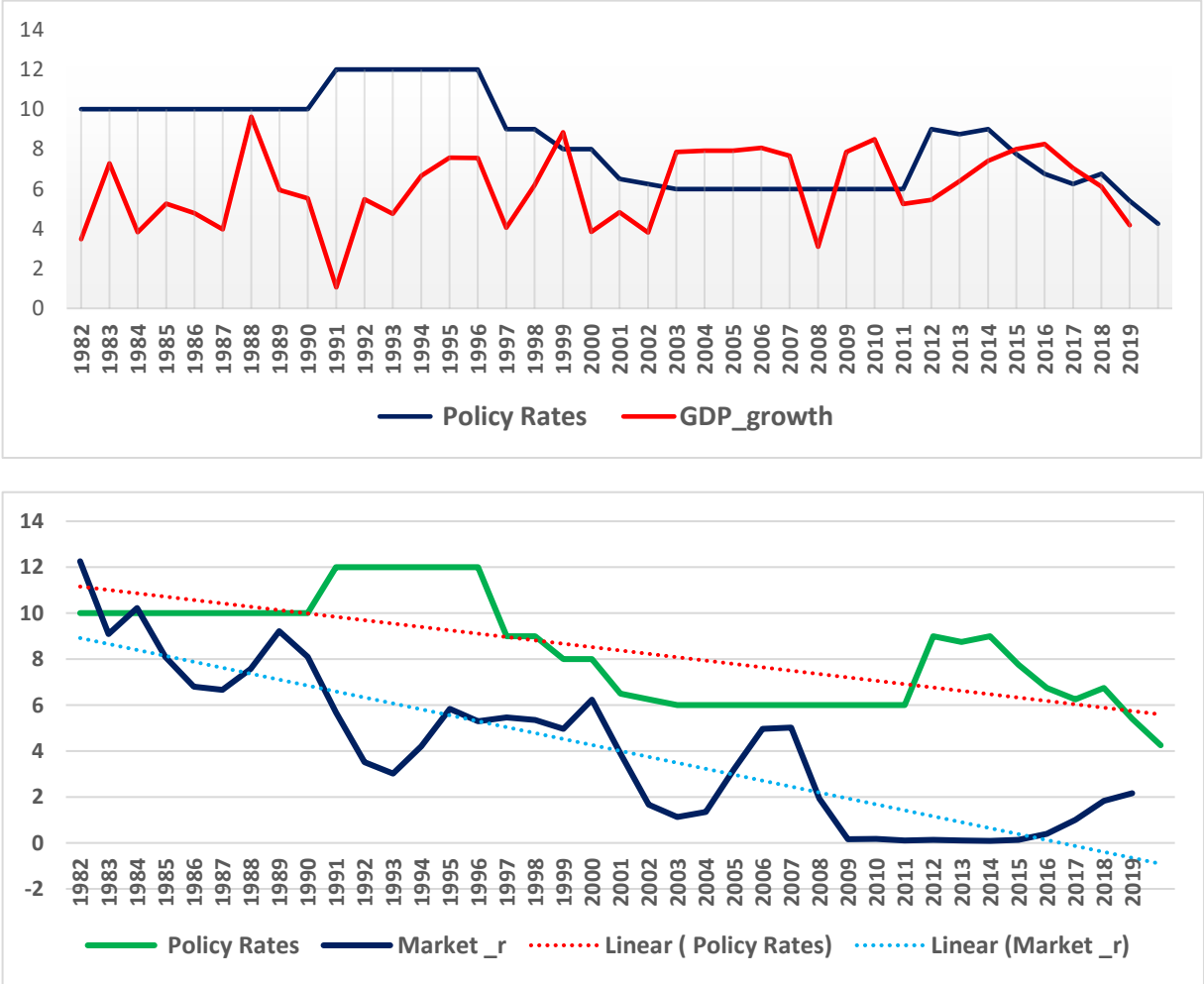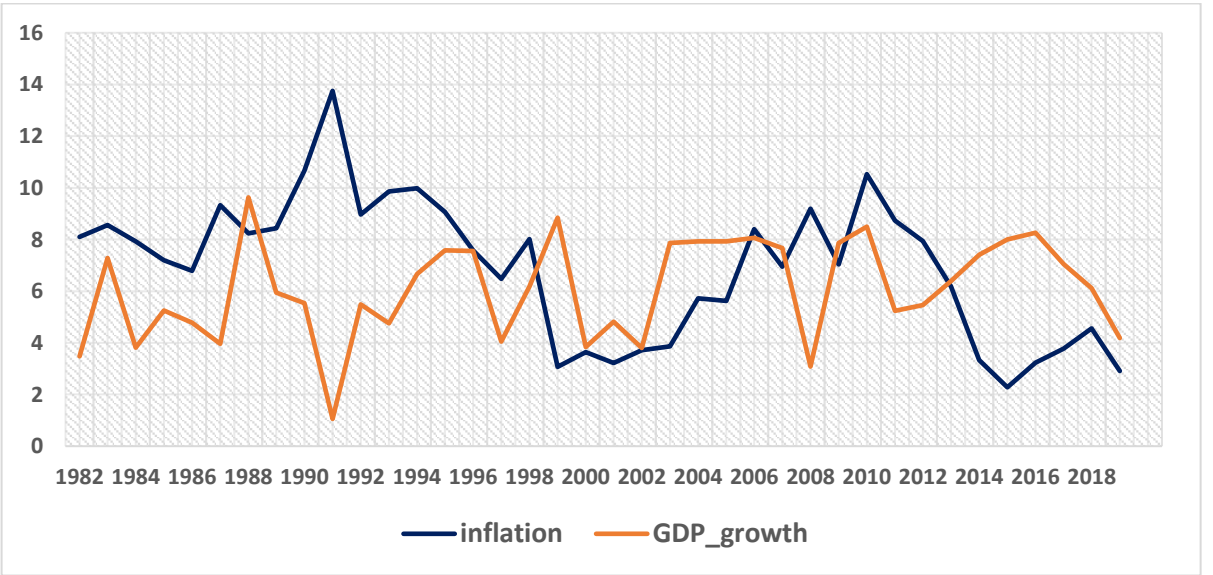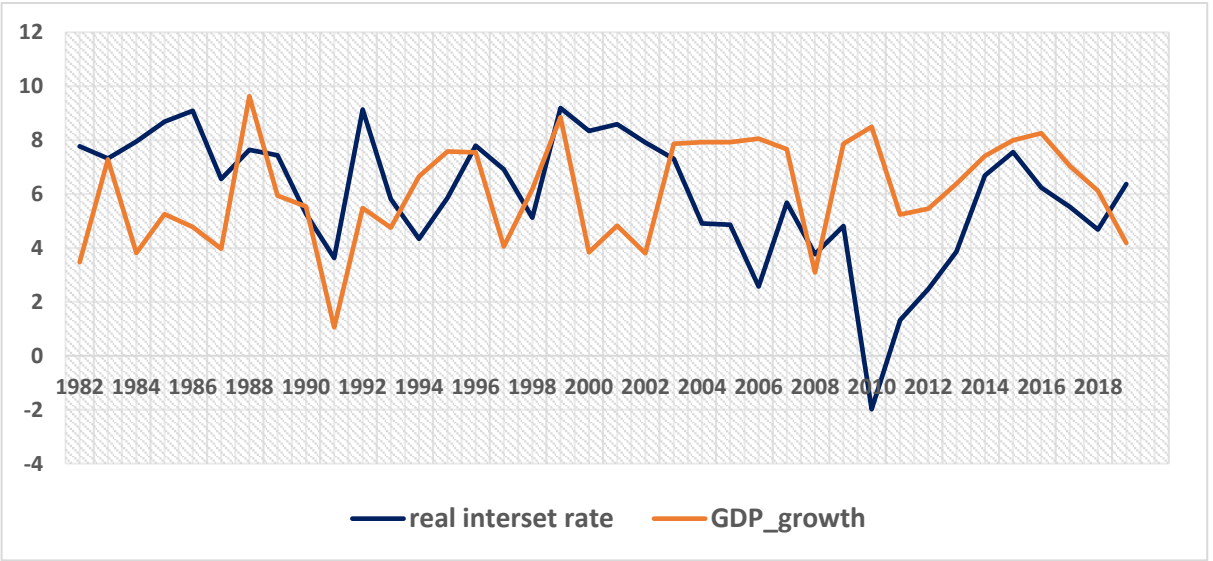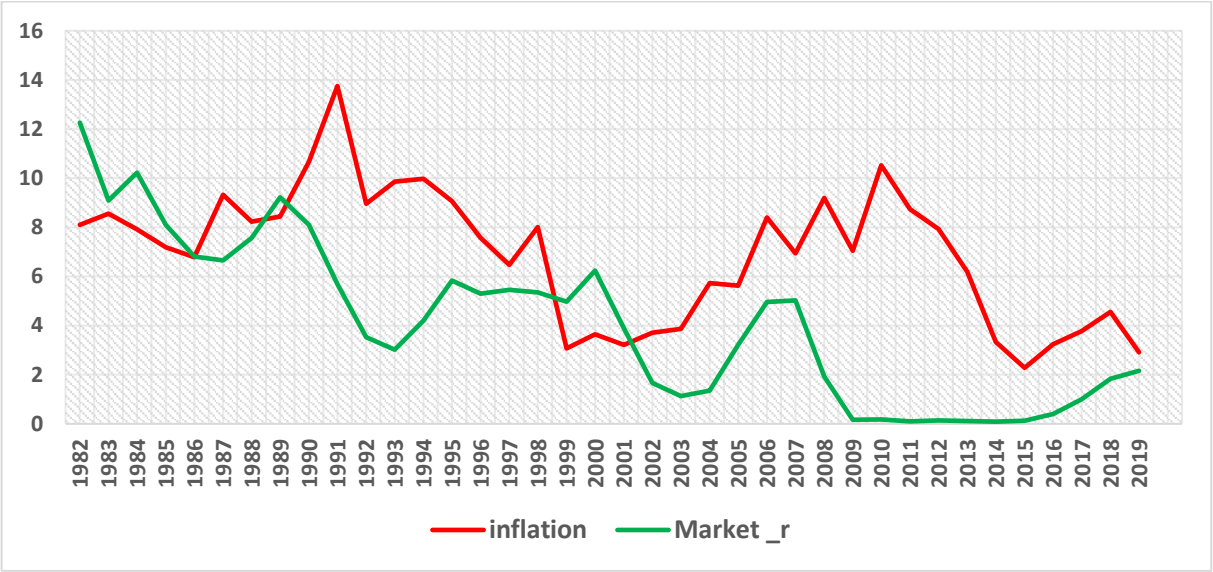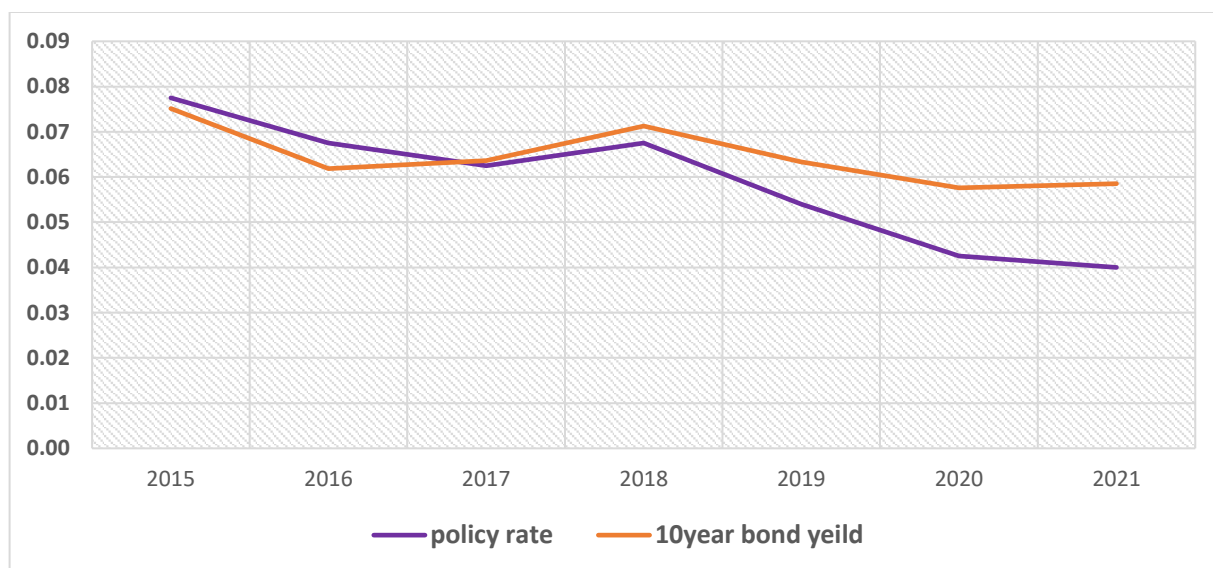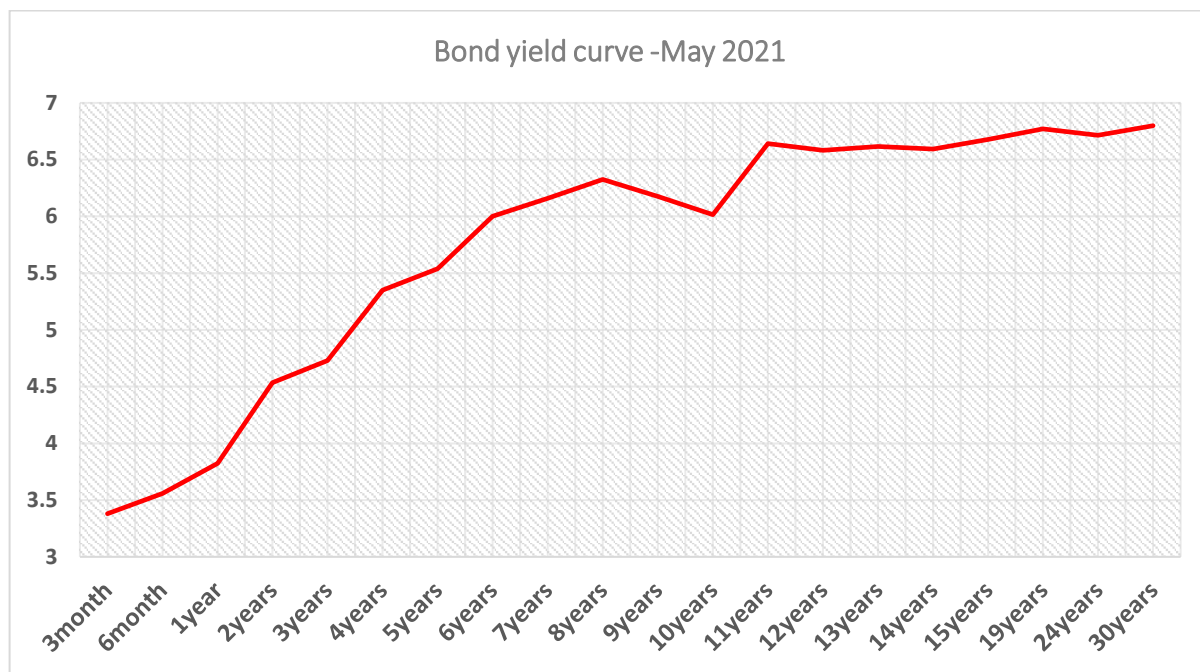
Sources, IMF and RBI 2020

Evolution of Selected Interest Variables in India

Trend of domestic currency depreciation seems procyclical to GDP growth rate (figure 8). Exchange has two possible transmission channels; the trade balance channel and firms' balance sheet channel (Marques, 2020). Depreciation of domestic currency will improve the trade balance position but the balance sheet position of firms will be worsened if their debt is foreign currency denominated so that credit to private sector and hence investment will be negatively influenced. Thus, if the trade balance effects of exchange outweighs the balance sheet effects, official exchange rate depreciation may bring a positive impact on economic growth. The positive relationship between exchange rate depreciation and GDP is also confirmed in table 2. Therefore,

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depreciation of domestic currency lead to improvement in competitiveness of firms in international markets and trade balance of the country will be enhanced.

Asset price and GDP growth rate have similar trend in the study period. In this study, asset price is measured by Bombay stock market index developed by incorporating 30 financial stable companies. The stock market was at higher recession during the financial crisis of 2008 (figure 8). Higher in asset price lead to improvement in wealth of asset holders and will result in rise in consumption and investment. Thus, in line with my expectation GDP growth rate and asset price shared similar trend overtime in India.

Moreover, the figure reveals that private credit and economic growth shared similar trend through time in India. Credit is expected to solve financial constraints of business firms and households. Thus, access to credit from financial institutions will enhance household consumption and investment. Therefore, private credit is supposed to boost employment and aggregate demand so that it will fasten the pass of economic growth in the country. It is in line with theory and literatures.

Credit to private sector is more likely improve household consumption, investment and employment and hence expansion in aggregate demand has inflationary pressure. The output gap theory assertion the positive association between inflation and output expansions. Accordingly figure 8 indicates that inflation and private credit have similar trend in the study period. However, trends of inflation and asset price seems indeterminate. The correlation matrix indicates exists of negative but very weak correlation between asset price and inflation rate. This implies, the financial market is not well developed in the country to bring a significant role in the economy and the financial system is dominated by the banking system. This idea is also shared by (Kamaiah, 2014) and (Sengupta, 2014).

Figure 8 trends of asset price, exchange rate, private credit, price and GDP growth rate

GDP_growth-right axis

GDP growth-right axis

inflation -right axis
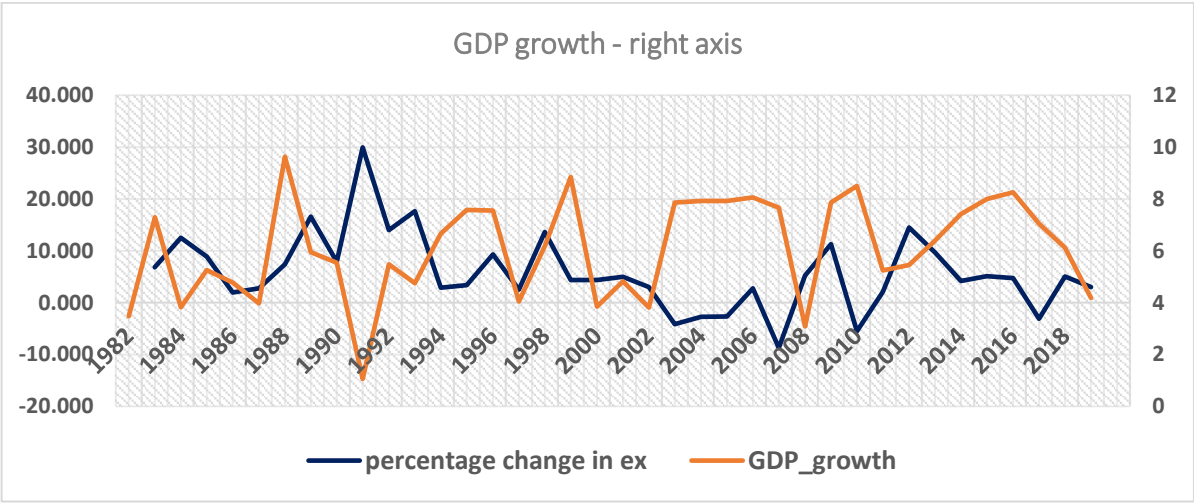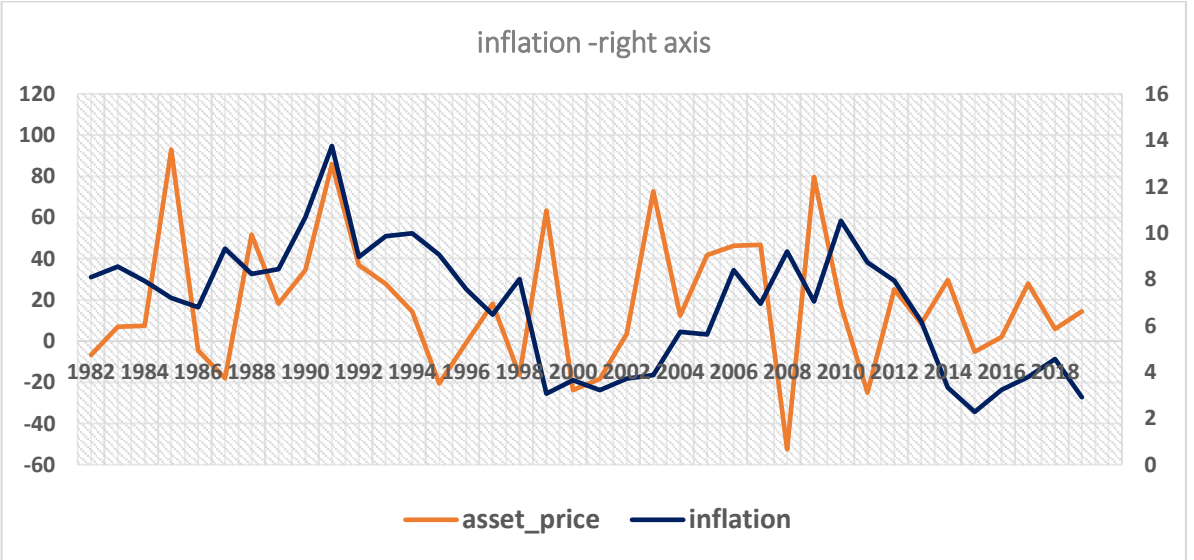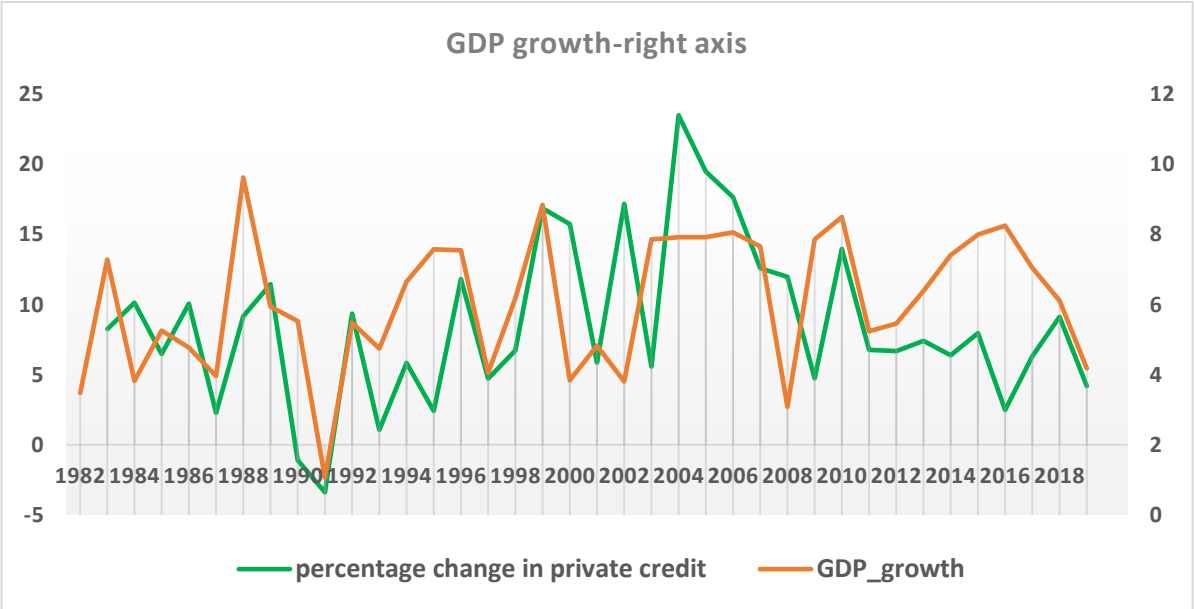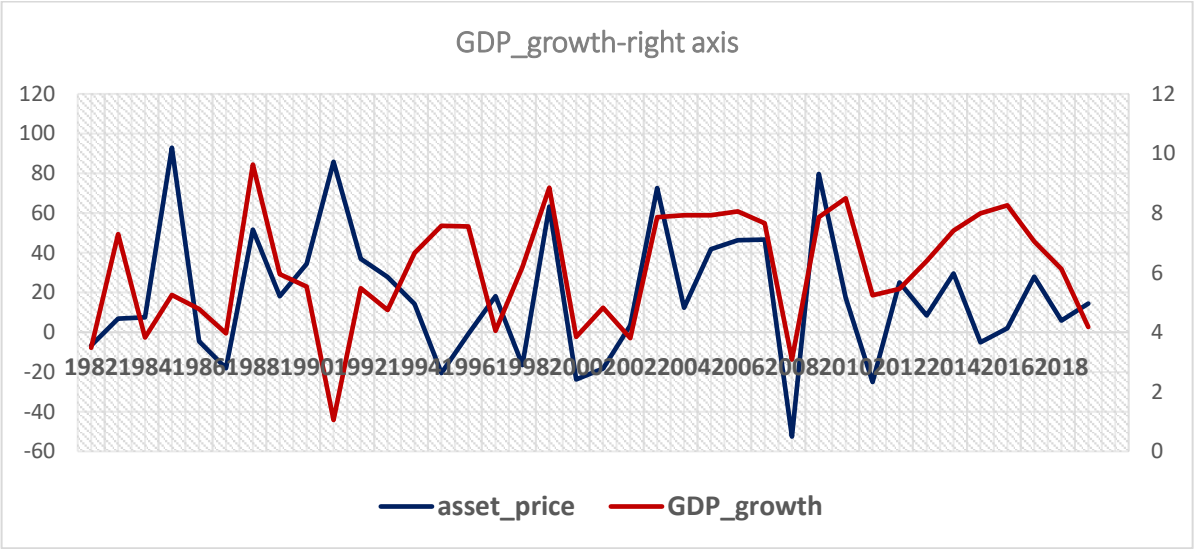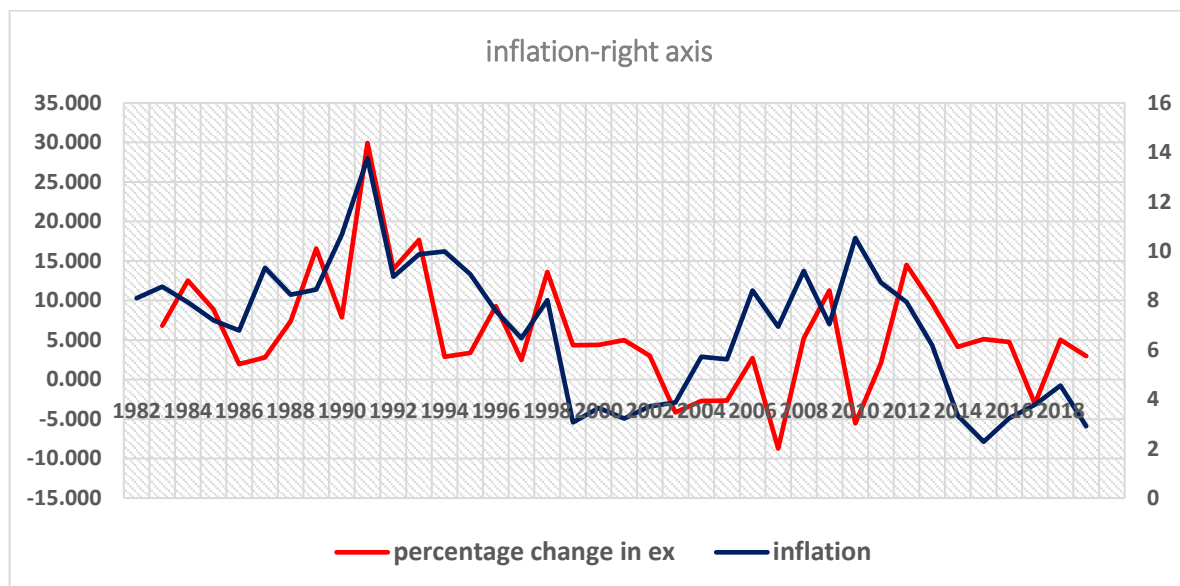
Sources: international financial statistics and World Bank, 2020

Scatter Plots

Policy rate is positively related with real interest rate (r) but GDP growth rate (y) and price (cpi) are negatively related with policy rate. This implies that policy rate can transmit to real interest rate via money market interest rates and interbank interest rates in India. Interest rate is an opportunity cost of investment and consumption and hence a higher interest rate will lead to lower investment and consumption. Aggregate demand will inversely respond to interest rate in turn so that GDP and interest rates will have negative correlation as shown on figure 9. Similar fashion is expected with general price level. A decline in aggregate demand following unexpected rise in interest rate will associated with decline in price (consumer price index). Obtaining a positive relationship between real interest rate and policy rate is in line with theory. Analogously, the negative relationship between GDP and policy rate, price and policy rate obeys macroeconomic theories.

Figure 9 Policy rate (prate), real interest rate, GDP growth rate (y) and price (cpi)
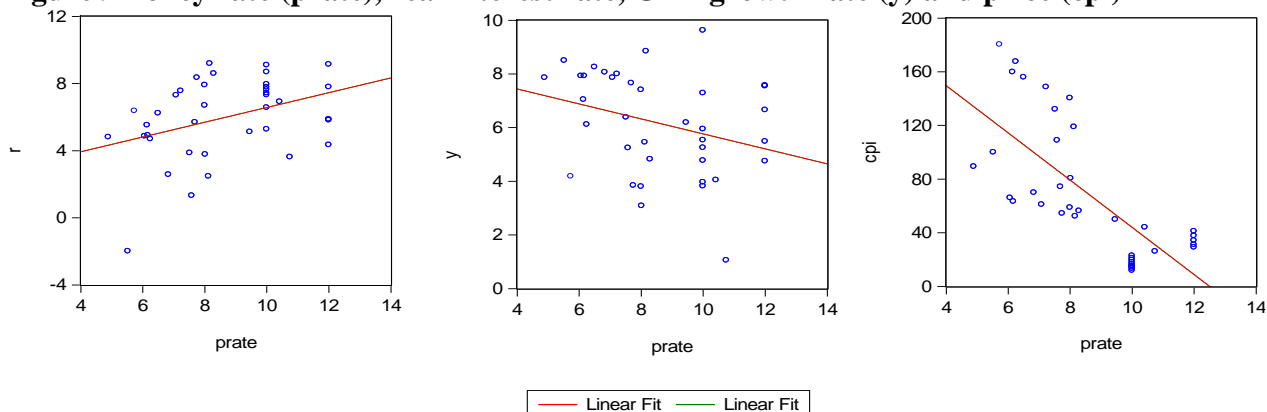
Sources, own estimation

Policy rate is negatively correlated with exchange rate but has weak correlation with asset price and credit (figure 10). A rise in policy rate leads to increase in interest rates which results in capital inflows. Capital inflows also will lead to appreciation of domestic currency (decline in exchange rate) and hence obtaining a downward sloping curve in the space of exchange rate ~policy rate is in line with economic theories. The relationship between asset price and policy rate is very weak and it is subject to empirical test. Moreover, the wide scatter pattern of private credit and policy rate reveals the relationship between credit and policy rate is not strong enough to support economic theories.

Figure 10 exchange rate (ex), asset price (ass), credit and policy rate
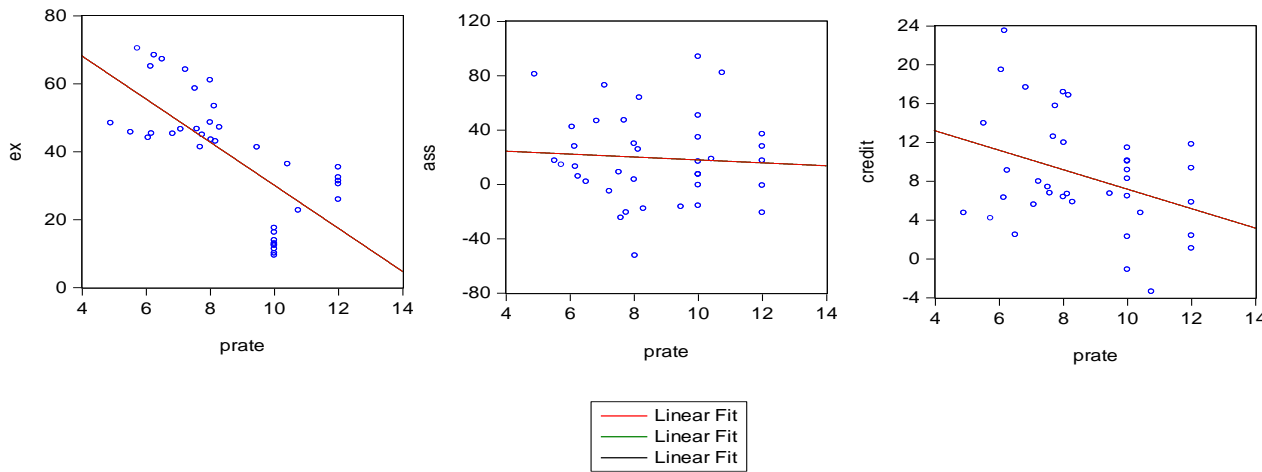
Sources, own estimation

Pairwise correlations

The correlation matrix confirms the existence of weak correlation between asset price and policy rate. However, exchange rate is strongly correlate with policy rate. Moreover, obtaining a positive correlation between RGDP and price satisfies theory of output gap-inflation theory. Accordingly, a positive output gap results in inflationary pressure through increasing cost of production. That is a positive output gap is associated with greater aggregate demand and thus to meet the higher demand firms will hire more labor at higher wage rate (due to tight competition among firms in labor market). To compensate the rising cost of production price will rise and hence a positive output gap results in higher price level and the reverse will hold for deflationary pressure. Therefore, for India case the output gap theory seems holds true. Asset price (assp) is weakly related with RGDP. It is in line with my expectation that stock market is not well developed in India and the country's financial system is dominated by the banking system so that a shock from stock market is not powerful to influence real variables. Thus, table 2 confirms existence of very weak or negligible relationship between asset price and real GRDP in India.

Table 2 Pairwise correlations in India

Corr	RGDP	Price (CPI)	Real interest rate (R)	Policy rate (P-rate)	Exchange rate (ex)	credit	Asset price (assp)
RGDP	1.00						
CPI	0.217	1.00					
R	-0.080	-0.352	1.00				
P-rate	-0.302	-0.717	0.371	1.00			
Ex	0.229	0.924	-0.294	-0.712	1.00		
Credit	0.33	-0.017	0.0114	-0.358	0.119	1.00	
Asp	0.238	-0.143	0.063	-0.067	-0.15	-0.08	1.00

Sources, Own estimation

Short summary

In this section a short summary regarding monetary policy framework and trends of selected variables is presented. National bank of Ethiopia (NBE) is adopted exchange rate and multiple indicator approach monetary policy framework in 1970 and 1992 respectively. The central bank shifted to inflation target monetary policy framework since 2008. Ethiopia used reserve required ratio, open market operation and monetary policy instance as major policy tools. Inflation and lending rate are weakly related while lending rate and money supply are negatively related. In line with theory private credit and GDP share similar trend. Inflation is also has similar trend with private credit. But weak correlation coefficient between credit and GDP and between credit and inflation implies that the credit channel is not expected to be an effective monetary policy channels in Ethiopia.

Exchange rate and GDP growth drift together confirming positive correlation between them. There exists a positive correlation between exchange and inflation in Ethiopia. Exchange rate relatively has strong correlation with GDP and price and thus, exchange rate seems an effective transmission channel. The negative correlation between inflation and GDP implies that supply shock outweigh the demand shock in the economy so that it may hinder effectiveness of monetary policy transmission channels in Ethiopia.

India experienced different monetary policy framework in different time periods. The country adopted monetary aggregate (M3) target in 1985. However, reserve bank of India (RBI) switched to multiple indicator in 1998. India has been adopting flexible inflation target monetary policy framework for the period 2016 to 2021. India has used different policy instruments such as policy rate, repo and reverse repo rates, cash reserve requirement and treasury bill. Policy rate is highly correlated with exchange rate and private credit. Exchange rate, in turn positively and strongly

correlate with price implying exchange rate channel could be an effective monetary policy transmission channel in India.

Asset price and GDP have similar trends overtime. However, asset price is weakly correlate with price and GDP in India. This implies that asset price channel would not be an effective monetary policy transmission channel in India due to less developed financial market in the country. Output and price have positive correlation which assertion that aggregate demand shock outweigh aggregate supply shocks in India. To confirm the trend analysis SVAR model is used which showed the efficacy of monetary policy transmission channels which is presented on section six.

5. Empirical Estimation Model

5.1. Structural Vector Autoregressive (SVAR)

Theoretical and empirical reviews confirm that monetary policy is effective in influencing GDP and price through varies transmission channels. However, there is no consensus about the relative effectiveness of the transmission mechanisms. Thus to investigate the efficacy of transmission channels we need to use an empirical model.

Structural vector autoregressive (SVAR) is used as estimation technique to analyze the effectiveness of monetary transmission channels. SVAR approach is used by a lot of economists such as (Buckle 2002), (Bayoumi, 2001), (Aleem, 2010), (Khundrakpam, 2012), (Wickramanayake, 2013), (Marques, 2020) and (Lambamo, 2020). SVAR can be identified using basic vector autoregressive model (VAR). Since VAR approach resolves simultaneity problem in macro variables, and hence using SVAR, to examine monetary policy transmission channels, will help to solve simultaneity problem between monetary policy and macroeconomic variables (Bayoumi, 2001).

A structural vector autoregressive (SVAR) can be specified as follows:

$$AY_t = \beta_0 + \beta_1 Y_{t-1} + U_t \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, Y_t is a vector of endogenous variables including the policy variable and transmission channels, U_t is structural shocks which is assumed that they satisfy the orthogonal assumption and A represents a matrix of contemporaneous relationships. Here orthogonality assumption implies that two or more shocks are not occurred at the same time. Thus, the citers paribus interpretation would be valid while interpretating the impact of a shock on interest variable.

However, selecting monetary policy variable (instrument) is intuitive for both Ethiopia and Indian cases. Literatures used Short term rates (policy rates), reserve money, money supply aggregates (M1), broad money supply (M3) and Treasury bill as proxy for policy variable. For instance, (Kumar B. , 2017) chooses the policy interest rate as proxy for policy variable.

Moreover, (Nyakerario, 2011) used policy rate as a proxy for monetary policy while studying the asset price transmission channels of monetary policy in Kenya. Policy rate is interest rate at which commercial banks borrowed from central bank and hence central bank used policy rate to regulate credit, exchange rate and price. Policy rate will determine the market interest rate in the economy (Nyakerario, 2011). Moreover, countries who implement inflation targeting do not explicitly focus on monetary aggregates and hence they would rather give emphasis on interest rate so as to meet

the target inflation rate. In this regard, India is following inflation targeting policy frameworks and hence taking monetary policy rate as proxy of policy variable is intuitive in this study. Therefore, I used central bank's policy rate as proxy for policy variable. However, for the case of Ethiopia I took narrow money supply (M1) as a proxy for monetary policy variable because of the following reasons; 1), large portion of the population do not have access to banks (only 35% of adults are opened account in banks), 2), there is no organized stock and capital markets, 3), only government bond and securities are traded in the country and 4), central bank is not independent to determine its policy rate. In such circumstance central bank is better to control money reserve and hence money supply.

Once the policy variable is determined, the structural equation written in equation 1 can be described as follows:

A vector of endogenous variables Y_t contains endogenous variables and transmission channels;

$$Y_t = [y_t, p_t, i_t, r_t, c_t, e_t, ap_t]$$

Where, y_t represents Real GDP, p_t − consumer price index, central bank policy rate (i_t) is policy variable. r_t − real interest rate to capture the interest rate channel, c_t- Credit to private, e_t-official exchange rate and asset price (ap_t). For Ethiopian case narrow money supply (M1) would be taken as policy variables and asset price channel is not considered given that there is no stock market in Ethiopia.

In the SVAR approach ordering of endogenous variables matters and it can be determined using prior economic theories and empirical reviews. (Aleem, 2010) and (Davoodi H. , 2013) placed asset price at the end while they put credit and exchange rate after real interest rate. They also put output and price before the policy variable.

Here I followed the country context, economic theory and Engle and Granger causality test to determine the appropriate placement of endogenous variables in SVAR system. The goal of monetary policy is price stabilization (inflation targeting monetary policy approach) and hence the central bank should respond to macroeconomic shocks on impact. Thus, I prefer to put the monetary policy variable (policy rate) at the last position. It is also supported by the Engle and Granger causality test (table 3). Moreover, the exchange rate is also expected to respond to asset price, credit and price shocks so as to stabilize price and to achieve the inflation targeting. Thus, following the Engle and Granger test result, exchange rate is placed in the fifth row.

Asset price and private credit are contemporaneously influenced by the change in market price and aggregate demand. It is a styled fact that the general price level affects the economic agents' expenditure decision on alternative portfolios. The Engle and Granger test also supports that<GDP and price has a causal effect on credit and asset price>. In addition the test indicates that credit causes asset price at the conventional level of significance.

Real interest rate is disregarded in this study because of some reasons such as 1), security markets are not well developed in developing and emerging countries. For instance, on average, private and public bond market capitalization indices for advanced economies are 0.51 and 0.46. But for developing and emerging economies the private bond market capitalization indices are 0 and 0.12. and for public bond market capitalization, developing and emerging economies has 0.43 and 0.29 (Prachi, 2012). This Implies that security markets are not progressed in emerging and developing countries. 2), poorly organized stock market is also another factor that hinder the role of monetary policy through interest rate. Prachi indicates that stock market capitalization as ratio of GDP is about 0.27 and 0.82 for developing and emerging economies respectively while advanced economies' stock market capitalization as share of GDP is about 0.9. thus, the interest rate channel is not an important channel in developing countries and emerging economies (Prachi, 2012).

Thus, via taking such issues into consideration the endogenous variables are ordered as $[y_t, p_t, c_t, ap_t, e_t, i_t]$.

The policy interest rate has a contemporaneous response to GDP and price shocks and GDP and price will respond to policy rate with a lag. It is reasonable because transmission effects of monetary policy to real variables will take time.

Credit channel is placed in the third row since it will respond to the price and GDP shocks contemporaneously due to justifications discussed previously.

Exchange rate will respond contemporaneously to all variables except policy rate because policy rate is assumed to be fast moving and monetary policy is expected to respond immediately to shocks in the economy. This is also confirmed in the Engle and Granger causality test presented in table3.

For Ethiopian case I used the following ordering. I used the Engle and Granger causality test to determine order of variables (table 6). I start with GDP in first row. Money supply (LM) and price(CPI) placed in the second and third rows. The ideas is that money supply should responds to GDP contemporaneously whereas price responds to money supply shock on impact. Exchange rate

(E), lending rate(LR) and private credit (LCR) are placed on row four, five and six rows respectively.

By taking the these assumptions and implication into account equation (1) SVAR can be presented in matrix form as follows;

Since any VAR (P) can be written as VAR (1) form

$$
\begin{bmatrix}
1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\
a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\
a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\
a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\
a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} \\
a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1
\end{bmatrix}
\begin{bmatrix}
y_t \\ p_t \\ c_t \\ ap_t \\ e_t \\ i_t
\end{bmatrix}
=
\begin{bmatrix}
\beta_{10} \\ \beta_{20} \\ \beta_{30} \\ \beta_{40} \\ \beta_{50} \\ \beta_{60}
\end{bmatrix}
+
\begin{bmatrix}
\beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} & \beta_{16} \\
\beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} & \beta_{26} \\
\beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} & \beta_{36} \\
\beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} & \beta_{45} & \beta_{46} \\
\beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & \beta_{55} & \beta_{56} \\
\beta_{61} & \beta_{62} & \beta_{63} & \beta_{64} & \beta_{65} & \beta_{66}
\end{bmatrix}
\begin{bmatrix}
y_{t-1} \\ p_{t-1} \\ c_{t-1} \\ ap_{t-1} \\ e_{t-1} \\ i_{t-1}
\end{bmatrix}
+
\begin{bmatrix}
U_{yt} \\ U_{pt} \\ U_{ct} \\ U_{apt} \\ U_{et} \\ U_{it}
\end{bmatrix}
$$

…………………………………………………………………………………………….….. (2)

Let $A = \begin{bmatrix}
1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\
a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\
a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\
a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\
a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} \\
a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1
\end{bmatrix}$

Identification process in SVAR approach involves obtaining matrix A. Elements in matrix A stands for contemporaneous relationship between endogenous variables including the transmission channels. For identification purpose the SVAR of the form of equation (1) should be written in reduced form. Multiplying equation 1 by A^{-1} will give us reduced form VAR:

$$A^{-1}AY_t = A^{-1}\beta_0 + A^{-1}\beta_1 Y_{t-1} + A^{-1}U_t$$

$$Y_t = G_0 + G_1 Y_{t-1} + \varepsilon_t$$

Where, $G_0 = A^{-1}\beta_0, \qquad G_1 = A^{-1}\beta_1 \ and$

$\varepsilon_t = A^{-1}U_t$……………………………………………………………………………………….(3)

ε_t- is residual or forecast error in the reduced form VAR. Thus, matrix A relates linearly the forecast error of the reduced form VAR ε_t and the structural shochks U_t (equation 3). This implies that forecast errors are linear combination of the structural shocks U_t.

The SVAR model assumes that structural shocks are orthogonal to one another (Cevik, 2013). This implies two or more shocks are not happening at the sometime and also there is no correlation among them so that the covariance between structural shocks is zero. Moreover, for identification purpose we need to impose a zero restriction on matrix A because the number of parameters in reduced form VAR is lower than the number of parameters in SVAR and hence we cannot estimate

parameters of SVAR without imposing a zero restrictions on some parameters. For n variables we have to impose $\frac{n(n-1)}{2}$ restrictions (Yesigat 2020). Accordingly, in this model 6 variables is considered as endogenous variables and hence 15 zero restrictions are imposed on SVAR. The restriction has to be made on the basis of economic institutive. Because imposition on matrix A means imposing restriction on the contemporaneous relations among endogenous variables in SVAR. Thus, restrictions (assumptions) made on variables ordering on equation (1) implies restrictions on matrix A and in turn it is equivalent to imposing restriction on A^{-1} and on the relationship between the forecast error and stock shocks.

The system become

$$
\begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{pt} \\ \varepsilon_{ct} \\ \varepsilon_{apt} \\ \varepsilon_{et} \\ \varepsilon_{it} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} U_{yt} \\ U_{pt} \\ U_{ct} \\ U_{apt} \\ U_{et} \\ U_{it} \end{bmatrix}
$$

Impulse Response

impulse response functions is used in this study because it is helpful to see the respective dynamics of macroeconomic variables and how they respond in the event of particular shocks (Pagan, 2000), (Claus, 2006) and (Buckle, 2007). It transforms the SVAR of equation (1) into a sum of shocks representation:

$$y_t = y_0 + \sum_{i=0}^{\infty} w_{ih} u_{h(t-i)} \dotfill (4)$$

Where y_t - represents variable of interest, y_0 − indicates initial conditions, w_{ih} − is the ith impulse response associated with the u_h shocks (Buckle 2002) and (Lambamo, 2020).

Data Descriptions

A quarterly data from 1982Q1 to 2019Q4 for both Ethiopia and India is used. Measurements and sources of data can be summarized in the following table.

Country	Variable	Sources of data	Measurement (description)
Ethiopia	Real GDP	NBE	Gross domestic product at constant price in LCU
	Price (cpi)	World Bank	Its consumer price index (2010=100)
	Money supply	NBE	Narrow money supply (M1) which sum of currency in circulation and demand deposits. It's a proxy for monetary policy variable in LCU
	Market interest rate	IMF	It is offered for deposits which is determined by demand for and supply of credits
	Credit	NBE	Amount of loans and advances provided to private by banks in LUC
	Official exchange	NBE	Amount of Birr per US dollar
India	Real GDP	IMF	Gross domestic product at constant price in LCU
	Price	World bank	Consumer price index (2010=100)
	Weighted average of call money rate	RBI	It is interest rate at which RBI, banks and other institutions are traded money in money market for overnight. It is used as proxy for policy variable
	Market interest rate	IMF	It is rate determined by demand and supply of credits
	Official exchange	World bank	Amount of Rupee per US dollar
	Private credit	World bank	Amount of credit provided for private sector by banks
	Asset price index	IMF	S&P BSE SENSEX will be used as a proxy for asset price. It is Bombay stock exchange sensitive index which is stock market index of 30 financially sound companies.

6. Result and Discussion

In this section major findings and discussion are presented. The result is displayed for India and Ethiopia in two separate parts. The first part deals with effectiveness of monetary policy channels and their possible challenges in India. Whereas in the second part monetary policy transmission mechanisms of Ethiopia is discussed briefly.

6.1. Part One: Monetary Policy Transmission Channels in India

A quarterly data from 1982 quarter one to 2019 quarter four is used in this study. The time period is determined on the basis of data availability. In time series analysis the first task is always checking variables stationary condition (order of integration). Augmented-Dickey Fuller (ADF) test is popular tool for unit root tests. Thus, ADF test result is presented in the annex part with trend and constant term at four lag length. The result shows that all variables are stationary at their first difference. Thus, in the SVAR model variables are taken at their first difference.

Pairwise Granger causality test

Ordering of endogenous variables is very important while using SVAR models. Ordering can be determined on the basis of economic theories and empirical reviews. In this regard I present theorical justifications and empirical evidences in the model development part. On the top of that a pairwise granger causality test has been undertaken to determine the order of variables. The result (table 3) confirms that GDP has a causal impact on price (CPI) and hence GDP should be placed before CPI in SVAR model. There is a causal impact from CPI to credit to private sector (CR) implies CR should be placed after CPI.

In general if a variable has a causal impact on another variable in pairwise causality test that variable has to be place first before the response variable. In doing so the Granger causality test confirms the ordering determined before which is $RGDP, CPI, CR, ASSP, EX, prate$ for India.

Optimal lag length determinations

Determining the optimal lag length for VAR system is also a necessary condition. The result shows (in the annex part) that LR and FPE criteria indicates 8 lag length while AIC, SH and HQ confirms 4 lag length. Literatures usually consider AIC and SC and hence for this study I have taken lag 4 for the VAR system.

Table 3 Granger causality tests in India

Pairwise Granger Causality Tests		
Null Hypothesis:	F-Statistic	Prob.
RGDP does not Granger Cause CPI	10.49***	0.0015
CPI does not Granger Cause RGDP	0.32	0.575
EX does not Granger Cause RGDP	0.96	0.328
RGDP does not Granger Cause EX	4.994**	0.027
RGDP does not Granger Cause CR	3.62*	0.059
CR does not Granger Cause RGDP	1.14	0.288
ASSP does not Granger Cause RGDP	1.12	0.291
RGDP does not Granger Cause ASSP	0.23	0.633
PRATE does not Granger Cause RGDP	0.35	0.554
RGDP does not Granger Cause PRATE	12.83***	0.0005
EX does not Granger Cause CPI	5.62**	0.0190
CPI does not Granger Cause EX	3.16*	0.078
CR does not Granger Cause CPI	0.098	0.754
CPI does not Granger Cause CR	17.64***	5.E-05
ASSP does not Granger Cause CPI	0.21	0.647
CPI does not Granger Cause ASSP	0.24	0.622
PRATE does not Granger Cause CPI	1.78	0.184
CPI does not Granger Cause PRATE	0.47	0.490
EX does not Granger Cause CR	1.69	0.195
CR does not Granger Cause EX	7.078***	0.0087
EX does not Granger Cause ASSP	0.207	0.65
ASSP does not Granger Cause EX	7.203***	0.0081
PRATE does not Granger Cause EX	0.68	0.410
EX does not Granger Cause PRATE	0.506	0.478
ASSP does not Granger Cause CR	0.199	0.656
CR does not Granger Cause ASSP	15.98***	0.0001
PRATE does not Granger Cause CR	0.83	0.363
CR does not Granger Cause PRATE	8.87***	0.0034
PRATE does not Granger Cause ASSP	0.155	0.694

Note, (*), (**) and (***) represents significance at 10%, 5% and 1% respectively

VAR system stability test

The roots of companion matrix is within the unit circle and hence the estimated VAR model is stable (appendix). Since parameter stability is important for forecasting beyond the sample period, having stable VAR system ensures the model is free from structural breakdown so that the forecasting power of the VAR system is good.

Impulse Response Functions

For SVAR impulse response dynamics worth much more than the SVAR parameters. Thus, here I presented the impulse response and variance decomposition of variables over 16 quarters with one standard deviation monetary policy shocks. These shows the dynamic response of output and price to monetary policy transmission channels and policy rate shocks. The dashed lines (red lines) indicates the 95% confidence interval. Accordingly, if the confidence interval ranges from negative to positive real numbers the dynamic response of the variable is statistically insignificant at 95% confidence interval. If the confidence interval incorporates only either negative or positive real numbers alone the dynamics response of the variable is statistically significant. The sign of significant variables are interpreted but the sign of insignificant variable is not interpreted because insignificant variables have statistically zero impact on the response variables.

This section is organized as, first, response of Real GDP and price for monetary policy variable (policy rate) shocks are interpreted using the baseline model. Here the baseline model stands for the impulse response function without including transmission channels of monetary policy. In this stage SVAR is done using three variables which are price, GDP and the policy variable (policy rate). The same approach is also used by Aleem (2010).

In the second stage, the response of monetary policy channels to policy rate shock and the impact of monetary policy transmission channels on output and price level is discussed by including all variables in the model. In this regard all endogenous variables are considered. lastly variance decomposition of output and price is presented to show the percentage variation in output and price due to variation in variables included in the VAR model. The same approach is used for Ethiopian case.
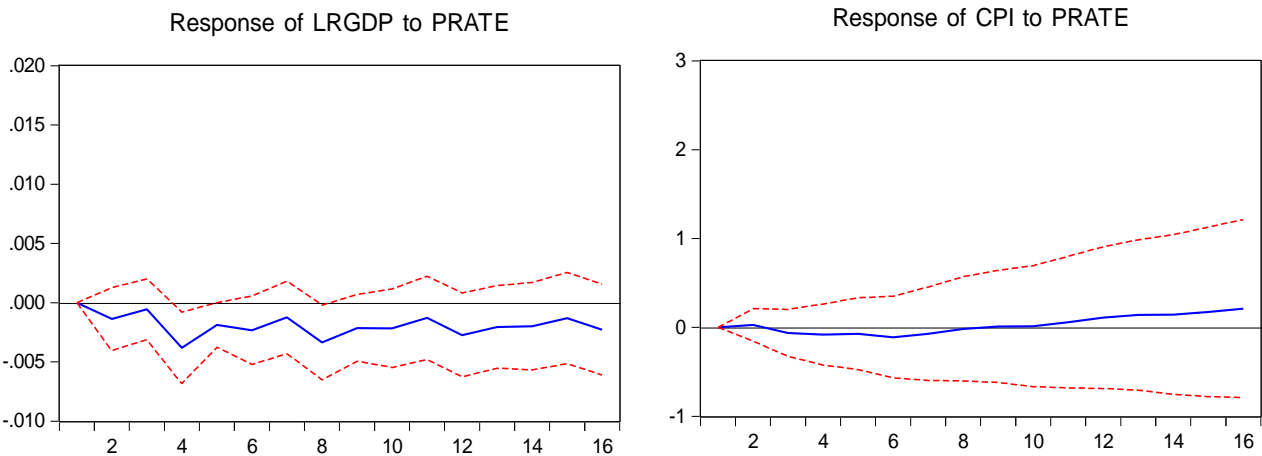
Impulse Response of Output and Price to Policy Rate Shocks

To see the direct impact of monetary policy on output and price level, in the first stage impulse response function is developed via excluding the transmission channels. Accordingly, a SVAR is developed incorporating GDP, price and the policy variable. This function can be acted as a baseline and enables to compare effectiveness level of monetary policy transmission channels.

Figure 11 shows the response of GDP and price to a positive one standard deviation shock in policy rate. The red lines represent the 95% confidence interval whereas the blue line stands for the point estimates. GDP responds negatively to monetary policy shocks (policy rate) in the 3rd quarter but the impact of the shock vanished after the 5th quarter. This implies that the impact of monetary policy on real GDP is temporarily. Change in policy rate will transmit to short term interest rates in the money market and interbank rates. The change in these short term interest rate will affect interest rate sensitive variables of consumption and investment levels. Thus, aggregate demand and output will be affected. Therefore, in the short run a tight monetary policy (rise in policy rate) has a negative impact on real GDP. It is in line with theory and empirical studies such as Aleem (2010).

However, price does not respond to the policy rate shocks (figure 11). The impact of a positive shock in one standard deviation of policy rate on price level is statistically insignificant at 95% confidence interval. This finding avoids the 'price puzzle' issues. Since the price puzzle will exist whenever, a tight monetary policy (rise in policy rate) results in inflationary pressure in reality but in theory, rise in policy rate is expected to reduce general price level and hence inflation.

Figure 11 impulse response of monetary policy channels to the policy variable (policy rate, prate)

Response of LRGDP to PRATE   Response of CPI to PRATE

Sources: author's estimation

Impulse Response of GDP and price to transmission channels

In the second stage all the transmission channels are including in the SVAR system so that the response of monetary policy channels to policy rate shocks is examined as shown in figure 12. However, rear interest rate is excluded due to the fact that it has weak correlation with GDP and price (table 2). The dynamic response of monetary policy channels to the policy rate shock reveals how the effect of monetary policy measures transmitted to the intermediate channels and hence to output and price levels in the economy. Moreover, figure 12 reveals the response of GDP and price to shocks in exchange rate (E), private credit (cr) and asset price (assp). The impact of policy rate on price and GDP remains insignificant at 95% confidence interval in India. However, policy rate has a significant impact on monetary policy transmission channels.

The figure indicates that credit responds negatively and significantly to a positive one standard deviation in policy rate shocks after the 4th quarter. This implies that the transmission of monetary policy to the private credit takes at least one year. The negative relationship between policy rate and private credit is also confirmed in the pair wise correlation matrix (table 2).

Exchange rate depreciates following the monetary policy rate shocks in one standard deviation[3]. Exchange rate responds positively to a policy rate shocks after 8th quarter. It has a persistent impact on exchange rate. RBI continuously decreasing policy rate and also domestic currency is depreciating overtime. However, the impact of policy shock on asset price is statistically insignificant at 95% confidence interval.

Examining the change in GDP and price in response to monetary policy transmission channels reveals the effectiveness level of transmission channels.

Real GDP responds negatively to exchange rate shocks on impact however, the impact of exchange rate vanished after the 4th quarter (figure 12). Since exchange rate channel has two dimension; the trade balance and the balance sheet channel which has an offsetting impact on output. Depreciation of domestic currency will boost GDP through improving trade balance but in the other round it will affect the balance sheet position of firms and the government for debt servicing. Figure 12 reveals that gained from the rise in competitiveness in international market is outweighed by appreciation of import costs and balance sheet deterioration of firms following exchange rate depreciation shock on impact. Up to 13 percent of variation in GDP is explained by variation in exchange rate in the

---

[3] Operational definition of exchange rate is amount of domestic currency per a unit of foreign currency (rupee per us dollar). Thus increase in exchange rate will reflect depreciation of rupee against dollar.

4th quarter (table 5). Thus, its impact on GDP is evidenced to be negative in the short run. Therfore, exchmage rate channel is an important channel to explin variation in output in India. It is also evidenced in the work of Kamaiah(2014). (Brandao, 2020) also finds that exchnage rate channnel is an important monetray policy transmission channels in emerging and developing countries.

Moreover, price responds positively and significantly to exchange rate shocks on impact (figure 12). It is in line with theory that depreciation of currency lead to rise in general price level which may result in import driven inflation. About 13.14% of variation in price is well explained by variation in exchange rate (table 6). However, it vanishes after one year.
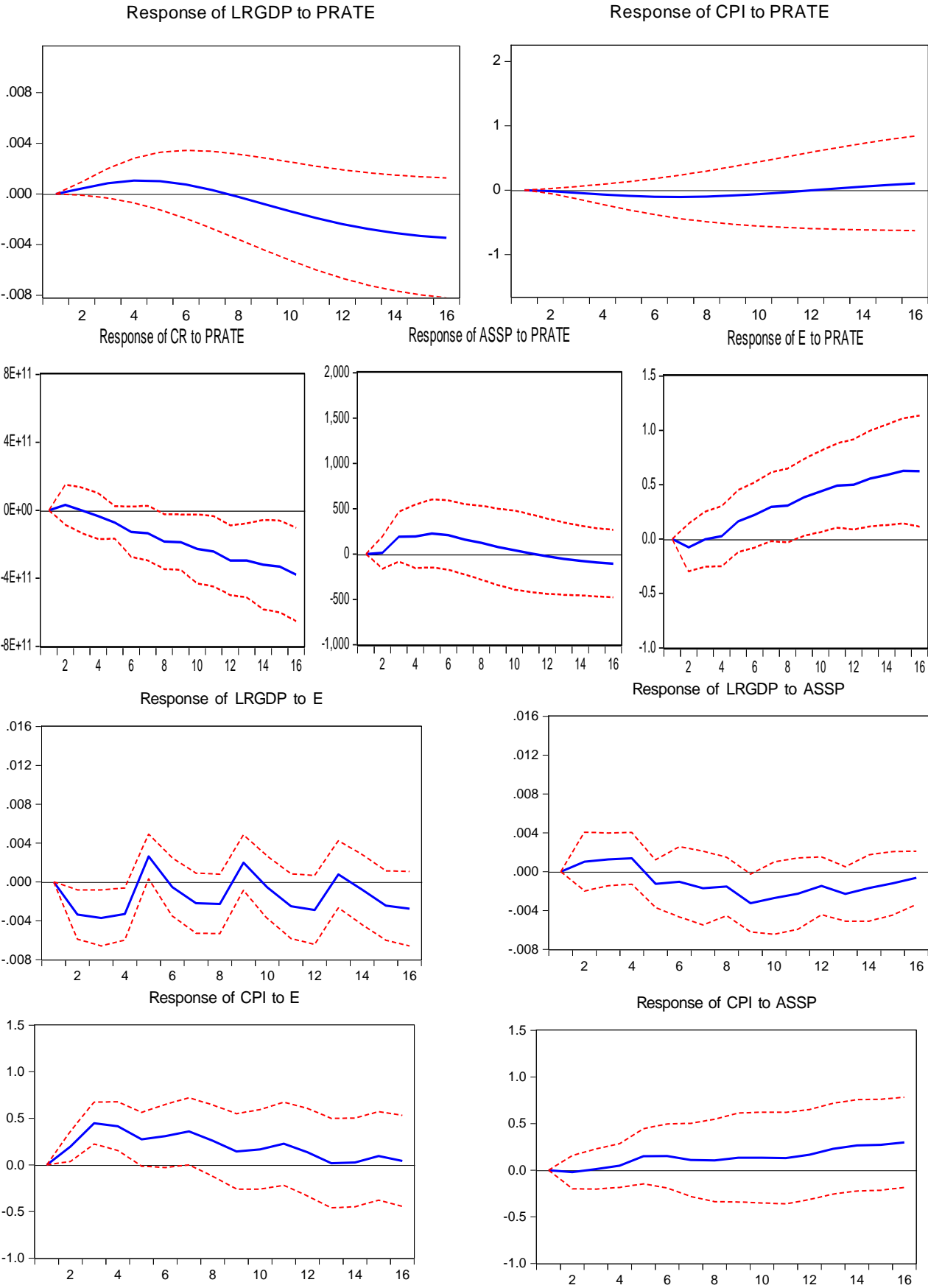
As my expectation the asset price channel is found insignificant, with exception of the 8th quarter (figure 12). It has a negative impact on GDP after two years. It may be because of the fact that the long run economic growth is determined by expenditure on education, research and development (R&D) (Mihaela, 2017). Institutions, human capital and physical capital are also major deriving forces for growth in the long run (Daniel, 2019). It is also shown that there exists weak correlation between policy rate and asset price (table 2). Thus, asset price channel is not an effective monetary policy transmission channels in India due to different hindering factors in which some of the challenging factors are discussed in the sub section 'challenges of monetary policy transmission channels in India'.

Therefore, the result ensures that exchange rate channel is effective monetary policy transmission channel in determining both GDP and price in India. It is also confirmed in the works of Kamaiah(2014) and Sengupta (2014).

The impact of credit on RGDP is statistically insignificant at 95% confidence interval (figure 12). But Price responds positively to the credit shock in the 2nd quarter and seems persistent at the 95% confidence interval. Thus, we can argue that the credit channel does not have an impact on output and has weak impact on price in the long run. It is also in line with the findings of (MISHRA, 2012). For ineffectiveness of the credit channel different reasons are responsible such as weak institutional framework, credit rationing, insufficient credit provision and higher collateral requirements are some of the factors that hinder effectiveness of the credit channel in India. Detail challenges of monetary policy transmission channels are discussed in the following subsection.

Figure 12 impulse response of GDP and price to monetary policy channels and policy rate

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of LRGDP to PRATE

Response of CPI to PRATE

Response of CR to PRATE

Response of ASSP to PRATE

Response of E to PRATE

Response of LRGDP to ASSP

Response of LRGDP to E

Response of CPI to E

Response of CPI to ASSP

Response of LRGDP to CR

Response of CPI to CR
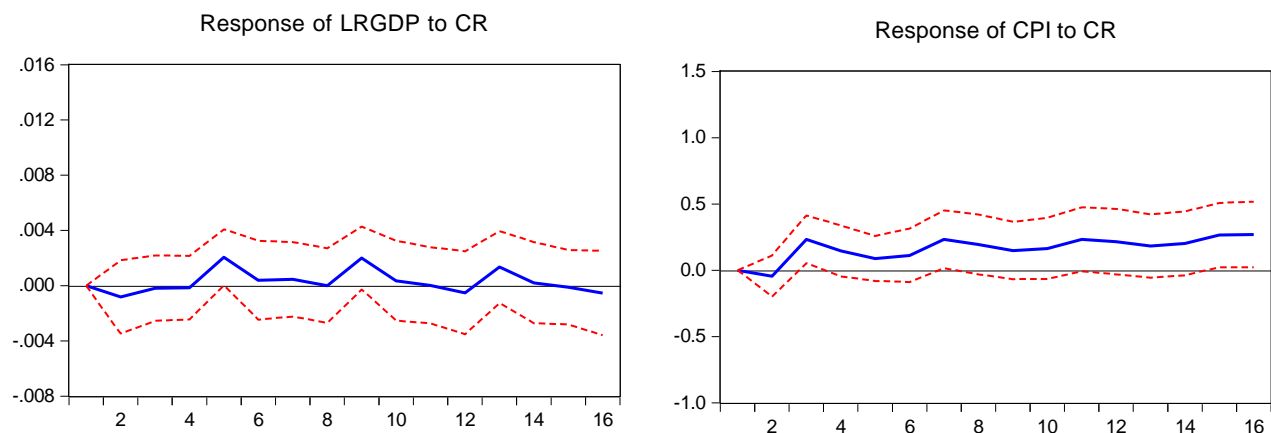
Variance Decomposition

Variance decomposition reveals the percentage of variation in GDP and price level that is explained by variation in shocks of transmission channels. For example table 4 indicates that in the first quarter any shock from monetary policy channels does not explain GDP of the country. However, variation in GDP is highly explained by the exchange rate variations in the 4th quarter (about 13%). The result also clearly shows the share of credit in explaining variation in GDP is the minimum among all the channels. Thus, it confirms figure 12 and we may argue that the credit channel is the "lost channel" in India. Asset price also explains only up to 5.75% of the variation in GDP.

Table 4 variance decomposition of LRGDP of India

Variable	D(LRGDP)					
Shocks	D(RGDP)	D(CPI)	D(CR)	D(ASSP)	D(E)	D(PRATE)
1-quarter	100	0	0	0	0	0
4-quarters	81.27	2.28	0.26	1.61	12.95	1.607
8-quarters	80.72	2.33	1.11	2.63	11.29	1.90
12-quarters	77.83	2.11	1.46	5.69	10.609	1.98
16-quarters	76.398	1.96	1.42	5.75	10.49	1.97

Similarly price variation is strongly explained by exchange rate variation (13.14%) in the 4th quarter. Asset price channel is weak even compared to credit channel. Asset price channel explains only up to 3.73% of variation in price while credit variation explains up to 4.74% of price variation. Thus, exchange rate is stronger in explaining the GDP and price variation in India. It confirms figure 12.

**Table 5 variance decomposition of Price (cpi) in India**

Variable	DCPI					
Shocks	DRGDP	DCPI	DCR	DASSP	DE	DPRATE
1-quarter	5.624	94.37	0	0	0	0
4-quarters	2.168	81.74	2.45	0.0946	13.14	0.398
8-quarters	2.31	81.42	2.85	1.065	11.803	0.5454
12-quarters	2.38	79.96	3.616	1.614	9.65	2.76
16-quarters	3.19	75.19	4.736	3.73	7.8	5.33

Sources: author's estimation

Robustness

Changing the order of endogenous variables in the SVAR model didn't bring a significant difference in the effectiveness of the monetary policy transmission channels in India. For instance the following result indicates impulse response function using orderings of CPI, LRGDP, LCR, EX, ASSP, prate. This order is taken as a test of robustness of my model because price level could affect aggregate demand so that RGDP may response for change in price. Moreover asset price may respond to change in exchange rate and so on. However, the result confirms the impulse response output presented on figure 12. Therefore, different diagnostic tests and cross checks confirm that the result presented on figure 12 is correct and reliable.

Figure 13 impulse response for robustness
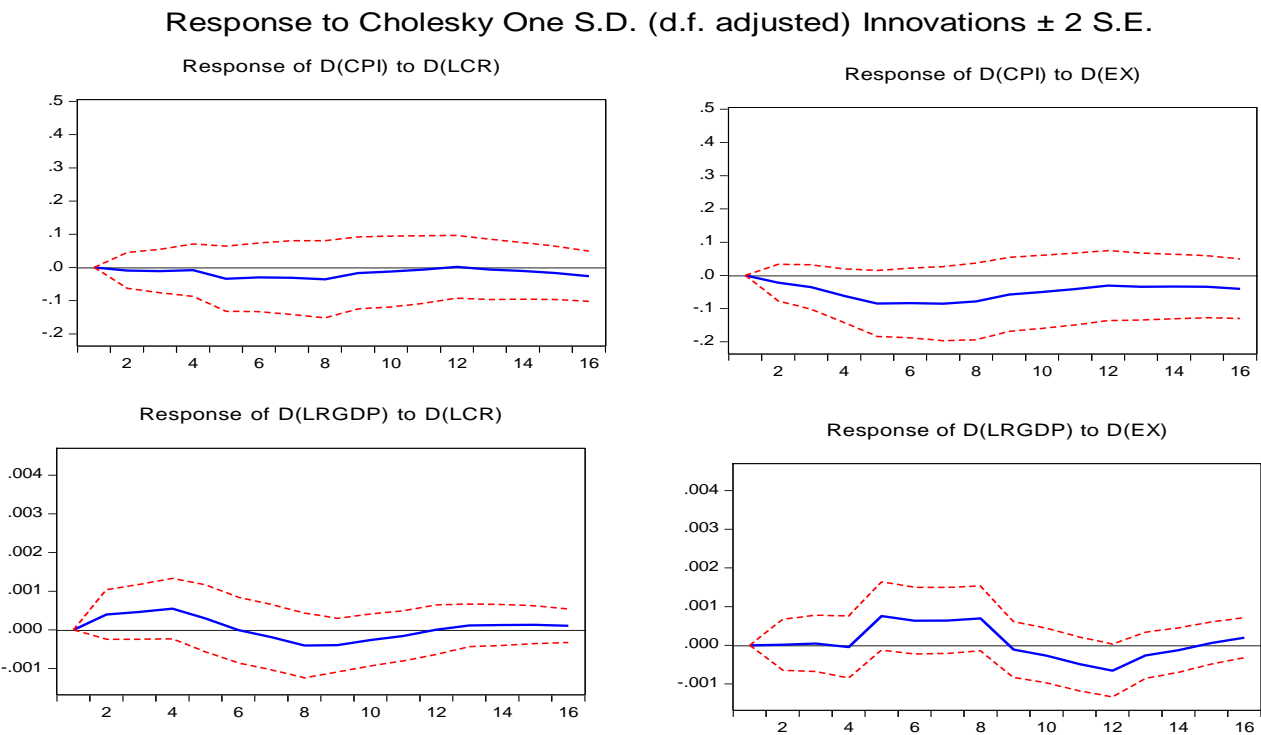
Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of D(CPI) to D(LASSP)

Response of D(CPI) to D(PRATE)

Response of D(LRGDP) to D(LASSP)

Response of D(LRGDP) to D(PRATE)
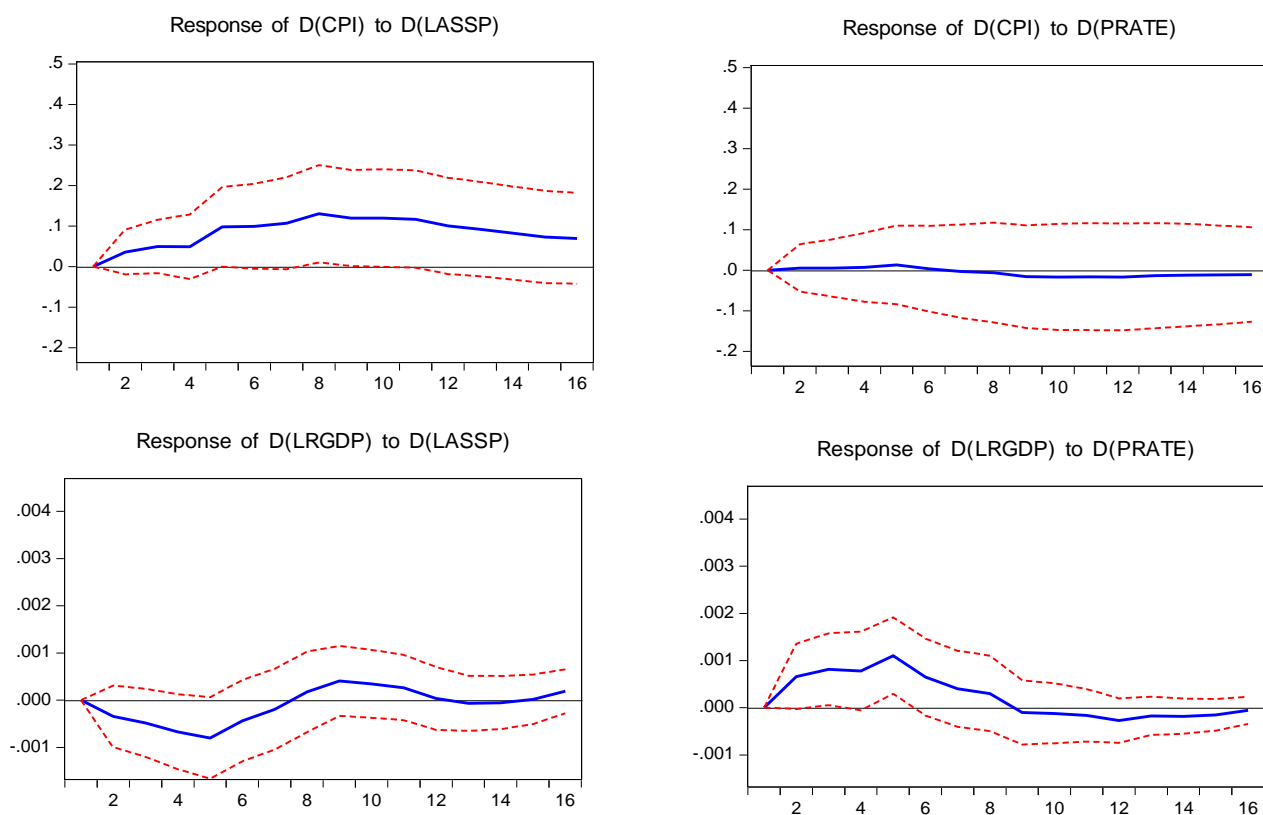
Sources, own estimation

Challenges of Monetary Policy Effectiveness in India

Monetary policy of India is facing different challenges. The major factors that hinder effectiveness of monetary policy transmission channels are;

1. Prevalence of Non-Performing Bank Loans

Figure 14 reflects that on average non-performing bank loans (bad loans) as percentage of total loans which increases through time. The rise in bad loans will affect the balance sheet position of commercial banks. This implies that commercial banks' profitability is deteriorated so that their willingness to expand credit will be also badly influenced. Different reasons are listed as causes of non-performing loans.

A study by (Klein, 2013) showed that high unemployment, domestic currency depreciation and high inflation rate are among causes of prevalence of non-performing loans in India. Therefore, effectiveness of monetary policy transmission channels specifically the credit channel will be weak and ineffective channel in India.

Figure 14 evolution of non-performing bank loans
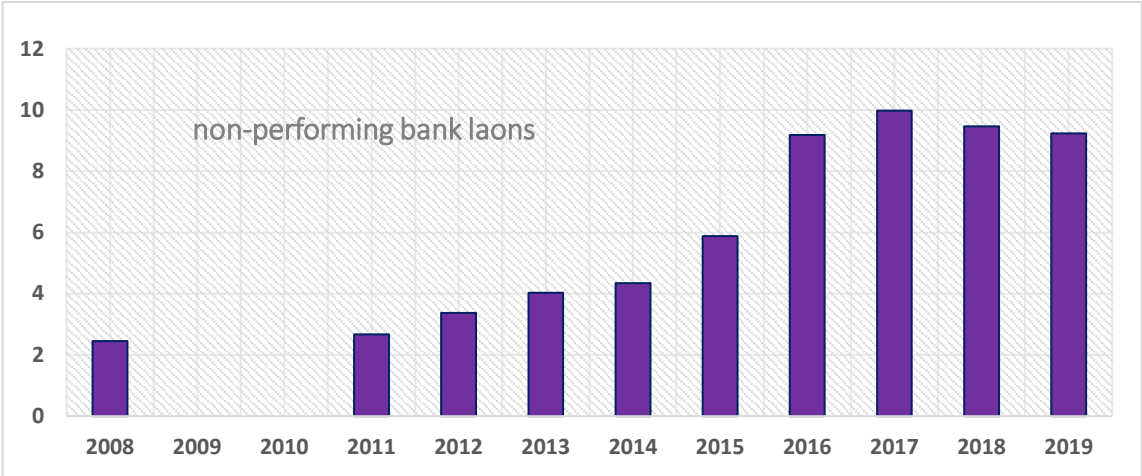
Sources, world bank

2. Lower Banking System's Efficiency Level

Financial institutions efficiency is measured by different indicators. But the most applicable indicators are bank net interest margin and return on asset. Accordingly, Commercial banks' net income to assets ratio for pre and after tax are taken as measure of return on asset before and after tax respectively.

Accounting value of bank's net interest revenue as a share of its average interest-bearing (total earning) assets is also taken as a proxy for net interest margin. Figure 15 indicates that the banks' net interest margin and profit (return on asset) are deteriorating through time. Moreover, there is higher statutory liquidity ratio in India. For instance it is about 18% in 2020 which implies that substantial portion of asset is not earning interest rate. This will bring a negative effect on quality of assets. Thus, if RBI reduces policy rate (figure 15 bottom panel ensures the continuous decrease in policy rate), but the lending rate is regulated, the expansionary monetary policy will pressure the interest rate margin for banks.

Consequently, commercial banks face lower interest margin and loss and hence loan provision behavior of banks will be reduced so that monetary policy transmission channels specifically the credit channel be ineffective.

Figure 15 trend of bank net interest margin and return on asset

Bank net interest margin (%)

Bank return on assets (%, after tax)

Bank return on assets (%, before tax)

policy rate
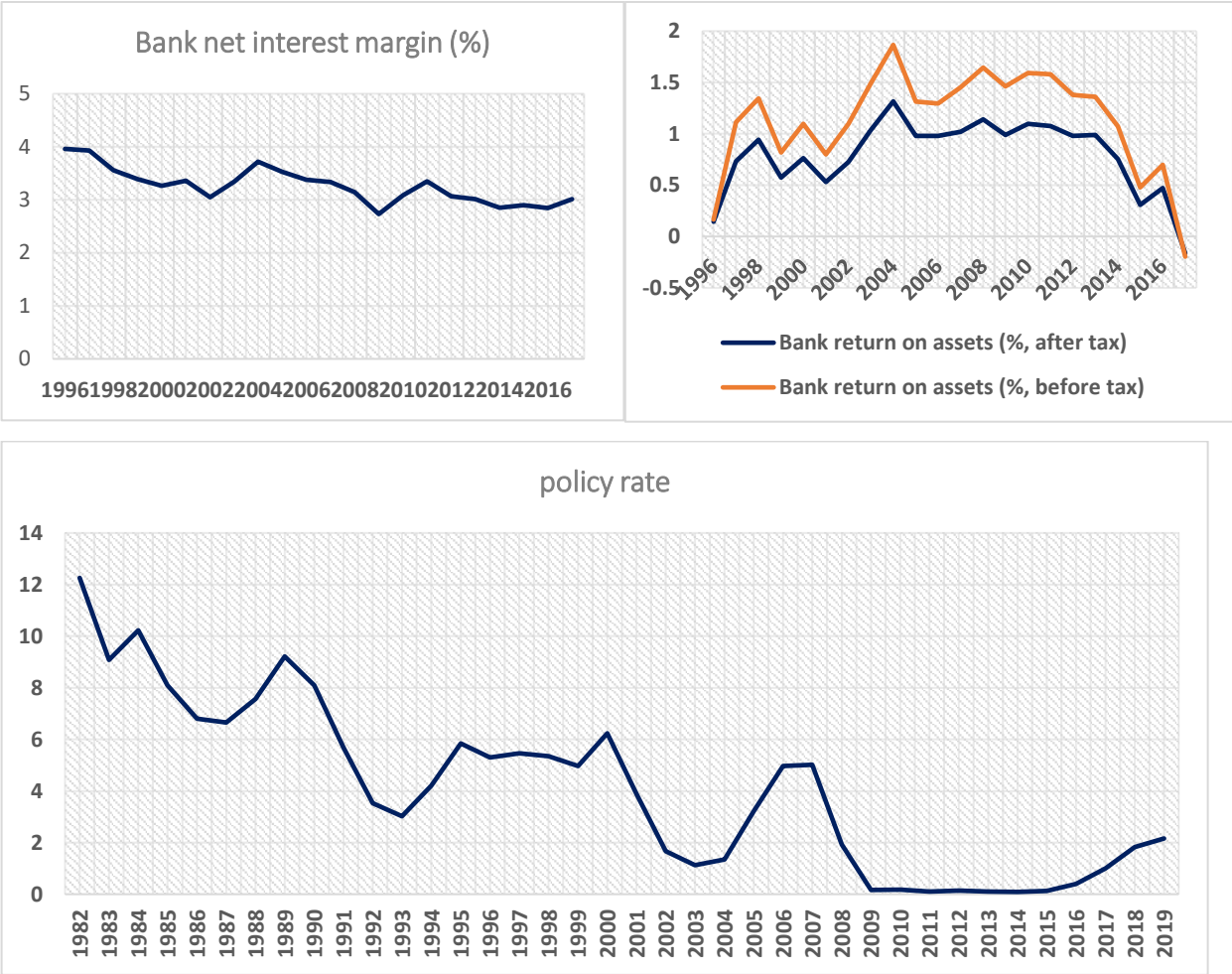
Note: *bank return on asset for both before and after tax are taken to control role of tax on net income of banks*

3. Higher Stock Market Volatility and Lower Stock Market Depth

In the third position; stock market volatility and lower stock market depth can be taken as challenging factors that affect effectiveness of monetary policy transmission channels in India. As shown in figure 16 below stock market is more volatile than developed economies of USA and United Kingdom. It is because of the fact that Indian stock market is not yet developed and highly exposed to foreign shocks[4]. Depth of Stock market is by far lower than the US and hence it will have an impact on effectiveness of monetary policy in India. Thus, it will not be surprising to observe the findings that total shocks of monetary policy variables could not transmitted to real variables.

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[4] https://theprint.in/economy/india-stocks-are-more-volatile-than-marijuana-related-shares-in-us/124743/

Figure 16 stock market volatility and stock market depth
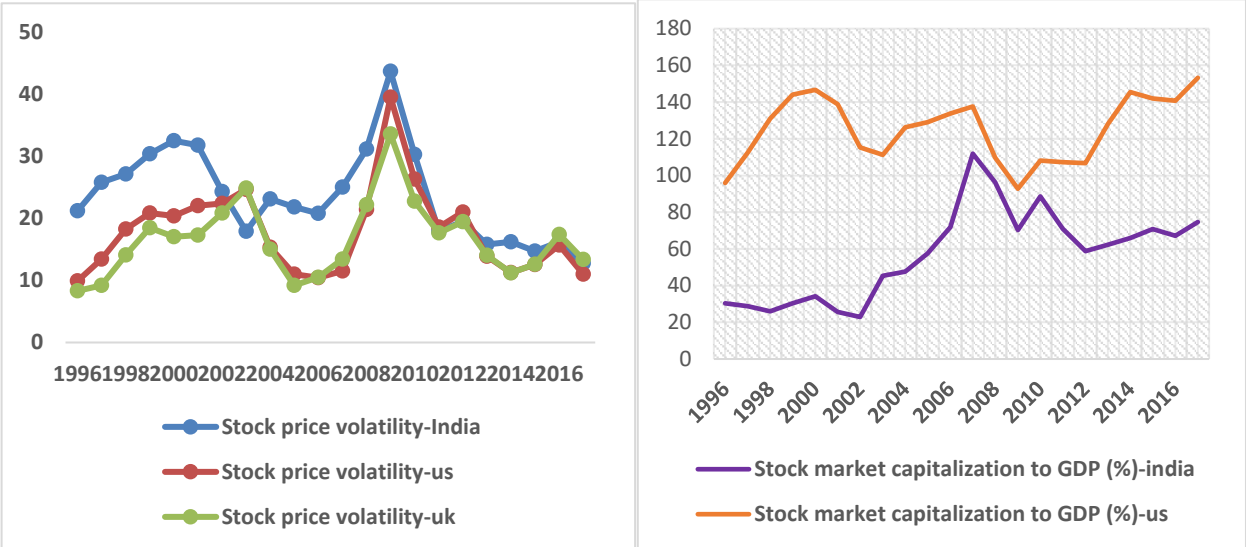
Sources, IMF, 2020

4. Government as Big Borrower and Slowdown of Private Investment

The government of India is acting as big borrower. Figure 17 shows that claims on central government is significant and growing overtime. If the government is a big borrower, the monetary policy transmission channels become ineffective. For instance if central bank cut policy rate so as to encourage credit to private sector, the huge government borrowing will make a pressure on interest rate (rise interest rate) through rise in money demand. Thus, the offseting effect of the govenmnet interfernce in the credit market will neutralzie the transmison possibilities of the centeral bank. Moroevr, it reveals the existence of fiscal dominance on monetary policy and hence the govment intrupt the RBI's operation which affects effectivness of monetary policy channels.

Figure 17 trends of private credit and claims on central government's as percentage of GDP
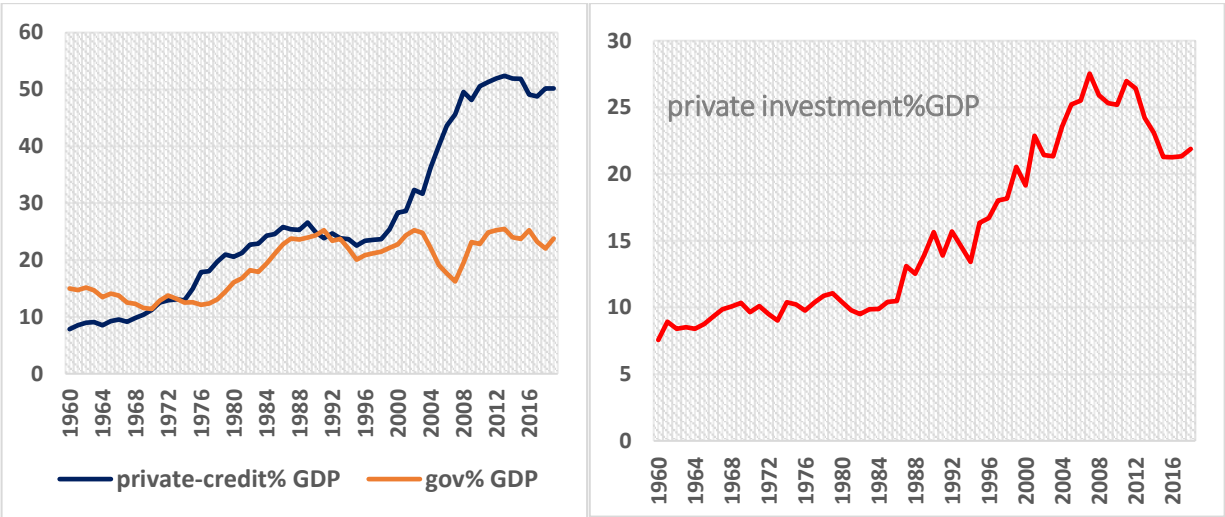
Sources, world bank data base, 2019

The transmission channels to be effective, the manufacturing sectors' capacity to utilize the credit availability does matter. That is even if credit is sufficiently available for private sectors, their balance sheet position has played great role. It can be seen in figure 17 that private Investment is slowing down especially following the great depreciation of 2008. This implies that, though the RBI of India has undertook different expansionary monetary policy measures, the transmission channels like credit is weak to boost the private investment level.

5. **Lower Level of Central Bank Independence**

I used a data set which is organized by (Mathew, 2003). He has chosen 2001 as calander year to measure central bank indpenednce among European uinon and emerging economies. Accrodingly, the writor used six indicators in three categories which are monetary policy independency, personnel idependence and fiscal independnce indicators. Thus, figure 18 reflects that Germany stood first with 33.5 points in centeral bank independency indicators. However, India is a country of least central bank indepency level with 17.5 points. Consequently, lower level of centeral bank independence will have a considerable impact on effectivness of monetary policy transmision channels. Because the central bank will not independntly detemined the opitmal policiy dessions rather their activity will depend on the will of the government so that monetary policy's effectivness will be badly affected. That is why credit and asset price channels are found weak in India.

Figure 18 central bank independence index
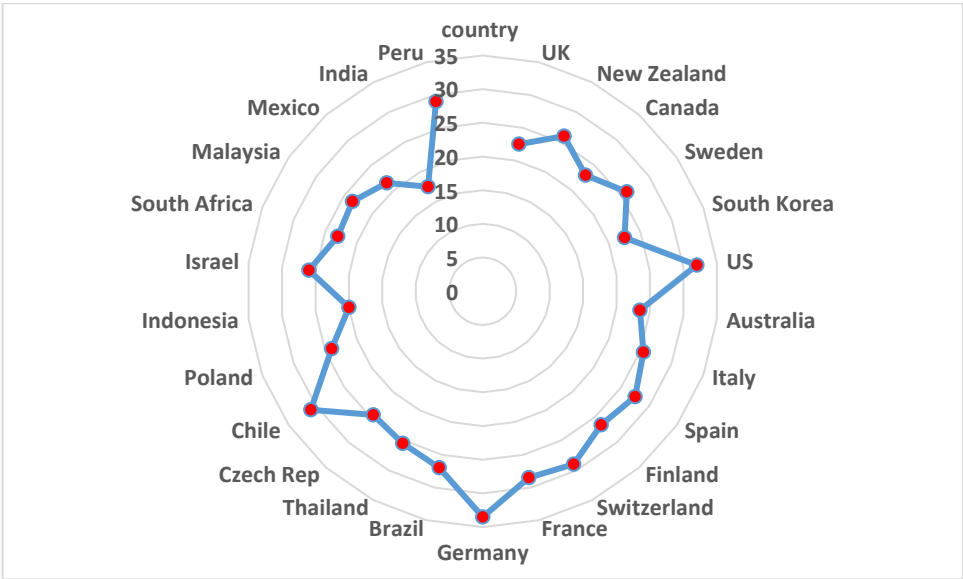
Sources: survey data of Mathew (2003)

6.2. Part Two: Monetary Policy Transmission Channels Of Ethiopia

In this section effectiveness of monetary policy transmission channels and some challenging factors are discussed for Ethiopian case. Accordingly, impulse response function is developed in two stages, first a baseline model is interpreted. This model contains only three variables that are GDP, price level and the policy variable (money supply). In the second step the impulse response of the SVAR system is presented in which all variables are included in the model.

However, the limited number of formal financial institutions and lower accessibility of banks may have an impact on effectiveness of monetary policy in Ethiopia. For instance, there are 18 banks (with total branches of 6,511), 18 insurance companies and 41 microfinance institutions in 2019/20 and only 37% of adults has count on the same year (NBE, 2021).

Variables may be taken at their difference or at level on the basis of variables order of integration while using the SVAR system and hence running the unit root test is a necessary condition. The unit root test presented on the appendix indicates that all variables are integrated of order one. Therefore, variables are taken at their first difference in the SVAR system.

Granger causality and diagnostic tests

I used similar approach like Indian case to determine the variables orderings. To do so, the granger causality test has been conducted. This test enables to determine the order of variables in the SVAR system. The result presented on table 6 confirms the order of $RGDP,\ M,\ CPI,\ E, LR, CR$ which is also supported by economic theories. That is the result reveals that RGDP has a causal impact on money supply (M), money supply also causes price change (CPI) and so on. On the other way round money supply is contemporaneously respond to output shock and hence money supply has to be placed after RGDP on the SVAR system and so on.

Moreover, different diagnostic tests are conducted including the lag order selections, serial autocorrelation and VAR stability tests. The FPE, AIC and HQ criteria indicates that lag length of five is an optimal lag length for the VAR estimation and hence for this paper I used five lag order while estimating the VAR and SVAR systems for Ethiopia (see the appendix).

Moreover, roots of the companion matrix lies within the unit circle so that the VAR system is stable (appendix).

Table 6 Granger causality test in Ethiopia

Pairwise Granger Causality Tests		
Null Hypothesis:	F-Statistic	Prob.
LM does not Granger Cause LRGDP	1.49	0.22
LRGDP does not Granger Cause LM	9.61***	0.0023
CPI does not Granger Cause LRGDP	2.76*	0.0986
LRGDP does not Granger Cause CPI	4.07**	0.045
LR does not Granger Cause LRGDP	0.175	0.676
LRGDP does not Granger Cause LR	3.105*	0.08
LCR does not Granger Cause LRGDP	0.387	0.53
LRGDP does not Granger Cause LCR	5.55**	0.0198
EX does not Granger Cause LRGDP	0.095	0.76
LRGDP does not Granger Cause EX	2.967*	0.087
LM does not Granger Cause CPI	0.655	0.42
CPI does not Granger Cause LM	0.457	0.50
LR does not Granger Cause CPI	1.58	0.21
CPI does not Granger Cause LR	0.756	0.386
LCR does not Granger Cause CPI	0.079	0.78
CPI does not Granger Cause LCR	0.031	0.86
EX does not Granger Cause CPI	1.022	0.31
CPI does not Granger Cause EX	1.27	0.26
LR does not Granger Cause LM	1.194	0.276
LM does not Granger Cause LR	11.908***	0.0007
LCR does not Granger Cause LM	1.81	0.18
LM does not Granger Cause LCR	18.78***	3.E-05
EX does not Granger Cause LM	2.646	0.106
LM does not Granger Cause EX	6.196**	0.014
LCR does not Granger Cause LR	0.398	0.53
LR does not Granger Cause LCR	10.314***	0.0016
EX does not Granger Cause LR	0.425	0.515
LR does not Granger Cause EX	0.022	0.88
EX does not Granger Cause LCR	0.367	0.54
LCR does not Granger Cause EX	1.70	0.19

Note, (*), (**) and (***) represents significance at 10%, 5% and 1% respectively
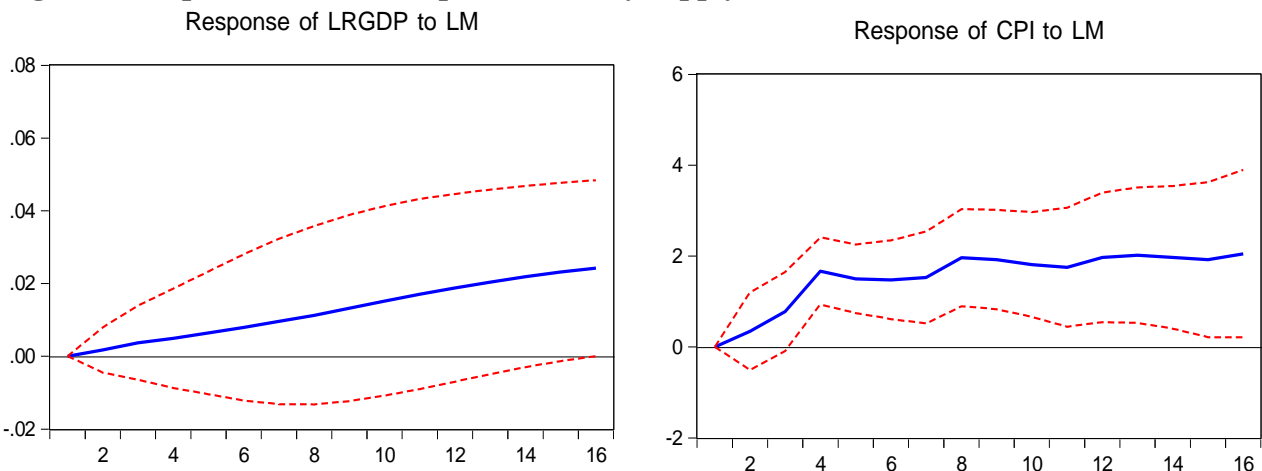
Impulse Response Model

In this section the dynamic response of output and price to a positive one standard deviation shock in money supply, private credit, exchange rate and lending rate are presented.

Response of real GDP and price to money supply shock

In the first instance impulse response function of output and price are conducted to see the direct impact of monetary policy on output and price. The result confirms that Price responds positively to money supply shocks after the 2nd quarter and the impact remains persistent (figure 19). It is in line with theory that money supply is a strong drivers of price change in the long run. That is in the long run with relatively stable velocity of money and output level, the change in money supply will be reflected proportionally on price change. This finding is in line with the works of (Younus, 2017).

However, the impact of money supply on real GDP is statistically insignificantly at 95% confidence interval (figure 19). It confirms also the quantity theory of money in which money supply affects more likely the price level than output. Thus, money supply neutrality seems holds true for Ethiopian case. Different reasons are responsible for monetary policy neutrality in the country. Some of them are 1), the investment is dominated by the government and the government is acting like a big firm in the economy, 2), central bank is not independent and hence the government highly interferes in the monetary policy to control money supply using different directives such as limiting the amount of cash withdrawals per day and interest rate floor settings, 3), majority of the population do not have access to formal financial institutions so that in situations where majority of the population do not have saving and demand deposits the national bank will have little power to influence decision making behavior of economic agents.

Figure 19 response of GDP and price to money supply shocks

Sources: author's own estimation

Impulse Response of Price and Output to Transmission channels' Shock

In this section a more a general SVAR model is used which incorporates all variables. Here the response of price and GDP to money supply shock and the response of monetary policy channels to money supply shock are conducted. These impulse response functions indicate the impact of money supply on output and price and on monetary policy transmission channels. It reveals how monetary policy channels are responsive to monetary policy variable shock (money supply). Moreover, the response of output and price to exchange rate, credit and lending rate shocks is presented.

In line with economic theory the impact of money supply on price remains positive and significant at 95% confidence interval (figure 20). The impact is also persistent however, the impact of money supply on GDP is statistically insignificant at 95% confidence interval. Figure 20 is extension of figure 19 in which figure 20 is obtain when all endogenous variables (GDP, price, money supply and all the transmission channels) are taken in the SVAR model. However, the impact of money supply is not different from the result of the simple model (figure 19). This implies the presence of transmission channels do not alter the direction and magnitude impact of money supply on price and real GDP.

Exchange rate responds positively and significantly at 95% confidence interval to a positive one standard deviation money supply shock on impact (figure 20). Expansionary monetary policy (increase in money supply) lead to deprecation of domestic currency (rise in exchange rate). It is in line theory that rise in money supply will result in decrease in interest rates. Domestic denominating assets and domestic currency will be less attractive for investors. Therefore, capital outflow will lead to depreciation of domestic currency. However, the figure confirms that the impact of money supply will vanish after the 4th quarter and become statistically insignificant. It is line with theory that money supply does not have a long lasting impact on real variables. Moreover, empirical literatures like Yesigat (2020) confirms this finding.

Response of private credit to monetary policy is positive at the 4th quarter. The impact of money supply on credit is weak and vanished in the long run (figure 20). The figure also shows that lending interest rate is not responsive to money supply shock because the lending rate is regulated by the government of Ethiopia.

Moreover, figure 20 shows impulse response of real GDP and price level to exchange rate, private credit and lending rate shocks. The impact of lending rate on real GDP and price is insignificant at 95% confidence interval in Ethiopia (figure 20). Interest rates that banks charge on loans and

deposits are regulated by the government and hence demand and supply of money do not have any role in determining the interest rates. Thus, it is not surprising to see ineffective lending rate transmission channel in Ethiopia.

The impact of exchange rate shock on real GDP is found insignificant at 95% confidence interval in Ethiopia (figure 20). It may be because of the fact that level of aggregate demand on imported goods is not responsive to exchange rate shocks. Official exchange rate depreciates through time (appendix d) but total import of goods and service continuously rises overtime (appendix e) so that import demand is not responsive to change in exchange rate. It may be because of the fact that imported capital and raw materials couldn't be substituted domestically produced products so that their import level is less sensitive to exchange rate depreciation so that aggregate domestic production and demand is less sensitive to exchange rate shocks.
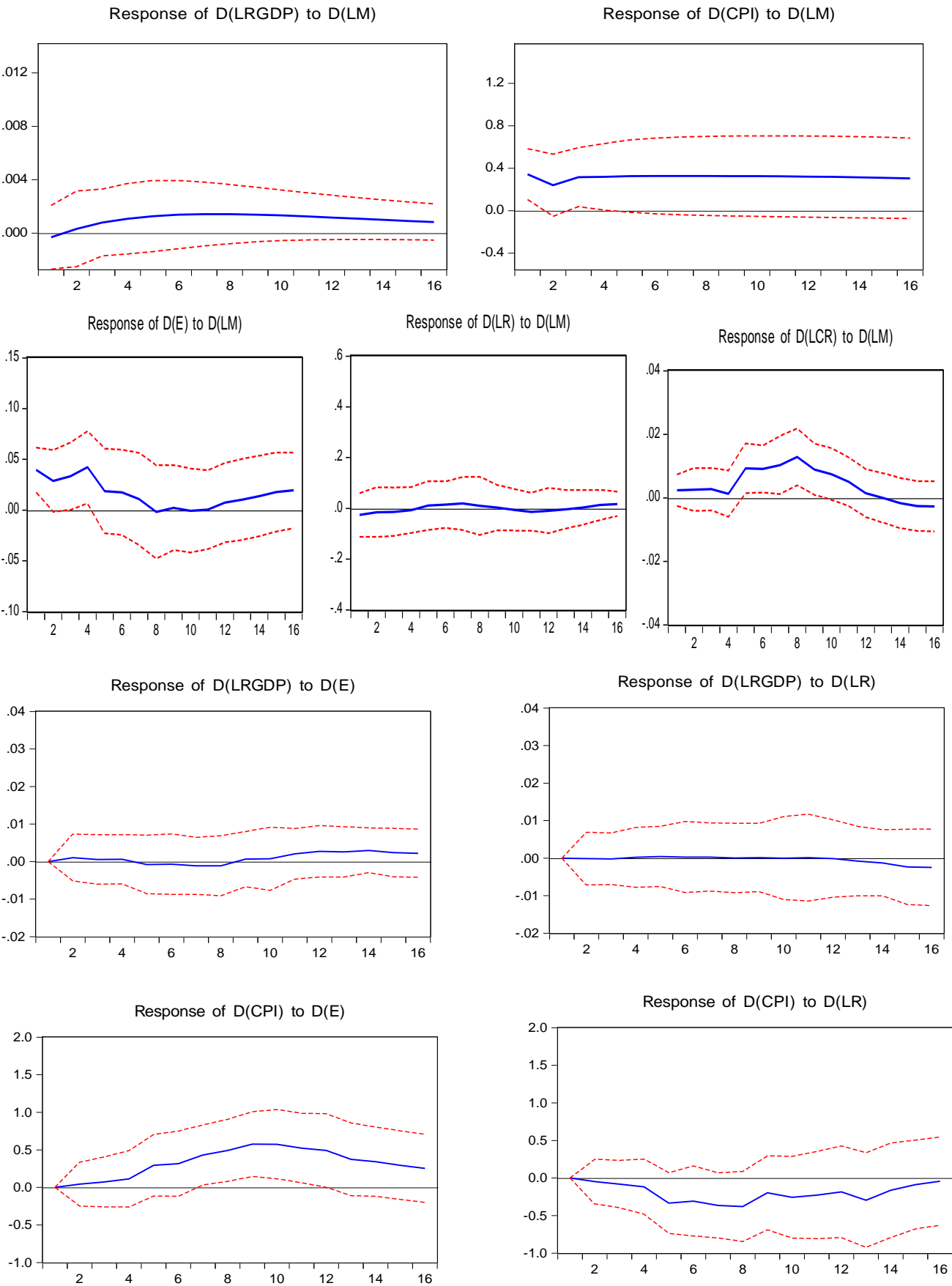
Price responds positively to a positive one standard deviation of official exchange rate shocks. It is styled fact that the country's import is higher compared to its export and the major imports are capital goods, food products, raw materials and gas oil. Thus, rise in exchange rate (depreciation of domestic currency) leads to higher domestic production costs and higher price in the economy. Therefore, depreciation of domestic currency results in rise in general price level in Ethiopia. Exchange rate channel is an effective transmission channel and thus it is an important factor to determine inflation. This result is consistent with the findings of Yesigat (2020).

The figure also reveals the dynamic impact of private credit on price and real GDP. Unfortunately credit provision by banks for private sectors do not have a significant impact on output and price in Ethiopia so that we can conclude that the credit channel is ineffective monetary transmission channel in Ethiopia. Different reasons account for the ineffectiveness of credit channel. Some of them are; the government adopted credit rationing approach, huge credit diversion for unintended purpose, inefficient credit utilization (allocative efficiency problem) behavior of firms and insufficient credit provision. Existence of loan diversion in Ethiopia for unintended purpose is confirmed in the study of (Shiferaw, 2016) and (Menza, 2017).

These problems in the credit market hinder to achieve the pre-determined objectives of credit service. Therefore, the credit channel found to be ineffective in Ethiopia.

Figure 20 impact of money supply on output, price and monetary policy channels

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of D(LRGDP) to D(LM)

Response of D(CPI) to D(LM)

Response of D(E) to D(LM)

Response of D(LR) to D(LM)

Response of D(LCR) to D(LM)

Response of D(LRGDP) to D(E)

Response of D(LRGDP) to D(LR)

Response of D(CPI) to D(E)

Response of D(CPI) to D(LR)

Response of D(LRGDP) to D(LCR)

Response of D(CPI) to D(LCR)
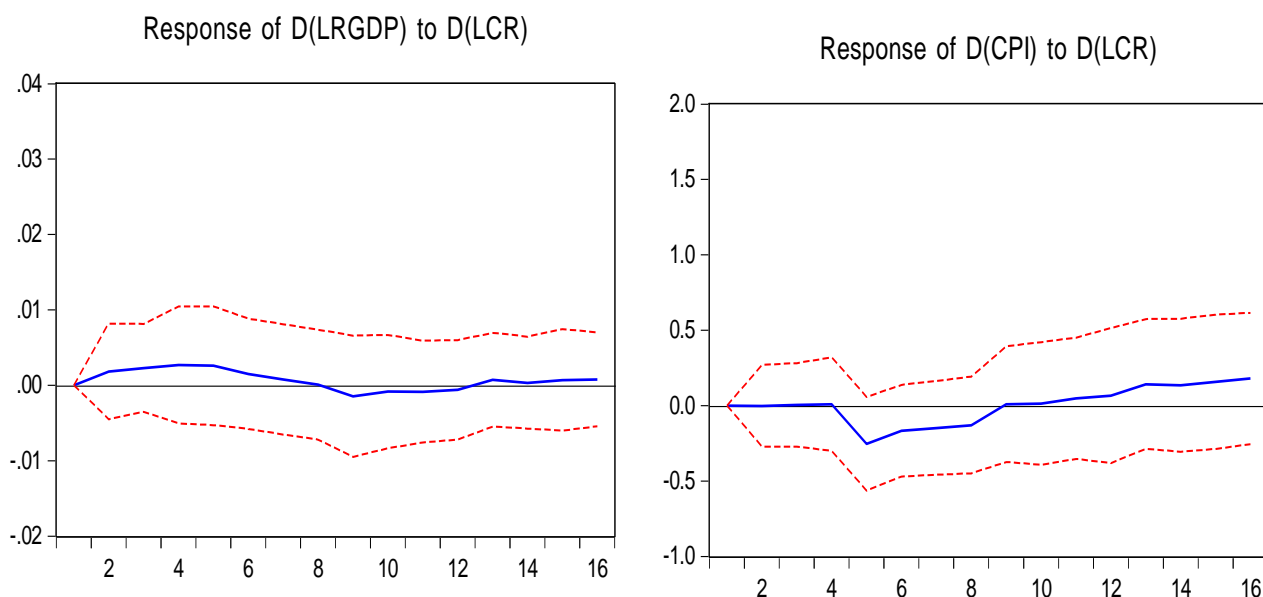
Sources: author's own estimation

Variance Decomposition

Table 7 and 8 show a percentage variation in real RGDP and price that is explained by the variables in the SVAR system. Exchange rate explains 1.82 % of variation in real GDP and 20.4% of variation in price. Thus, exchange rate is significantly affect price rather output in Ethiopia. Money supply explain about 13.31% of price level variation. Whereas lending rate explains up to 7.56% of variation of consumer price index.

Table 7 variance decomposition for RGDP in Ethiopian case

Variable	D(RGDP)					
Shocks	D(LRGDP)	D(LM)	D(CPI)	D(E)	D(LR)	D(LCR)
1-quarter	100.00	0	0	0	0	0
4-quarters	98.18	0.14	0.75	0.094	0.005	0.81
8-quarters	89.21	0.63	0.78	0.25	0.018	1.11
12-quarters	88.12	0.92	8.93	0.76	0.0199	1.24
16-quarters	86.166	0.95	9.19	1.82	0.593	1.28

Table 8 variance decomposition for Price level of Ethiopia

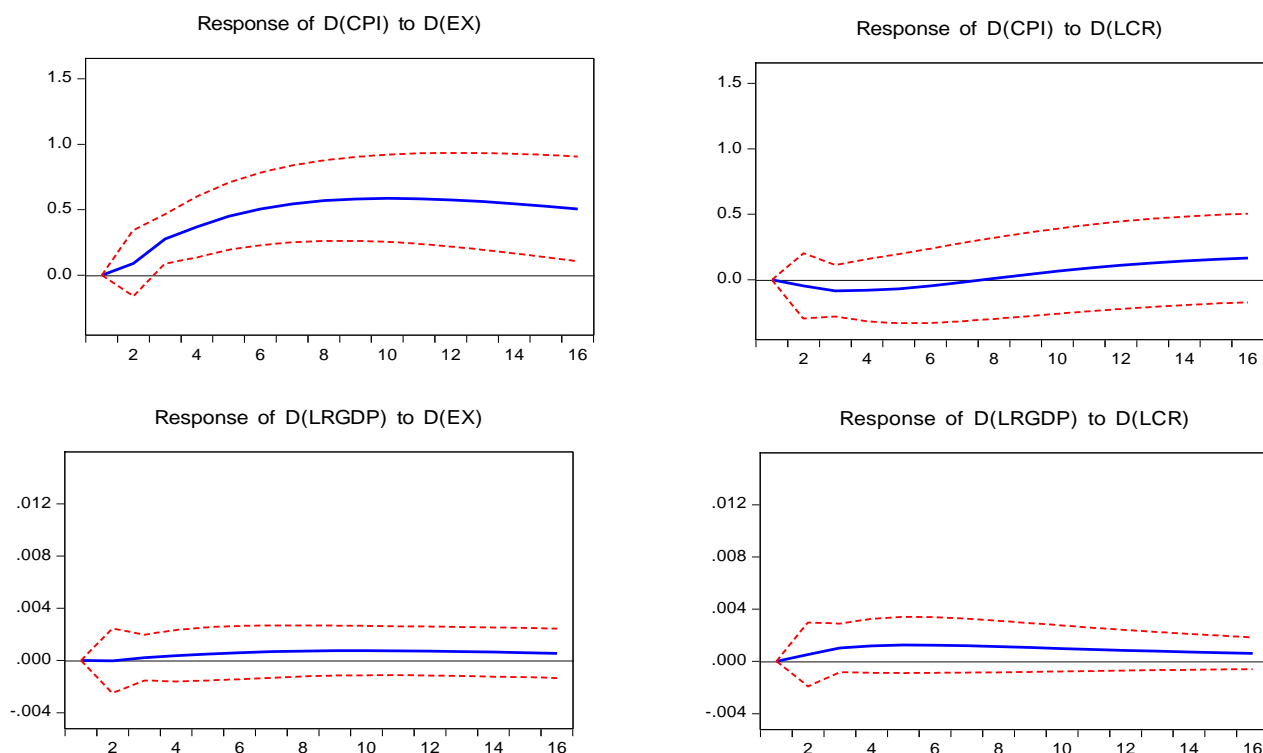| Variable	DCPI					
Shocks	D(LRGDP)	D(LM)	D(CPI)	D(E)	D(LR)	D(LCR)
1-quarter	3.98	7.35	88.66	0	0	0
4-quarters	2.43	7.53	89.11	0.44	0.48	0.0022
8-quarters	3.66	17.45	60.61	9.004	7.20	1.87
12-quarters	7.17	14.60	48.91	20.039	7.734	1.54
16-quarters	11.81	13.31	44.75	20.4002	7.56	2.16

Sources, own estimation

Robustness

Like that of the Indian case, robustness of the result is checked in different orders for the case of Ethiopia too. The idea is that if the result presented on figure 20 is correct changing the order of endogenous variables in the SVAR model shouldn't bring a different output. In doing so, on the basis of the premises that price might have a contemporaneous impact on output (GDP) and monetary policy also has to respond contemporaneously to change in GDP, I develop a SVAR model using the order $CPI, RGDP, M, LR, E, CR$. However, the result (shown on figure 21) fully confirms the statistical output presented on figure 20.

Figure 21 Impulse response: Robustness

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Response of D(CPI) to D(LM)

Response of D(CPI) to D(LR)

Response of D(LRGDP) to D(LM)

Response of D(LRGDP) to D(LR)

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Sources; own estimation

**Challenges of Monetary Policy Transmission Channels in Ethiopia**

Monetary policy is highly interrupted by the government in Ethiopia. For instance the government used different directives to restrict the amount of cash withdrawals per day for households and business enterprises. The national bank website of Ethiopia indicates that the central bank limits the amount of cash withdrawal since 2020. An individual can make withdrawal up to 100,000 Birr per a day and 500,000 Birr per a month whereas business enterprise can withdraw up to 200,000 per a day and up to one million Birr per a month due to liquidity constraints in commercial banks. Such government interference may have an impact on effectiveness of monetary policy transmission channels. Moreover, there are a number of factors that are responsible for ineffectiveness of monetary policy transmission channels such as:

1. **Higher Bank Cost Relative to Income**

Figure 22 shows commercial banks are incurring higher costs especially from 2011 onwards. However, it is obvious that commercial banks are established for profit generating purpose and hence if commercial banks are facing higher operating costs relative to their income generating capacity their loan provision behavior will be affected negatively. First, they will face liquidity constraint if they are not profitable in their business operation. Second, commercial banks become risk averse and may be psychologically influenced so that their willingness to extend credit

provision to private sectors will be badly affected. Thus, these factors will affect the credit provision abilities and willingness of banks to creditors so that the credit channel will be weak following monetary policy shocks.

Figure 22 ratio of bank cost to income and banks' capitalization and return's volatility (z-score)
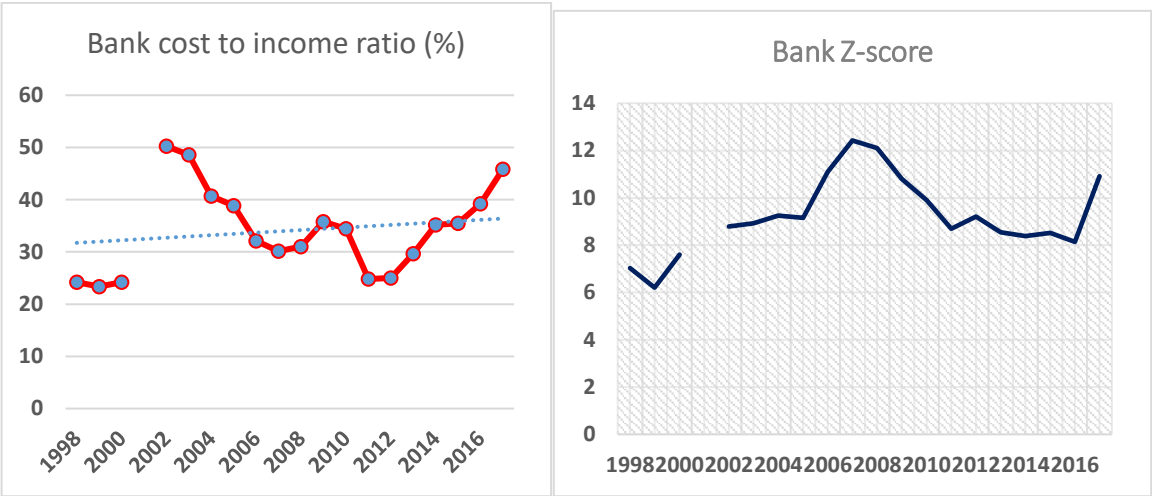
Sources International financial statistics, IMF 2020

2. **Rise In Volatility of Commercial Banking System (Bank Z-Score)**

Bank Z-score measures volatility level of commercial banks' capitalization and returns and hence it shows insolvency level of commercial banks. A higher z-score stands for lower insolvency problem and vice versa. Figure 22 shows that z-score declines following the financial crisis which implies that commercial banks had faced insolvency problem from 2008 to 2015. However in 2016 there is improvement in z-score. Thus, banks z-score seems uncertain and less predictable and hence volatility of bank's return and capitalization will hinder the effectiveness of monetary policy transmission channels. This is because of the fact that higher volatility of return increases bank's risk of uncertainty so that their willingness to provide credit will be negatively influenced.

3. **Majority of the People Do Not Have Bank Account**

The World Bank data indicates that only 37% of people (15+ age) have an account at a formal financial institution in 2019. The number of depositors with commercial banks per 1000 adults is about 136. This implies that central bank will be weakened to control currency in circulation given that large portion of the society does not have bank access. Therefore, the credit and the lending rate channel will be ineffective transmission channels of monetary policy.

4. Payment systems are not supported by electronically

Figure 23 shows that the number of ATM machines and number of branches per 100,000 adults are not balanced. Existence of limited ATM machines is an indicator that the payment system is not well developed in Ethiopia. If transactions are not made electronically, partially it will have a backward dragging effect on effectiveness of monetary policy transmission channels in the country.

Figure 23 number of bank branches and ATM machines per 100,000 adults
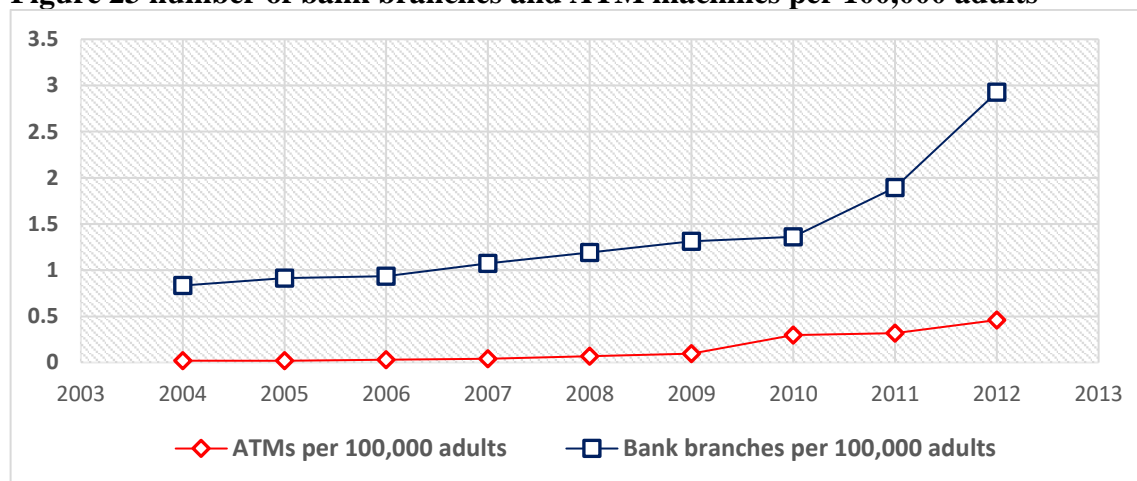
Sources, IMF, 2020

Summary

From the impulse response result the following elements can be summarized. The impact of policy rate on price and GDP is insignificant at 95% confidence interval in India. Exchange rate responds positively to shock in policy rate in India. However policy rate affects private credit negatively. The impact of policy rate on asset price is statistically insignificant at 95% confidence interval in India. Real GDP responds negatively to exchange rate shocks. The impact of exchange rate shocks on price is found to be positive in India while asset price channel is found weak monetary policy transmission channel in the country. The exchange rate channel is an effective channel in India and explains about 12.95% and 13.14% of variation in GDP and price respectively in India. This result is supported with the trend analysis.

The impact of money supply on price is positive and persistent in Ethiopia. But money supply has insignificant impact on GDP. Exchange rate is an important channel in Ethiopia and explains about 20% of variation in price. Lending interest rate and private credit are weak transmission channels. This result confirms the trend analysis presented in the monetary policy framework of the country.

7. Conclusion

This study examined effectiveness and challenges of monetary policy transmission channels of India and Ethiopia. Both Ethiopia and India has been experiencing different monetary policy frameworks in their economic story. For instance in the 1970s and 1980s Ethiopia had followed exchange rate targeting framework and from 1992 to 2008 the country had adopted multiple indicator approach. Ethiopia has shifted to exchange rate and price stability approach since 2008. Accordingly, Ethiopia targets a single digit inflation rate though it is not yet achieved. Whereas India adopted monetary aggregates monetary policy framework following its independence until 1998. From 1998 to 2016 RBI shifted to multiple indicator approach and from 2016 onwards India is following flexible inflation targeting [2%, 6% inflation targeting].

A quarterly data from 1982Q1 to 2019Q4 is used to achieve the research objectives. SVAR is also used to examine the sign and duration of response of output and price to monetary policy shocks and channels of monetary policy for both Ethiopia and India. Impulse response functions are developed since they are better showing response of macroeconomic variables over SVAR parameters. The impulse response shows the dynamic response of output and price for a positive one standard deviation shock in monetary policy shock and transmission channels.

Exchange rate responds positively (depreciated) for a positive one standard deviation shock in policy rate in India. While the impact of policy rate on private credit is negative. The impact of policy rate on asset price is found statistically insignificant at 95% confidence interval in India. The impact of exchange rate on GDP is found to be negative but price responds positively for exchange rate shocks in India. Asset price channel is found weak monetary policy transmission channel in India. Private credit do not have a significant impact on price change. Thus exchange rate channel is important channel in India and explains about 12.95% and 13.14% of variation in GDP and price respectively in India. A different factors may be responsible for ineffectiveness of some of monetary policy transmission channels in India but to list some of them, low banking sectors' efficiency level, prevalence of bad loans, high stock market volatility and lower stock market depth, high government interference in the form of big borrower and low status of central bank independence.

Money supply is one of the major driving forces of inflation in Ethiopia. Exchange rate and credit are positively respond to a positive one standard deviation shock in money supply.

Exchange rate is an important channel in Ethiopia and explains about 20% of variation in price. Lending interest rate and private credit by banks are found insignificant at 95% confidence interval in Ethiopia. Different factors are responsible for the effectiveness of monetary policy transmission

channels such as higher bank costs, volatility of commercial banks' banking system, less usage of banking services among the people and low habit of using electronics machines.

8. Recommendation

The paper ensures that majority of monetary policy transmission channels are weak due to different challenging factors in India and Ethiopia. Therefore, policy makers in India has to revisit their economic policies to minimize the default rates so that the non-performing loans will be minimized. This can be done via creating strong follow-up strategies for borrowers. RBI is less independent compared to other emerging and advanced economies and hence it needs some policy measures to improve the central bank's independency. The government need to take policy measurements to enhance the stock market depth in India. This will enable the monetary authority to influence the asset price (stocks and equities) so that it become more effective transmission channels in the economy.

Number of commercial bank branches has to be improved in Ethiopia so that households could have access to financial services and hence monetary policy transmission channels become more effective. The limited ATM machine availability implies poor electronics payment in Ethiopia. Thus, it needs effort to enhance the digitalization of the financial sectors in the country so that monetary policy might be effective.

However, this paper has limitations in some grounds. For instance it is conducted using the assumption of positive shock in monetary policy that is the study shows the effectiveness of monetary policy transmission channels following a positive unanticipated shock in monetary policy (monetary policy easing). However, literatures argued the possibility of monetary policy asymmetry implying monetary tightening has higher impact on real variables than monetary policy easing. Thus, further research may be conducted to compare effectiveness of alternative monetary policy channels under different monetary policy perspectives for both India and Ethiopian perspective. In second instance, this paper didn't consider any macroeconomic crisis, like the covid-19 crisis, but such economic events may distort the usual functioning the monetary authority and hence still further research works may be initiated to see the effectiveness of monetary policy transmission channels via taking some episodes into accounts.

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Appendix for Ethiopia
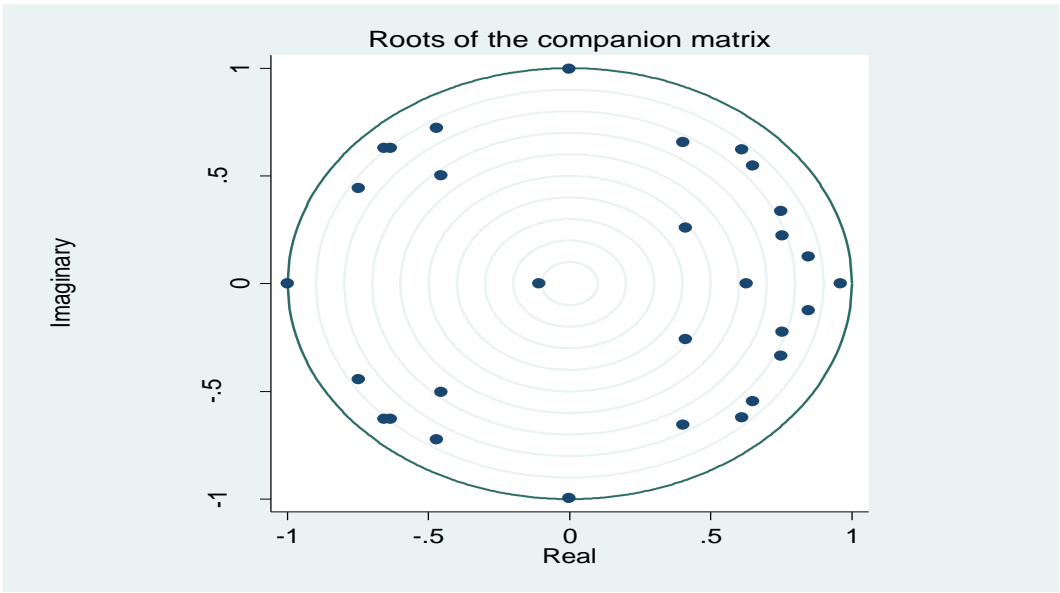
a: autocorrelation test
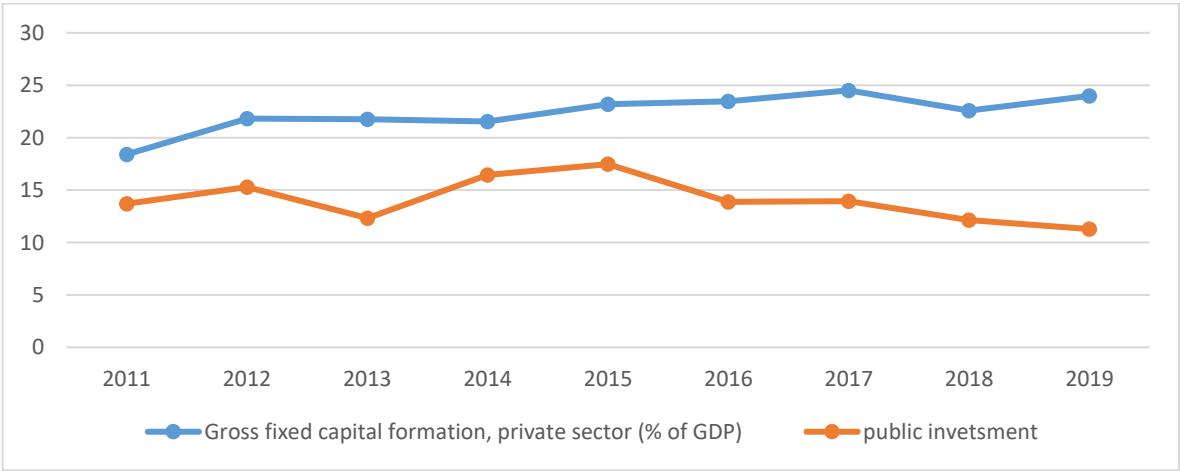
```
. varlmar, mlag(5)

    Lagrange-multiplier test
```

lag	chi2	df	Prob > chi2
1	12.9518	36	0.99986
2	8.8664	36	1.00000
3	41.9312	36	0.22917
4	139.5152	36	0.00000
5	26.2671	36	0.88297

```
    H0: no autocorrelation at lag order
```

b. VAR stability test

Roots of the companion matrix
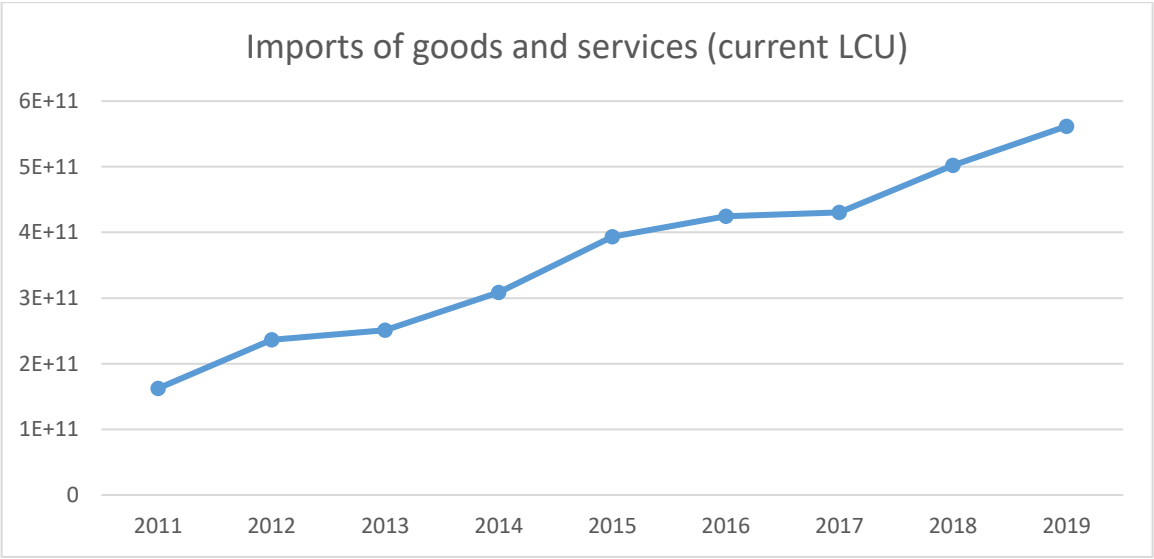
c. public and private investments trend

d. trends of official exchange rate

exchnage rate
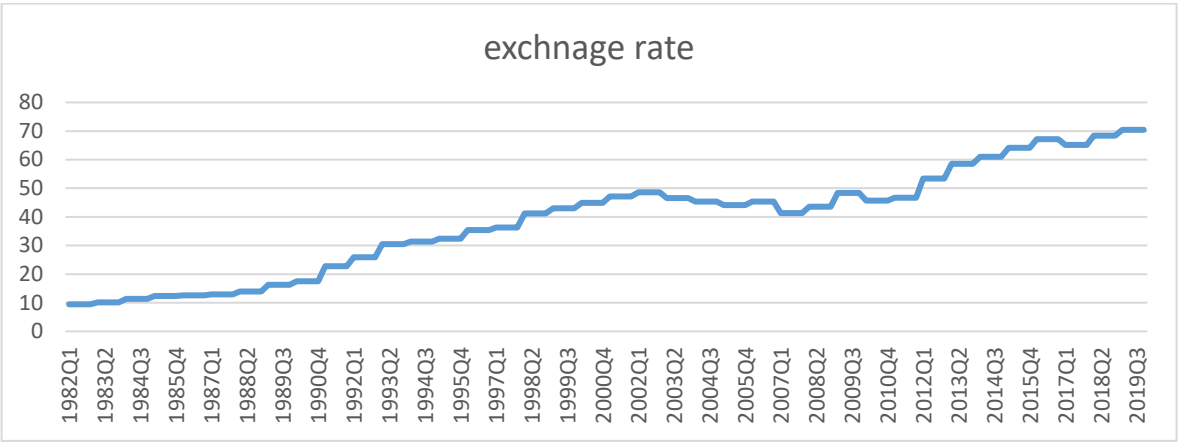
e. evolution of import of goods and services

Imports of goods and services (current LCU)

f. trends of trade balance

trade balance (TB)
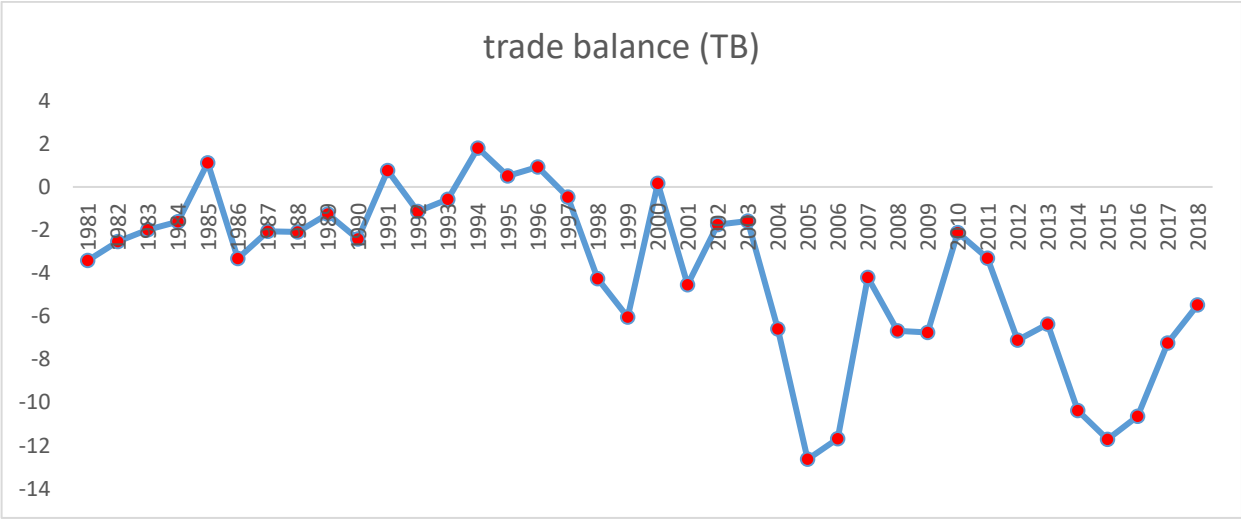
g. impulse response function (dynamics of the SVAR system)

Response to Cholesky One S.D. Innovations ± 2 S.E.
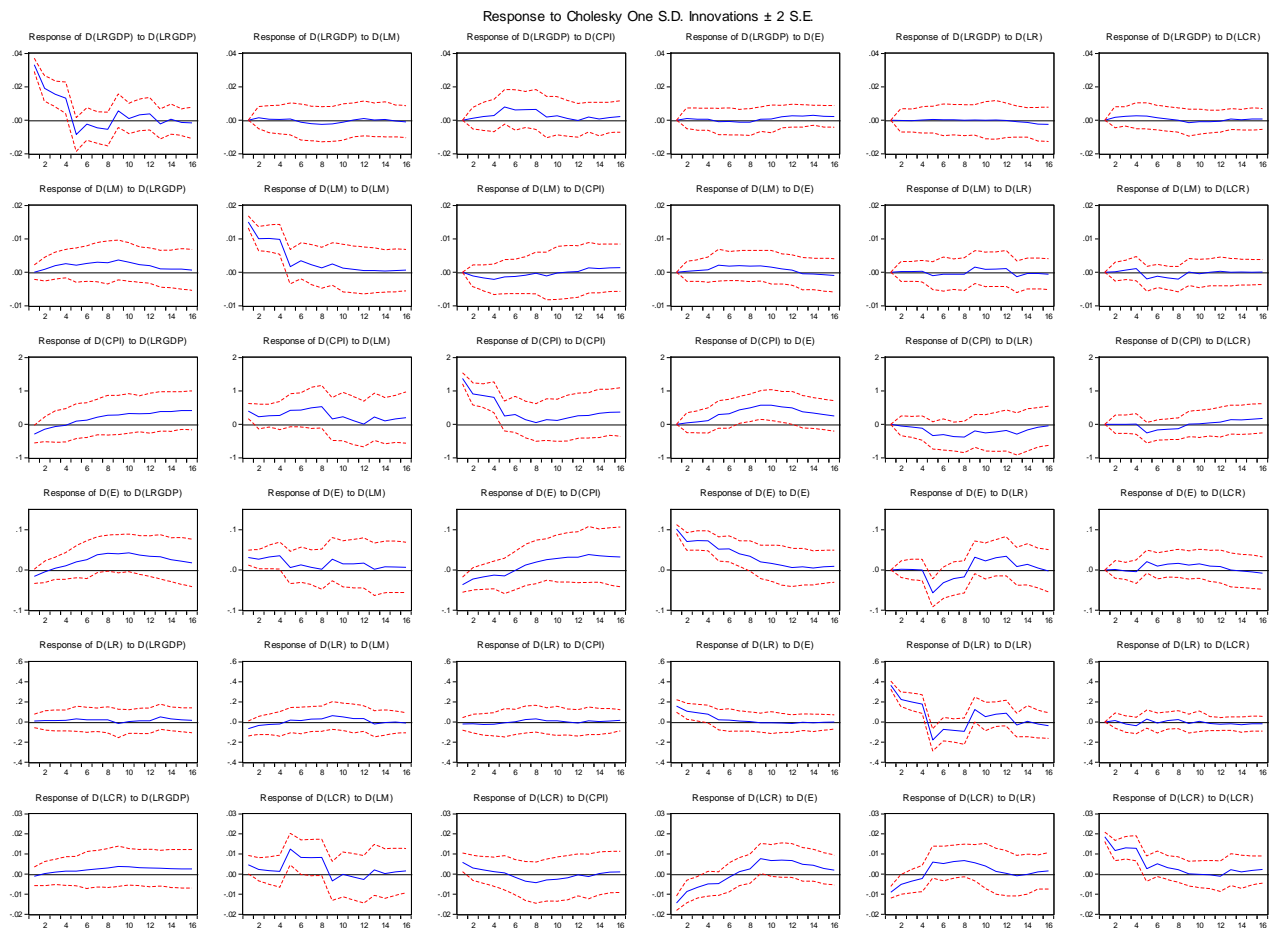
h. *Unit root test*

Table : Unit root test: with trend and constant, maximum lag 4

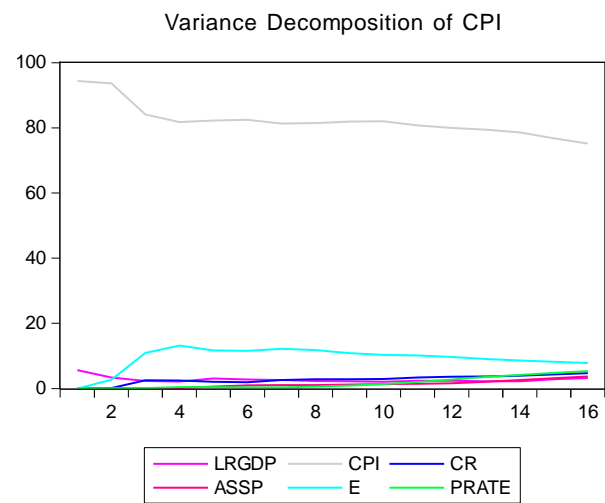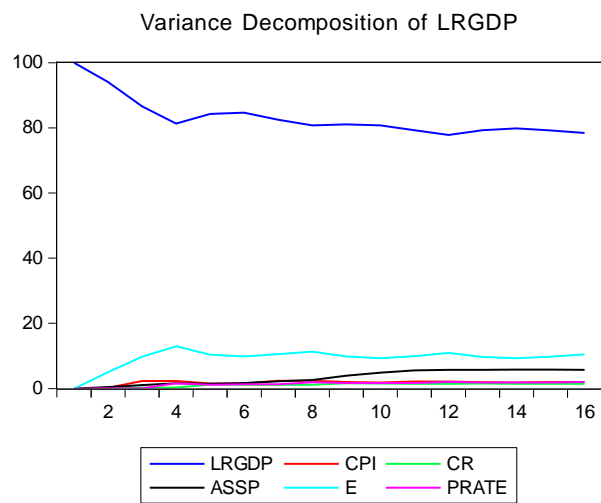| Variables	Level		First difference	
	5% critical value: -3.44		5% critical value: -3.44	
	Statistics	p-values	Statistics	p-values
LRGDP	-0.1655	0.993	-4.88	0.0005***
LM	-0.577	0.978	-5.06	0.0003***
CPI	3.096	1.00	-3.803	0.0189**
E	-0.496	0.983	-4.46	0.0024***
LR	-1.562	0.803	-4.577	0.0016***
LCR	-1.05	0.933	-5.53	0.0000****

Note, (***) and (**) represents significance level at 1% and 5% respectively

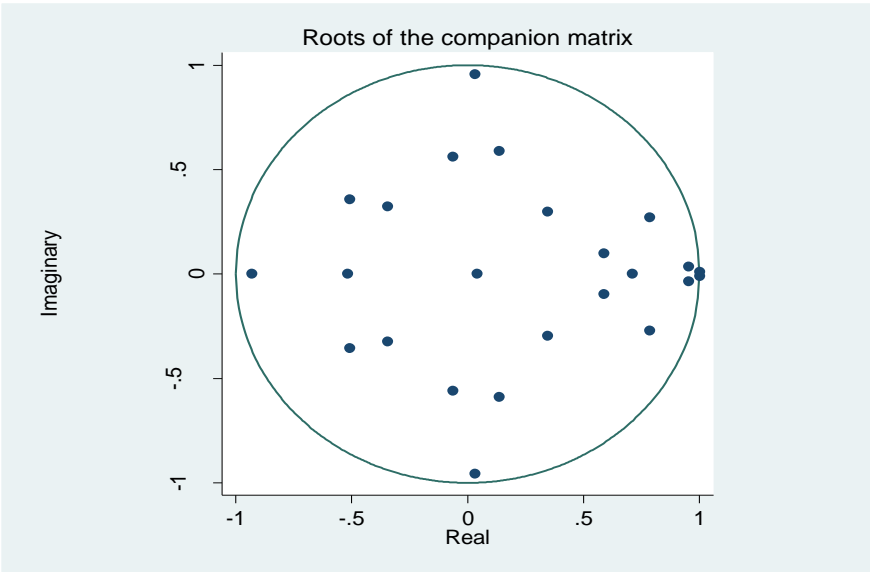i.optimal lag length determination

Table : lag length determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	284.34	NA	8.21e-10	-3.893	-3.77	-3.84
1	560.04	524.41	2.88e-11	-7.24	-6.37*	-6.89
2	574.07	25.49	3.92e-11	-6.938	-5.32	-6.28
3	592.91	32.68	5.2e-11	-6.69	-4.33	-5.73
4	750.29	259.72	9.30e-12	-8.39	-5.28	-7.13
5	851.78	158.97	**3.8e-12***	**-9.311***	-5.45	**-7.74***
6	861.77	14.80	5.63e-12	-8.94	-4.34	-7.07
7	868.92	9.99	8.80e-12	-8.54	-3.19	-6.37
8	928.66	78.5*	6.69e-12	-8.87	-2.78	-6.40
* indicates lag order selected by the criterion						

Appendix for India

a. Variance decomposition

Variance Decomposition of LRGDP

Variance Decomposition of CPI

b, VAR stability tests

Roots of the companion matrix

c.impulse response

Response to Cholesky One S.D. Innovations ± 2 S.E.
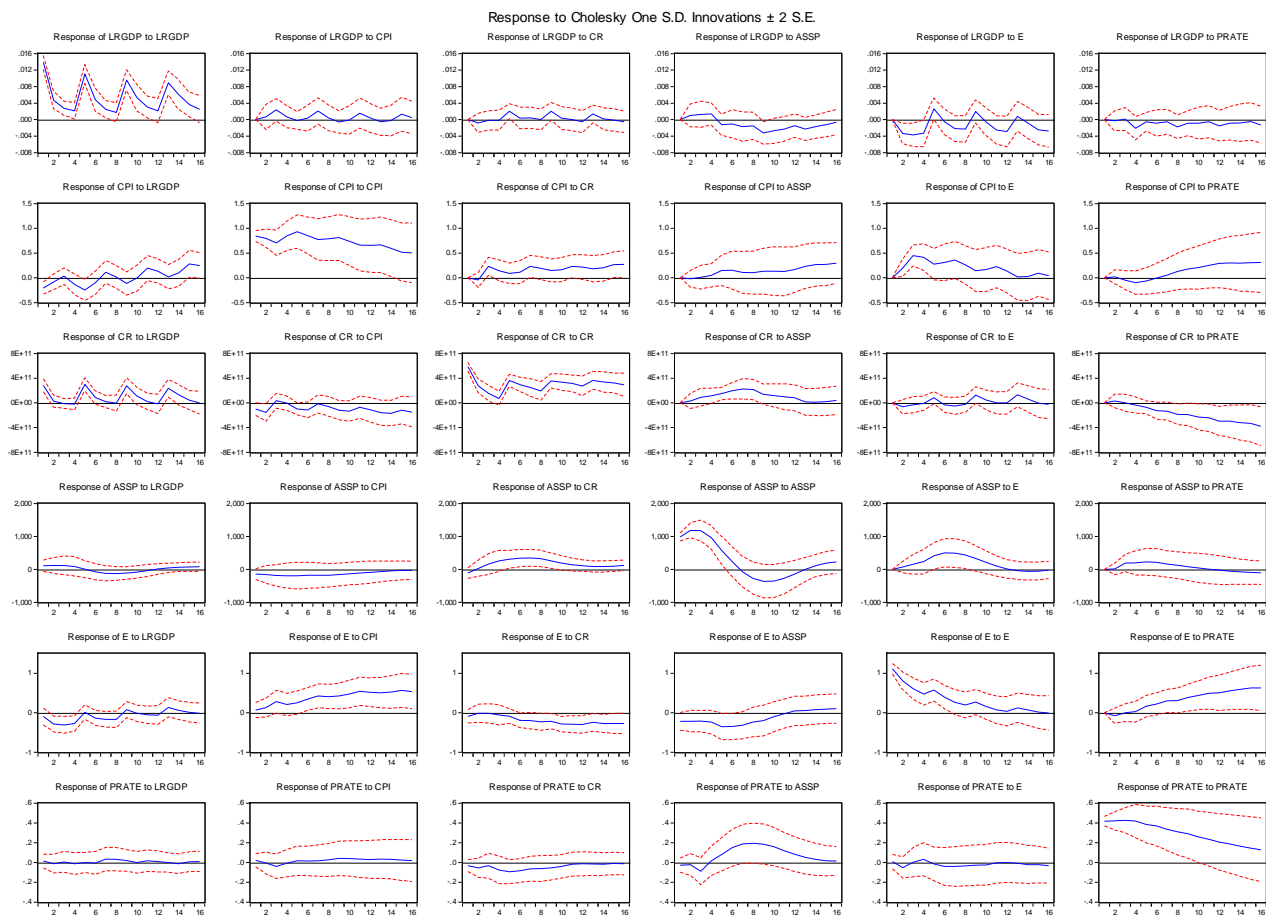
d, unit root test

Table 3: Unit root test: with trend and constant, maximum lag 4

Variables	Level		First difference	
	5% critical value: -3.44		5% critical value: -3.44	
	Statistics	p-values	Statistics	p-values
LRGDP	-2.689	0.243	-4.40	0.0029***
CPI	0.676	0.9996	-6.308	0.0000***
CR	-0.6105	0.9767	-4.434	0.0026***
PRATE	-2.11	0.535	-11.229	0.0000***
E	-1.9905	0.6013	-4.7277	0.0009***
ASSP	0.669	0.9996	-6.0844	0.0000***

Sources: author's estimation

Note: (***) indicates Significance level at 1% level of significance.

e. Optimal lag length determination

Table : Optimal lag length determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10100.94	NA	9.89e+53	141.3557	141.4801	141.4063
1	-10052.69	91.77201	8.34e+53	141.1844	142.0547	141.5381
2	-9947.251	191.7038	3.16e+53	140.2133	141.8294	140.8700
3	-9888.542	101.8179	2.32e+53	139.8957	142.2577	140.8555
4	-9633.611	420.7247	1.10e+52	**136.35***	**139.94***	**138.09***
5	-9596.647	57.90219	1.11e+52	136.8202	140.6740	138.3862
6	-9572.297	36.09851	1.34e+52	136.9832	141.5828	138.8523
7	-9545.675	37.23354	1.60e+52	137.1143	142.4599	139.2865
8	-9455.264	**118.86***	**7.9e+51***	136.837	142.4448	138.8286
* indicates lag order selected by the criterion						