ESTIMATING THE RESPONSE OF REAL OUTPUT TO MONETARY POLICY INSTRUMENTS SHOCKS IN VIETNAM

A MSc in Economics and Finance dissertation

by

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List of abbreviations

CPI: Consumer Price Index

DF test: Dicky Fuller test

FEVD: Focast Error Variance Decomposition

GDP: Gross Domestic Product

IRF: Impulse Response Function

NEER: Nominal Effective Exchange Rate

OIRF: Orthogonalized Impulse Response Function

REER: Real Effective Exchange Rate

SBV: State Bank of Vietnam

VAR: Vector Autoregression

1. Introduction

1.1 Background of the study

After the economic and financial sector reforms in 1986, Vietnam is in the quick developing road and the main objective of Vietnam in the next ten years which is written in the Socio-Economic Development Plan 2011-2015 is to become an industrialized country with high output growth rate and reasonable inflation rate. On the way to achieve the target, the understanding of fiscal and monetary policy and their effect on the macroeconomics stability is becoming significantly important to Vietnamese authorities.

Furthermore, it is often said that the more open and developed Vietnam is, the easier the economy to be affected by international circumstance as Vietnam was not affected by the Asian crisis in 1997 much as it is being influenced by the recent global financial crisis in 2008. Being more sensitive to global economy, it is more crucial to build an effective policy instruments system to adjust the economy, especially during the recession.

Theory suggests that shocks in monetary policy could have influence in output growth and inflation through different instruments; however, the detailed impact of those tools on recent Vietnamese economy has not been studied quantitatively. This creates difficulty for policy makers to manipulate the suitable policies to achieve the main objective. Therefore, an empirical study of the relationship between monetary policy instruments and the macroeconomics variables such as output and inflation is timely and necessary.

1.2 Research target

As the main object of this study is to clarify the impact of monetary policy shocks in output and inflation, this paper aims at answering the following research questions:

- Do real GDP and inflation rate in Vietnam affected by monetary policy instruments?
- If yes, what direction does real output changes when there are changes in monetary policy from the State Bank of Vietnam and how significant are those changes?
- How long does it take the change in the policy to become the change in the real output?
- What is the most useful instrument that is being used by the State Bank of Vietnam?
- Is there any thing that the Vietnamese authorities should consider to improve the effectiveness of the

monetary policy instruments?

1.3 Hypothesis

This paper attempts to examine the relationship between output, inflation and monetary instruments by testing the following hypothesis:

- Output growth and inflation are affected by shocks in monetary policies and the effect follows the theory
- All monetary policy instruments have impact on output in the same way
- Interest rate is the most effective instrument of monetary policy in Vietnam

1.4 Significant of the study

The relationship between the policy instruments and the outcome of the economy such as output growth and inflation raises a lot of concern both theoretical and empirical. However, there are still many controversial opinions about the direction that macroeconomics variables are affected by the monetary policy for different countries.

Thus far, there have been some studies about monetary policy in Vietnam such as a study by Camen (2006) on the both external factors and policy factor on the fluctuation in inflation or the study by Le (2007) on the target of monetary policy, whether should it be inflation targeting or exchange rate targeting. There are also some other researches focused particularly on changes in output caused by the exchange rate ratio. However, all those papers do not point out clearly and directly the direction in which real GDP in Vietnam changed due to monetary policy shocks. There is also a paper by Le and Wade (2008) on monetary transmission mechanism in which relationship between output and monetary policy instruments has been mentioned and clarified, however, due to the lack of quarterly data on real GDP, the authors uses the industrial output index as a proxy of output, which may somehow distort the results. Furthermore, the studies use the data from 1996 to 2005 so it did not cover the significant changes in the policies of the SBV during year 2008 and 2009 due to the recent financial crisis so the result seems to be not up-to-date.

This study, therefore, is timely and relevant to the current circumstance of Vietnam as it helps policy makers to manipulate the instruments in order to achieve the main target in output growth. It can also be a suggestion for further researches on monetary policy as well as other policies in Vietnam, contributing a more understanding about the evolution of the Vietnamese money market. Furthermore, this study,

somehow, adds to the wide knowledge of monetary transmission mechanism in different countries in reality.

1.5 Content of the paper

The first part of the dissertation shows the background, the research questions as well as the significance of the study. The remaining parts include:

- Part 2 provides the over view of the financial system and monetary policy instruments in Vietnam
- Part 3 summarises the related literature review
- Part 4 points out the data and methodology used in the regression model of the study
- Part 5 gives the estimated result and discuss its policy implications for Vietnam
- Final part summaries the study, its contribution as well as its limitation and suggest areas for further researches.

2. Financial system and monetary policy instruments in Vietnam

2.1 Macroeconomic developments

2.1.1 Economic growth

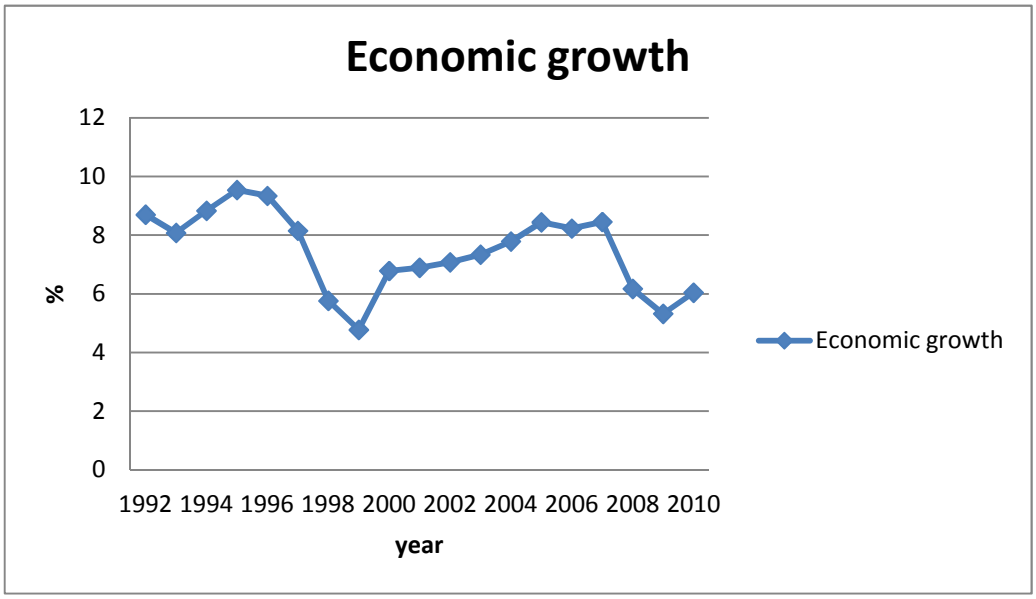


Figure 1: *Inflation and Economic growth (Source: IMF)*

Since the reform in 1986, Vietnam has seen a very strong performance in the economic development. Annual growth rate was 7.4% per year for the 1990s decade and the rate reached the top of nearly 10% per year in 1995 and 1996. This number for the period 2000-2009 was 7.25 and was one of the highest

growth rates in East Asia. According to Central Intelligent Agency (CIA) Real GDP growth rate of Vietnam often ranked in top 30 of the world, except year 2009.

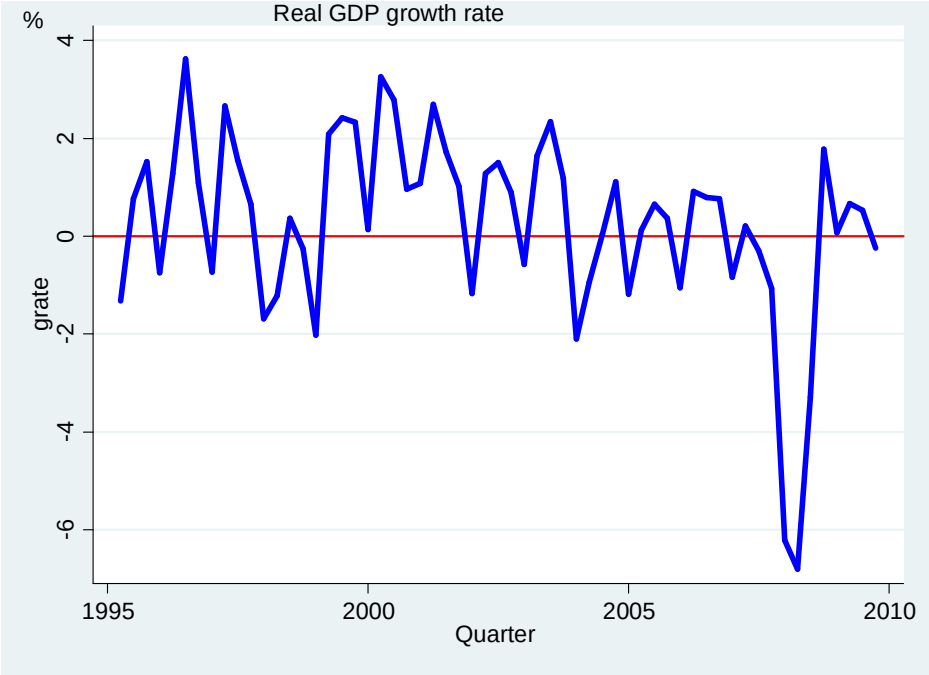


Figure 2: *Real GDP growth rate (own calculation)*

According to the new five year Socio-Economic Development Plan for 2011-2015, which is being built by the Vietnamese Government this year, the main goal for this period is to enable Vietnam to become a mid-developed industrialized country in 2020, and to reach this goal, the annual economic growth rate target is set to be around 7-8% for the next five years. It is also suggested by the IMF that the economic growth rate of Vietnam will rise gradually in the next three years.

However, as can be seen from figure 2, when the real GDP growth rate is calculated by dividing the nominal GDP growth rate to the price level, it was not as high as the nominal one. In particular, it fluctuated around 0 and sometimes dropped far below 0 (in the end of year 2008) which means that the inflation rate of Vietnam was also very high as well. Figure 3 shows the relatively comparison between nominal GDP growth rate and inflation after 1995.

2.1.2 Inflation

Vietnam experienced hyperinflation in the second half of the 1980s and early 1990s. In the years 1989 to 1991, the annual inflation rate was above 40%. It was then followed by a reduction of the inflation rate to

20% in 1992 and closed to 10% in 1995. During this period, Vietnam made great effort to follow restrictive monetary policy and fiscal policy to control the inflation.

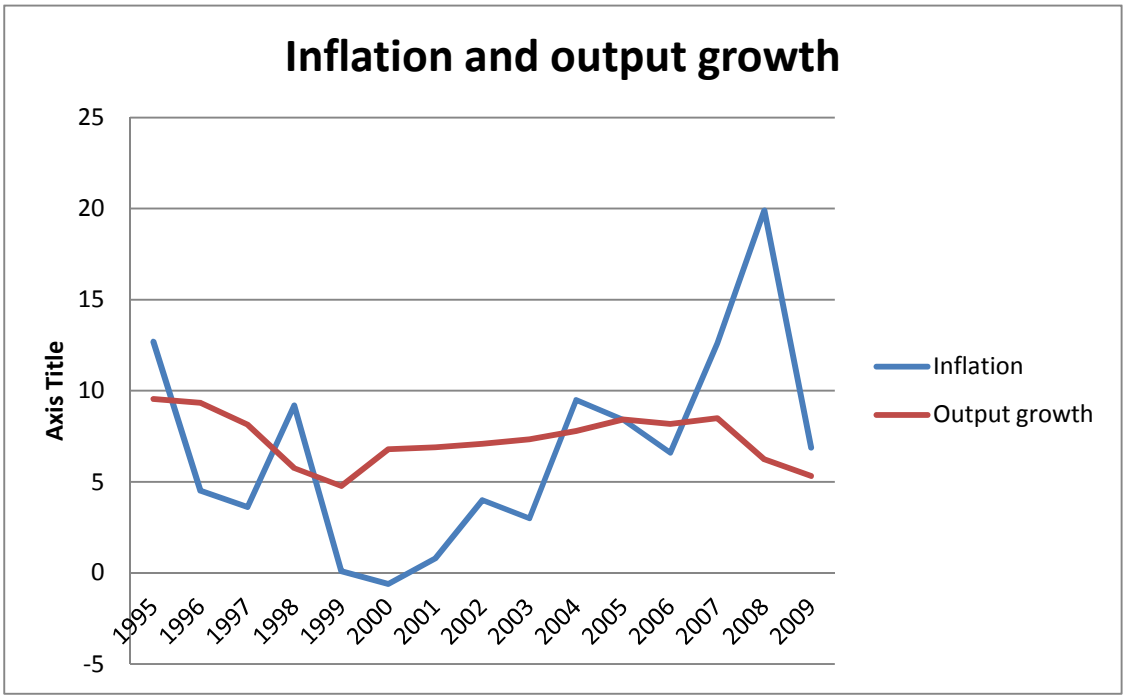


Figure 3: *Inflation and nominal GDP growth rate (Source: IMF)*

These policies were successful to keep inflation rate under 10% since 1995. It even went far above expectation as there was a slightly deflation in the year 1999 and 2000. Since then, after a long period keeping the inflation rate below growth rate (one of the main annual macroeconomic target in the Socio-Economic Development plan), inflation has picked up again in 2008 due to the effect of the recent world financial crisis.

Base on the knowledge of inflation rate in Vietnam in recent years, the model in this dissertation considers the quarterly data in 15 years from 1995 to 2009.

2.2 Finacial system

Since 1988, after a comprehensive financial sector reform, Vietnam saw a dramatically transition from the mono-bank system to a two-tier bank system containing 2 parts:

- The first one is the State Bank of Vietnam (SBV) which belongs to the Government. It is governed

by the Law on the State Bank of Vietnam and its governor is a member of the Government. The State Bank of Vietnam takes the highest responsibility in controlling the financial market and supervising the activities of commercial banks using monetary instruments. It has a monopoly on printing currency, which is loaned to the Government as a legal tender.

- The second part is a system of Specialized Commercial Banks and other financial organizations which do the main banking functions such as borrowing and lending money from people and companies. These banks are in different ownership forms including:
  - ✓ four large State-Owned Commercial Banks
  - ✓ one smaller state-owned commercial bank
  - ✓ Join-Stock banks most of which are established in 1991-1993
  - ✓ joint-venture banks
  - ✓ representative offices or branches of foreign banks
  - ✓ credit co-operatives
  - ✓ an extensive system of People's Credit Funds, Finance Companies and government-owned insurance company.

2.3 Monetary policy

2.3.1 Legal framework

The Government has a function to prepare an annual plan for monetary policy, including the projection for inflation and output which is then submitted to the National Assembly. Part of the role of the National Assembly is to set the annual inflation and output target in line with the state budget and economic growth objectives (in Socio-Economic Development Plan). The implementation of monetary policy is also organized by the Government such as determine the amount of liquidity to be injected into the economy. The Government is required to report this activity to the National Assembly, which takes the responsibility to supervise the monetary implementation.

Base on the plan from the Government and National Assembly, the main function of the SBV is to prepare for the monetary policy to be implemented through monetary policy instruments and undertake the unified management of all banking activities. Therefore, legally, the process of monetary policy formulation is largely the responsibility of not only the State Bank but also the National Assembly, the Government and the National Monetary Policy Advisory Board. Apart from setting the objectives, they

play important roles in supervising the activities of the State Bank. Hence, the strong involvement of the Government limits the independence of the monetary policies. According to Radzyner and Riesinger (1997), Central bank in transition economies in Central and Eastern Europe country (CEEC-5) are independent with the Government regarding the formulation and implementation of monetary policy since the early 1990s. With the exception of Poland, the Czech National Bank, National Bank of Hungarian, Bank of Slovakia and Bank of Slovenia have formal obligation to design monetary policy separately though importance changes or problems are in fact discussed and jointly resolved with the role of Government. The research then concluded that the independence of the Central Bank can have influence on the effectiveness of its policies.

When it comes to the goals of the SBV, it is stated in the Law of the Bank that it would aim at stabilization of the value of the currency, which means stabilization of the exchange rate regime, controlling inflation rate and facilitating socio-economic development among some other tasks. Among multi-goals, it can be seen from the actual Vietnamese economic policy that economic growth seems to be the de facto primary goal of the government Camen (2006)

2.3.2 Monetary policy instruments

The State Bank of Vietnam is the central of the macroeconomics policy and it conducts its policy by using some monetary policy instruments to determine the two annual targets which are exchange rate target and the injection of total liquidity (M2) and credit to the economy. The control of money supply is conducted through the following important instruments of monetary policy:

Interest rate

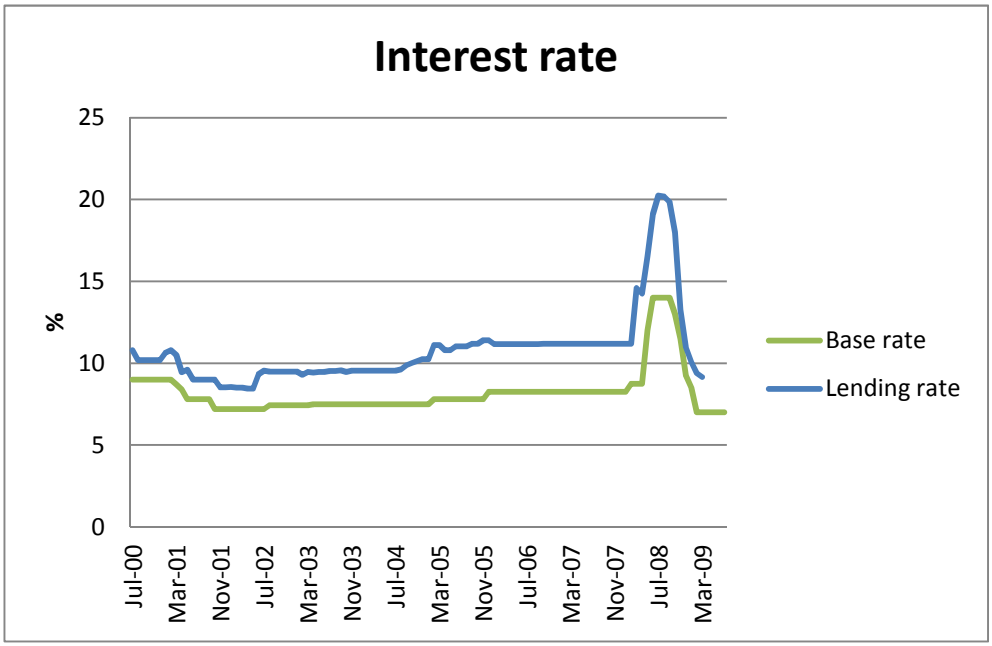


Figure 4: *Interest rate in Vietnam (Source: ECOWIN and SBV website)*

Interest rates have been gradually liberalized since the mid-1990s. The policy of positive real interest rate started in the end of 1992, which has been adjusted flexibly in line with inflation rate. The State Bank of Vietnam sets three main interest rates: Base rate, Discount rate and Refinancing rate.

The base rate is started to be announced as the reference rate for other interest rates of the banks since 2000. However, this rate is kept quite constant for a long period of time. For instance, it was fixed at about 7.5% for more than 3 years from 2002 to 2005 and then kept at 8.25% for nearly 3 years later while other interest rate has fluctuated so much. Figure 4 shows the base rate and the lending rate from July 2000 to July 2009. It seems that the gap between base rate and lending rate is becoming larger as the base rate may not do its function as a signal of lending rates for commercial banks.

The refinancing and discount rate work as the ceiling and the floor for lending from the State Bank. These rates have been used recently as monetary policy tool to implement a tightening monetary policy.

Open market operation

This tool is used since July 2000 in the way that the State Bank trades securities with credit institutions. The trading of securities is often in the form of auctions by volume or auctions for interest rate. The common securities in the trading are Government bonds, State Bank bills or securities selected by the State Bank. In the very beginning, only short-term securities are traded but since 2003, securities with

more than a year maturity are also available for auctions. Recently, this instrument plays an important role in adjusting the total liquidity injected into the economy.

Reserve requirement policy

This is a certain fraction of the deposits that commercial banks are required to kept in a form of vault cash to reduce the possibility of bank crises. By changing the requirement rate, the State Bank can change the amount of money that commercial banks can inject to the economy and indirectly affect the money supply in Vietnam. The required reserve is set for all types of deposits in either domestic currency or foreign currency. This tool has been used in Vietnam since 1991 and used to be an important instrument in the part. However, in today's environment, the SBV primarily targets interest rate so require reserve become relatively less important instruments.

Foreign exchange intervention

Base on the definition of IMF, the exchange rate regime in Vietnam can be considered as a managed-floating one or intermediate (Vo, *et al.* (2001). Along with the economic reform starts in 1986, the exchange rate regime in Vietnam has been switched from a multiple exchange rates with two official exchange rates[1] to a single fixed rate in 1989 administered by the SBV. Since the unification in 1989, the exchange rate determination has become more market-oriented. In 1991, a system of a narrow band adjusted around an official exchange rate is established marking the change from a pegged exchange rate to the managed-floating one. Besides the domestic currency VND, the USD is also widely used and the bilateral VND/USD exchange rate is the most important one as it is classified as a key nominal anchor.

3. Literature review

Monetary policy is considered to be an important policy of every country, which is one of the two main tools of Governmental intervention to the economy as the "visible hand". It is widely accepted that monetary policy's main goals are economic growth, price stability and low rate of unemployment and even though sometimes it is considered as the machine "*for doing quickly and commodiously, what would be done, though less quickly and commodiously, without it*", but it is an extremely efficient machine with special features. Monetary policy can help preventing the economic disturbance from money itself and other sources as well as providing a stable economic background (Friedman (1968) According to Friedman, exchange rates, the price level and the amount of aggregate money (currency and adjusted

[1] The foreign trading and non-trading and a so-called internal exchange rate

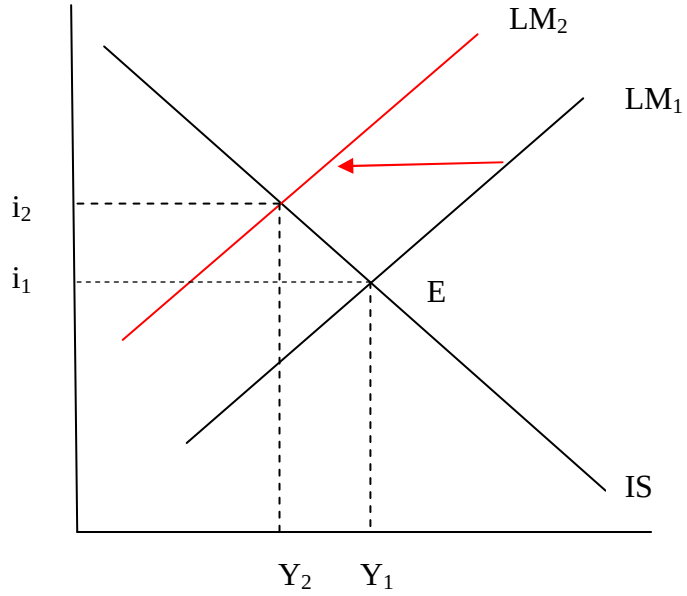
demand deposits) are among the most important instruments for policy makers.

An examination of the theoretical and the empirical analysis leads to the consideration of various potential monetary policy instruments that is necessary for the studies of the effects of monetary policy to two macroeconomic variables: output and inflation.

3.1 Theoretical literature review

3.1.1 Traditional Keynesian IS/LM model

The relationship between interest rate and output has been discovered and explained very early in the traditional Keynesian IS-LM model. Suppose that the Central bank is following a tight monetary policy by reduce money supply, the real money balance M/P will then decrease (P is unchanged in short run) and the LM curve will shift to the left (from LM_1 to LM_2 in figure 5) implies that the demand for money is higher than the supply one, therefore people will sell bonds to receive cash which then makes an increase in interest rate. This in turn raises the capital cost for production, hence results in a reduction in investment spending and net export. The new equilibrium in the IS-LM model will move along the IS curve showing a decline in output. Mankiw (2009) This progress can be summarized by a schematic connection from Mishkin (1995) "$M^S\downarrow \rightarrow i\uparrow \rightarrow I\downarrow$, $NX\downarrow \rightarrow Y\downarrow$"[2]



[2] The notation M^S, i, I, NX, Y stands for Money supply, interest rate, Investment, Net export and Output, respectively

Figure 5: *A tight monetary policy*

Further studies confirm that beside businesses' investment spending, a fall in investment could also be understood as a postponement in consumers' residential housing and consumer durable expenditure

3.1.2 The Mundell-Fleming Model

By adding the effects of international trade and finance to the traditional IS/LM model, the Mundell-Fleming Model extends the explanation of response of output to monetary policy shocks for an open economy with imperfect capital mobility. Suppose that an expansion in money supply is implied by the central bank. Then, the real money balances will increase, shifting the LM curve to the right. Interest rate, as a result, will fall below the world interest rate r* making a flow of capital out of the economy. Furthermore, an increase in the amount of investment to other countries raises the demand for foreign currency so, causing the domestic currency to depreciate in value. This depreciation, then, make domestic goods become relatively cheaper than foreign goods so spur net export and increase output.

3.1.3 Tobin q's theory

A famous Tobin'q theory of investment gives another systematic formal account of the link between stock prices and business investment and then on output. In his paper, Tobin (1969) denote "q" as the ratio of market value of shares (V_t) per unit of capital (K_t) as $q_t=V_t/K_t$. When the interest rate r increase, the opportunity cost of holding a share increase, which make shares become relatively less attractive than bond. Consequently, financial investors will sell off their shares of the firm to buy bonds, and the market value of shares V_t will drop. The decrease in the share price leads to a decline in q_t which also equal to the fact that the marginal benefit from investment (i.e the gain q_t in the value of shares resulting from the installation of an extra unit of capital) will also reduce. At the optimal level of investment, the marginal dividend forgone is just compensated by the extra capital gain on shares. Clearly, the lower the market valuation q_t of an extra unit of capital, the lower chance the firm can push its level of investment before the marginal installation cost reaches the threshold where the shareholder's additional capital gain is offset by the extra dividend forgone. Therefore, firms may not purchase new investment goods when the value of q_t is low so that investment will decrease causing output to fall. This relationship between value of q and investment is then mentioned by Mishkin (1996) as the following equity channel of the monetary

transmission mechanism "$M^S\downarrow \rightarrow P^e\downarrow \rightarrow q\downarrow \rightarrow I\downarrow \rightarrow Y\downarrow$".

3.1.4 Monetary transmission mechanism

Monetary transmission mechanism is defined as "*the route by which monetary policy is translated into changes in output, employment, prices and inflation*" (Samuelson and Nordhaus (2010), pp 211). In Vietnam, monetary policy can influence the economy through three main channels: interest rate channel, credit channel and exchange rate channel.

Interest rate

In his research on monetary transmission mechanism, Taylor (1995) emphasizes that interest rate is a key component of how monetary policy affects the economy. He points out that there is a circle relationship between the movements in real GDP and inflation and the short-term interest rate. As his explanation, a change in the short-term interest will affect both the long-term interest rate[3] and the exchange rate although it is not the only factor that has impact on those variables over time. Due to the rigidities in the economy (e.g. price stickiness) this change in the nominal interest rates (both long rate and short rate) and nominal exchange rate will then result in movements in real interest rates and real exchange rates. Those real rates change in turn affect real investment, real consumption and real net export, which are all constituents of GDP, hence leads to a change in real GDP. In long run, real variables return to their normal value when wages and goods prices are not rigid. In turn, the change in real GDP and inflation will also have effect on the short rate. In the case of zero nominal interest rate, a decrease in real interest rate still can stimulate the economy by the expected price level and expected inflation. An expansion in the broad money makes the expected price level and thereby the expected inflation goes up. As the result, the real interest rate decrease and investment, net export and hence output all increase. It is described as the following notation: $M^S\uparrow \rightarrow P^e\uparrow \rightarrow \pi^e\uparrow \rightarrow r\uparrow \rightarrow I\uparrow$, $NX\uparrow \rightarrow Y\uparrow$[4]. He comes to the conclusion that there is strong evidence of interest rate as a strong monetary channel that affects output.

Domestic credit

Mishkin (1996) demonstrated in his paper three reasons explaining the importance of credit channels to

[3] The long-term interest rate is approximately an average of expected short-term interest rates
[4] Notation are same as previous one, P^e, π^e are expectation of price level and expectation of inflation, respectively

the economy. Firstly, the effect of credit market imperfection to the firms' decision on input and output such as the number of workers and machines is widely accepted. Secondly, there is empirical evidence that small companies who face credit constrained are more affected by monetary policy than large firms. Finally, he pointed out that asymmetric information in the imperfect credit market also helps to clarify some economic phenomena.

In earlier research by Bernanke and Gertler (1995), the monetary policy transmission is compared with a "black box" and due to the dissatisfaction with lack of empirical proof of interest rate channel effects, they suggested that credit channel has its own role in explaining the impact of monetary policy to the economy and using the complementary movement in the external finance premium along with interest rate may help to bring a better explanation. This credit channel accounts for the agency problems of asymmetric information and costly enforcement of contracts arise in the financial market and is divided into two specific channels: the bank lending channel and the balance sheet channel.

The bank lending channel explains the effects of monetary policy through the change in the supply of intermediated credit or bank loans. In the credit market, banks play an important role in solving the asymmetric information problem as it seems that bank loans cannot be substitute perfectly with other sources of funds.

Hence, despite the fact that large firms may directly access the stock and bond markets to get the credit without going through banks, small and medium-sized firms will still depend mostly on borrowing from banks for their investment. Consequently, a decrease in bank reserves and bank deposit due to a contraction of monetary policy will reduce the volume of bank loans and in turn will cause investment to decline. This is result from the fact that that when the bank loans decrease, firms need to find new lenders and establish a new credit relationship which are costly to firms and are likely to reduce firms' performance in reality, which means that investment declines. Output will then go down as a result. The effect is described in the schematic summary by (Mishkin, 1995) "$M^S\downarrow\rightarrow$ bank deposit$\downarrow\rightarrow$ bank loans$\downarrow\rightarrow$ I$\downarrow\rightarrow$Y$\downarrow$"

However, the existence of the bank lending channel is still controversial. Some researchers, such as Romer and Romer (1989) are suspicious of the ability that bank loans can be affected significantly by the

monetary policy due to financial deregulation and innovation base on the case of the United State in the mid-1980s. From that time onwards, the existence of certificates of deposit (CDs) makes it easier for the banks to deal with the deposits reduction difficulty during a monetary contraction. This fact along with the drop of the traditional bank lending business all over the world make the role of the banks as well as the availability of bank lending channel less important (Edwards and Mishkin (1995)

The balance-sheet channel (or the net worth channel) explains the effects of monetary policy to the economy base on the change in borrowers' balance sheets and income statements. The former one is affected in different ways.

A decline in money supply induced by a monetary contraction may account for a lower equity prices (P^e). This lower net worth raises the problems of adverse selection and moral hazard. The former happens because a drop in net worth will lower value of collateral for lenders' loans and they suffer from higher looses. Moral hazard problem happens due to the fact that when the equity value of firms reduces, they may have more incentive to invest in riskier portfolios and loans are more likely to be defaulted. So that, a fall in a firm's net worth might result in a decline in lending and thereby, in investment. Thus, the output or aggregate demand will decrease as well. This process can be described as follows:
"$M^S\downarrow\rightarrow P^e\downarrow\rightarrow$ adverse selection and moral hazard$\uparrow\rightarrow$ lending$\downarrow\rightarrow$I$\downarrow\rightarrow$Y$\downarrow$" (Mishkin, 1995)

Furthermore, a tightening of monetary policy may also push up interest rate which leads to a deterioration of firm's balance sheets because of a lower cash flow, a higher interest rate and hence a rise in the chance of adverse selection and moral hazard problem. Stiglitz and Weiss (1981) called this phenomenon "credit rationing" where firms who are willing to pay the highest interest rate are those who have the riskiest investment. This change builds up a "financial pressure" that account for the drop in investment and hence the fall in output.
"$M^S\downarrow\rightarrow$ i$\uparrow\rightarrow$ cash flow$\downarrow\rightarrow$adverse selection and moral hazard$\uparrow\rightarrow$ lending$\downarrow\rightarrow$ I$\downarrow\rightarrow$ Y$\downarrow$" (Mishkin, 1995)

A third way that to describe the link between output and change in the monetary policy is through the price level. A money supply reduction may cause an unanticipated fall in the price level because of nominal price rigidity in contracts. A result of this is a decline in the real net worth which then increases the problem of adverse selection and moral hazard. The continued effects are as previous case an can be

summarized as

"$M^S\downarrow\rightarrow$ unanticipated P$\downarrow\rightarrow$ adverse selection and moral hazard$\uparrow\rightarrow$ lending$\downarrow\rightarrow$ I$\downarrow\rightarrow$Y$\downarrow$" (Mishkin, 1995)

The theory of credit channel on business asset is similarly applied to consumer spending by Bernanke and Gertler (1995). A tightening monetary policy may leads to a lower equity prices as explanation above, hence, consumers might meet a higher possibility of financial distress (i.e. their financial assets such as stock and bond price is lower) and it is likely that they may prefer the more liquid asset rather than the illiquid one. This results in a decline in the consumption of durable goods and housing and in turn a fall in output. Mishkin (1995) summaries this process as follows:

"$M^S\downarrow\rightarrow$ $P^e\downarrow\rightarrow$ financial assets$\downarrow\rightarrow$ likelihood of financial distress$\uparrow\rightarrow$ consumer durable and housing expenditure$\downarrow\rightarrow$ Y$\downarrow$"

Exchange rate

To an open economy, net export is impacted by the exchange rate so that one channel that monetary policy can influence the economy is through the exchange rate channel. In his research paper, Taylor (1995) confirmed that this is a crucial channel in monetary transition mechanism. When the authorities follow a contractionary monetary policy results in a raise in interest rate as explained by the ISLM model above the relative price of the domestic currency to foreign currency will change as result from the fact that deposit in the domestic currency become more attractive than deposit in other currency. This is the appreciation of the domestic currency which makes domestic goods become relatively more expensive than foreign goods so that import is stimulated while export reduces. Consequently, net export will decline causing a fall in output. This relationship can be seen in the work of Mishkin (1996) and it is summarized as below: "$M^S\downarrow\rightarrow$ i$\uparrow\rightarrow$E$\downarrow\rightarrow$NX$\downarrow\rightarrow$Y$\downarrow$[5]"

A research from IMF (1996) on 145 countries during 30 years considering the effect of different exchange rate regime to macroeconomic performance gives the conclusion that countries with fixed exchange rate regime can achieve lower inflation rate by increasing the currency's confidence and bringing higher policy discipline. A pegged exchange rate regime, therefore, is considered to be an anti-inflationary tool but equally, output growth and employment are at risk of higher volatility. From

[5] The notation M^S, i, E, NX, Y stands for Money supply, interest rate, Exchange rate (domestic currency to foreign currency), Net export and Output, respectively.

Radzyner and Riesinger (1997)'s point of view, a pegged or fluctuation with narrow bands exchange rate reduce the possibility of using exchange rate as an effective monetary policy instruments. They also suggested that Central bank should be allowed to create monetary policy autonomously independent with the Government.

When it comes to macroeconomics view, it seems to be a trade-off between low inflation rate and high output growth as evidences show that countries with fixed exchange rate are likely to achieve lower economic growth than countries that allow exchange rate to fluctuate with less control. This is due to the effect of exchange rate on investment and productivity. On one hand, a country that follows a fixed exchange rate regime was able to have higher investment by reducing the uncertainties in policy making process and bringing lower interest rate. On the other hand, it might achieve a lower rate of productivity growth due to the misallocation of resources, in case the exchange rate fixed is the wrong one. In other way, countries that allow the exchange rate to fluctuate will catch up better with the true price in the exchange rate market, which help to reduce price distortion and make a better resources allocation. In brief, considering both effects, a conclusion is drawn that growing pace is often higher in country with floating exchange rate regime IMF (1996).

3.2 Empirical literature review

Along with a wide variety supporting theories, there are many researches on the relationship between monetary policy instruments and macroeconomics indicators. Many studies focus on the monetary transmission mechanism in different period such as the studies of Bernanke and Blinder (1992) and Bernanke and Gertler (1995) for the United State. The study also applied for many different countries such as Disyatat and Vongsinsirikul (2003) build a VAR model for Thailand; Morsink and Bayoumi (1999) examines the case of Japan and Hsing (2004) works through the data of Venezuela.

In many VAR-based researches, short-term interest rates have been used as a preferred indicator of monetary policy stance. An example of this is the conclusion of Bernanke and Blinder (1992) about the particular role of Federal Fund Rate as the main policy tool implemented by Fed over 30 years. However, the theory of interest rate transmission mechanism is highly controversial as there is mild evidence of the quantitative effect of interest rate through the neoclassical cost of capital variable. Romer and Romer (1994) suggested in their reduced form, a significant negative response of real GDP to changes in the

federal funds rate in US after war. Conversely, the studies of Boivin and Giannoni (2002) point out the decreasing response of real output to the interest channel since 1980s. Empirical research on the "Tobin's q" formulation has no more success. Due to this observation, many other researchers, for example Bernanke and Gertler (1995) suggest that other mechanism rather than interest rate may also be the transmission of monetary policy and they consider the credit channel among others to be an important monetary transmission mechanism.

The research on response of output to exchange rate also receives different result. Edwards (1986) examined the group of twelve developing countries for 16 years since 1965 by building a model of real output on money growth surprises, fiscal deficit, relative price of exports to imports and real exchange rate. He then came to the conclusion that devaluations have negative impact on output for the short period of one year and after that, with other variables kept constant, real devaluations affects output in a positive way and in long run, the effect is neutral. Another research by Upadhyaya (1999) in 6 Asian countries including India, Pakistan, Sri Lanka, Thailand, the Philippines and Malaysia comes to some contradiction. The general result is also the same that in long term devaluation has neutral effect on real output except the case of Thailand and Pakistan where the impact was negative.

There are several researches on response of output growth and inflation to monetary policy instruments in Vietnam. The study by Vo, *et al.* (2001) on the relationship between money supply, inflation and output growth point out that both monetary and exchange rate policy have little effect on output and price level. Changes in broad money do not help to predict real output as well. Le and Wade (2008) also build a VAR model on the monetary policy transmission in Vietnam and found a significant relationship between aggregate money supply to real output. Among the transmission channel, interest rate has less effect on output than credit and exchange rate channels. The exchange rate also be confirmed as an important explanatory factor of output fluctuation in the study of Le (2007) but the role of interest rate channel was not obvious.

4. Data, methodology and estimation technique

4.1 Conceptual framework

The dissertation uses the Vector Autoregression (VAR) approach to analyze the effect of monetary policy shocks to the macro economy. It is used to undertake the analysis of the role of different monetary policy

instruments such as interest rate, domestic credit, reserve and exchange rate to the output and inflation. The great apply of VAR is that the policy impact can be clarified individually without a whole structural model of the economy. According to Sims (1980), VAR is considered to be a valuable tool to investigate the dynamic effects of a shock to one variable on another variable. This is also a suitable approach to examine a multiple time series process as VAR supplies different criteria to suggest the optimal lengths for the variables. Furthermore, it includes systems of equations that allow the variables to be dynamically interrelated.

Besides the VAR, the Dickey Fuller test is used to test for stationarity of the variables.

4.2 Specification of the Model

Firstly, a basic reduced form VAR model will be estimated including three variables rgdp, cpi and money supply (m2).

$$GDP = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} GDP_{t-i} + \sum_{i=1}^{m} \alpha_{2i} CPI_{t-i} + \sum_{i=1}^{m} \alpha_{3i} M2_{t-i} + u_i$$

$$CPI = \beta_0 + \sum_{i=1}^{m} \beta_{1i} GDP_{t-i} + \sum_{i=1}^{m} \beta_{2i} CPI_{t-i} + \sum_{i=1}^{m} \beta_{3i} M2_{t-i} + u_i$$

$$M2 = \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} GDP_{t-i} + \sum_{i=1}^{m} \gamma_{2i} CPI_{t-i} + \sum_{i=1}^{m} \gamma_{3i} M2_{t-i} + u_i$$

Then we take the Granger-causality test and find the impulse response functions (IRF) for the effect of shocks in monetary policy to output and inflation.

The Money supply or broad money is used as a measure of monetary policy shocks because the State Bank of Vietnam considers the growth rate of M2 be the operating target in formulating and implementing monetary policy (SBV (2003). This measure can be different for a particular case of a country. As regarding to Singapore, the real effective exchange rate (REER) is used as monetary policy shocks proxy in an analysis from Hwee (2004). In other research, Disyatat and Vongsinsirikul (2003) use real output, the price level and the fourteen-day repurchase rate are used as variables in their base model for the case of Thailand and the fourteen-day repurchase rate is referred to as the proxy of monetary policy shocks.

Then, different variables will be added alternatively to the base model, namely lendrate, credit, and exrate

to examine their individual effect to the output and inflation of the economy.

4.3 Data

4.3.1 Data availability

According to the brief background of Vietnamese macroeconomic view as well as the availability of the data, the model in this dissertation is estimated using quarterly, seasonally-adjusted data from 1995Q1 to 2009Q4 to study the response of output to different monetary policy instruments.

The data set contain the following variables:

- rgdp: Real Gross domestic product (real GDP, constant 1994 price)
- cpi: Consumer price index (CPI, 2000=100)
- m2: Broad money (measured in billions of VND)
- lendrate: Lending rate from the SBV (measured in %)
- credit: Domestic credit (measured in billions of VND)
- exrate: Nominal exchange rate ratio VND/USD

These variables are taken from the ECOWIN data (from Reuter) except exrate which is from the International Monetary Fund's International Financial Statistics (IMF's IFS) and rgdp is calculated base on the GDP and price level (ECOWIN)

4.3.2 Data description

- RGDP is used as a proxy for output of the economy which is calculated by the constant price in 1994. The reason why real output is used instead of nominal output is that the latter one is not adjusted by price level which experienced dramatic fluctuation during time and hence, it does not reflect a true movement of output. After adjusted by the price level (CPI), the real GDP gives a better performance for output change. The quarterly data for GDP is not available for Vietnam so the data is used in this research to work out rgdp is quarterly data which is converted from annual data after being seasonally adjusted.
- CPI is use as a proxy of inflation. There are several measures of inflation such as GDP deflator, CPI but the SBV uses CPI as a main inflation measure.

- M2: Broad money or high-powered money, it is the sum of money and quasi-money, according to IMF definition.
- Lending rate: The SBV has controlled two lending facilities: the discount rate and the refinancing rate. According to the discount policy, the refinancing rate can be seen as the ceiling and the discount rate serves as the floor rate and together they create a band for lending to move. Therefore, the lending rate is used in this regression to be a proxy of interest rate channel as a tool of monetary policy. There is also a base rate that is set by the SBV and it is sometimes referred to as a monetary policy tool in Vietnam, however, this base interest rate has rarely changed over the time and does not reflect the supply of and demand for in the money market but serves as a reference rate for commercial banks to set their deposit and lending interest rate, hence, it is of little importance when doing model on Vietnam's monetary policy.
- Domestic credit: This is one of the channel through which monetary policy could influence a change in output. It is an important annual target of the SBV defined by the Government. The need for including Domestic credit in the study of monetary policy bases on the research of the role of money supply by Vo, *et al.* (2000)
- Exchange rate: In this dissertation, the nominal exchange rate between VND and USD is used as a measure of monetary policy through exchange rate channel. Another better measure is the Nominal Effective Exchange Rate (NEER) which is *"An unadjusted weighted average value of a country's currency relative to all major currencies being traded within an index or pool of currencies"* (http://www.investopedia.com/terms/n/neer.asp) and the weights are determined by the importance of the foreign trading country. However, this data is not available for Vietnam then the VND/USD ratio is used instead.

4.3.3 Descriptive analysis of data:

The number of observations, mean, standard deviation, max and min of the variables used is summary in the following table:

Variable	Obs	Mean	Std. Dev.	Min	Max
rgdp	60	342296	36794.73	278938.4	391641.7
cpi	60	94.18135	25.21713	64.6655	155.739
m2	59	467497.6	494718.7	37514.8	1842320
lendrate	53	12.18118	3.225493	8.51667	21
credit	59	418264.4	466700	39611.2	1888720
exrate	59	14639.58	1882.474	11013	17941

Table 1: *Summary of data*

4.3.4 Test for stationary property

All the input data used are in log level except the lendrate. It is denoted by a letter “l” infront of the variables’ names. The Dikey Fuller is used to test for evidence of non-stationarity. According to the test (Appendix 1), all the variables are shown to be non-stationarity at the 95% level of confidence. All the series are integrated order 1-I (1), as a consequence, the first difference of these variables, which are stationary, will be used in the regression model.

5. Model estimation, regression result and policy implication

5.1 Model estimation and regression result

5.1.1 The basic model

The regressions in the basic and the extended models will use 8 lags as maximum number of lags due to the limited number of observations. When the number of lag is over 10, the test on Granger is unavailable.

The result for checking the optimal lag lengths for the VAR model is as follow[6]

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	437.969				5.6e-12	-17.3988	-17.3551	-17.284
1	492.608	109.28	9	0.000	9.0e-13	-19.2243	-19.0496	-18.7654*
2	504.905	24.593	9	0.003	7.9e-13	-19.3562	-19.0504*	-18.5531
3	514.858	19.906	9	0.018	7.7e-13*	-19.3943	-18.9575	-18.2471
4	519.192	8.6683	9	0.468	9.5e-13	-19.2077	-18.6398	-17.7163
5	532.897	27.41	9	0.001	8.1e-13	-19.3959	-18.6969	-17.5603
6	540.752	15.71	9	0.073	8.9e-13	-19.3501	-18.52	-17.1704
7	554.424	27.344	9	0.001	8.0e-13	-19.537	-18.5759	-17.0131
8	563.761	18.673*	9	0.028	8.7e-13	-19.5504*	-18.4583	-16.6824

Table 2: *VAR model optimal lag lengths check*

Among those criteria, the AIC will be the based to choose the number of lags. According to the AIC, 8 lags will be used for the basic model.

The Granger-causality Wald tests for the basic model is as following

Equation	Excluded	chi2	df	Prob > chi2
dlrgdp	dlcpi	32.048	8	0.000
dlrgdp	dlm2	35.727	8	**0.000**
dlrgdp	ALL	57.673	16	0.000

[6] The criteria are LR: sequential modified LR test statistic; FPE: Final prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Information Criterion; HQIC: Hannan-Qinn Information Criterion; SBIC: Schwartz Bayesian Information Criterion.

dlcpi	dlrgdp	36.47	8	0.000
dlcpi	dlm2	38.309	8	**0.000**
dlcpi	ALL	63.595	16	0.000
dlm2	dlrgdp	29.28	8	0.000
dlm2	dlcpi	28.378	8	0.000
dlm2	ALL	88.705	16	0.000

Table 3: *Granger causality Wald tests for the basic model*

It can be seen from the Granger test that all the variables bilateral cause each others, meaning that past value of inflation and money supply can be used to forecast the present value of real GDP and vice versa. This is somehow different from the result by Le and Wade (2008) that at the 5% significant level, both money supply and output do not cause inflation. A leading explanation is the imperfection in using the industrial output indicator as a proxy for out in the model of Le and Wade.

Monetary theory suggests that an increase in the money supply results in a rise in the price level as well as a potential increase in output but the initial negative response of output to an expansion monetary policy shock seems somewhat contradictory. The orthogonalized impulse response function (oIRF) illustrates that a growth in broad money causes a decrease in output dies after 4 quarters.

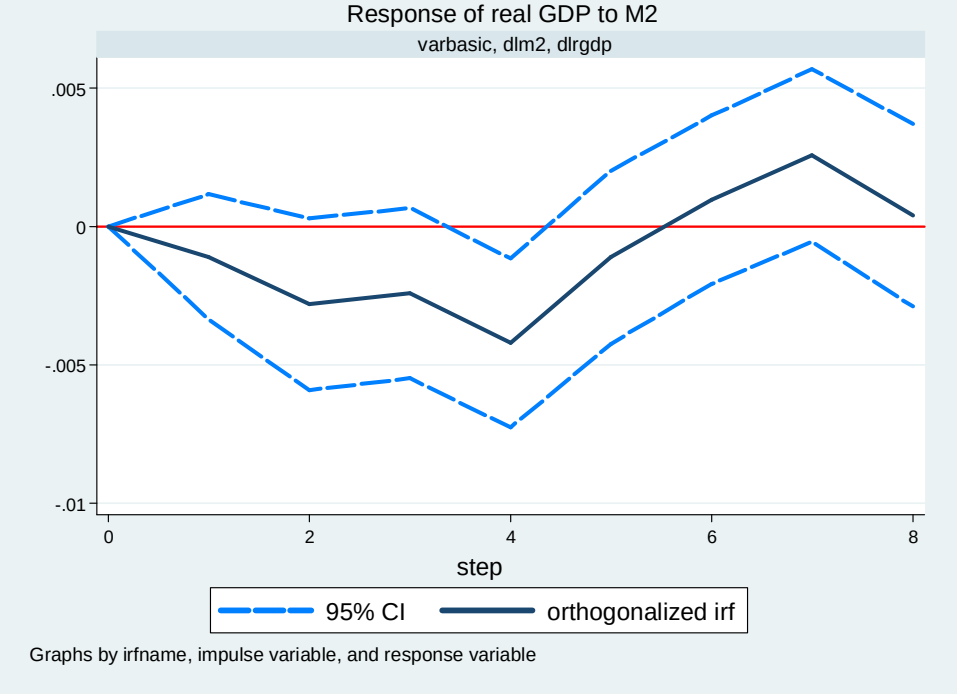


Figure 6: *Response of real GDP to M2*

However, the theoretical pattern is true from the second year onward but the evidence is not clear as the 95% confidence level from the second year is around 0.

The Cholesky forecast-error variance decomposition (FEVD) table 4 gives an idea of the share of fluctuations in a variable caused by shocks on other variables. The variance decomposition is calculated for the end of the first two years (quarter 4 and quarter 8). The columns give the percentage of the variance explain for the variables in the rows which all adding up to 100%. The result shows that M2 shocks do not affect output significantly as in end of the first year, only 8.26% of the change in output can be explained by changes in broad money and this number nearly doubles after one year while own shocks account for most of the rest. Reversely, the research by Le and Wade (2008) brings the conclusion that money shocks bring about 44.24% changes in output after a year which is significant.

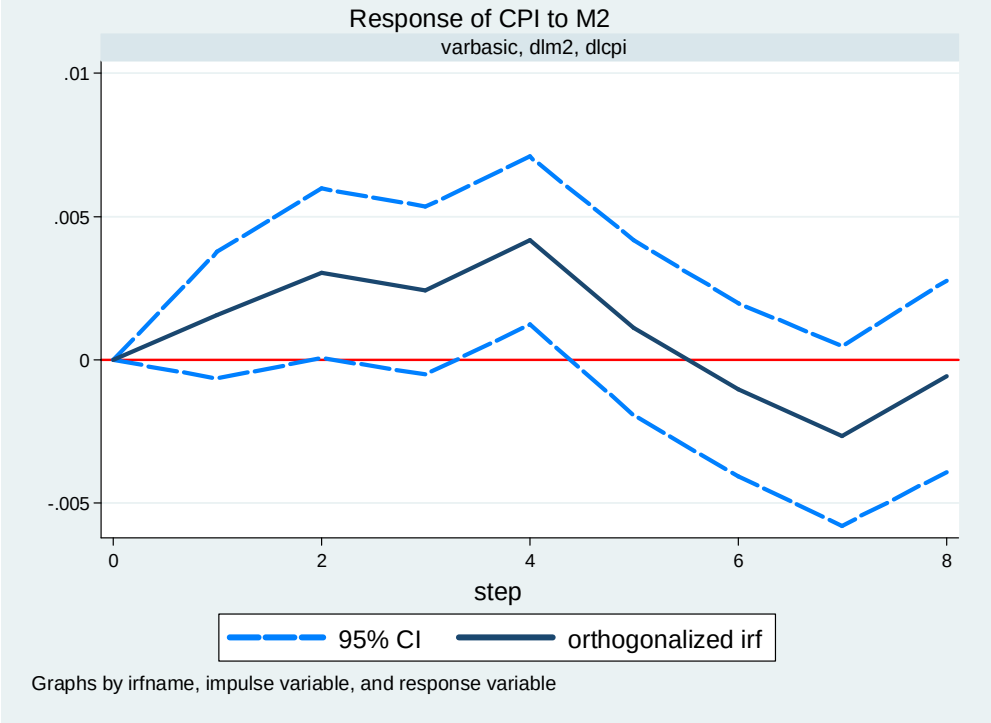


Figure 7: *Response of CPI to M2*

The response of inflation to change in money supply is different form those of output. During the first 4 quarters, a rise in M2 accounts approximately more than 10% for an increase in inflation. From quarter 5 onward, the response is not significant as the confidence level is close to 0. A noticeable point here is that

the response is reverse in the 7th quarter, which means that an increase in M2 may lead to an increase in inflation followed by a decline after quarter 7. In the end of the 2nd year, inflation brings about more than 16% change in inflation which is still small in comparison with roughly 66% change in inflation as a result of previous change in real GDP.

Response variables	Impulse variables			
	Quarter 4			
	Real GDP	CPI	M2	∑
Real GDP	76.87	14.86	8.26	100
CPI	77.67	11.84	10.49	100
M2	12.95	6.85	80.2	100
	Quarter 8			
Real GDP	66.11	18.45	15.44	100
CPI	62.62	20.86	16.52	100
M2	44.46	17.28	38.26	100

Table 4: *Cholesky forecast-error variance decomposition (FEVD)*[7]

[7] VAR analysis using data in percentage changes

5.1.2 Model with lending rate

The variable *lendrate* is then added to the basic model to do a VAR model on 4 variables *d2lgdp*, *dlcpi*, *dlm2*, *dlendrate* with 8 lags. According to the optimal lags check (appendix 2) the number of 8 lags is chosen.

Equation	Excluded	chi2	df	Prob > chi2
dlrgdp	dlcpi	35.323	8	**0.000**
dlrgdp	dlm2	31.946	8	**0.000**
dlrgdp	dlendrate	15.76	8	**0.046**
dlrgdp	ALL	99.961	24	0.000
dlcpi	dlrgdp	43.829	8	**0.000**
dlcpi	dlm2	31.642	8	**0.000**
dlcpi	dlendrate	14.85	8	**0.062**
dlcpi	ALL	108.39	24	0.000
dlm2	dlrgdp	20.955	8	0.007
dlm2	dlcpi	19.123	8	0.014
dlm2	dlendrate	20.649	8	0.008
dlm2	ALL	222.72	24	0.000
dlendrate	dlrgdp	32.485	8	0.000
dlendrate	dlcpi	34.937	8	**0.000**
dlendrate	dlm2	29.287	8	0.000
dlendrate	ALL	262.81	24	0.000

Table 5: *Granger-causality tests for the model with lending rate*

Real GDP, inflation and money supply still have bilateral causality as in the basic model which means that when changes in interest rate are considered, previous value of output, money supply and inflation still help to explain present value of each other. Past movement of interest rate also helps to predict current output and quantity of money supply but it is not useful in the forecast of inflation. The

relationship between these variables is clearly illustrated by the IRF graphs.

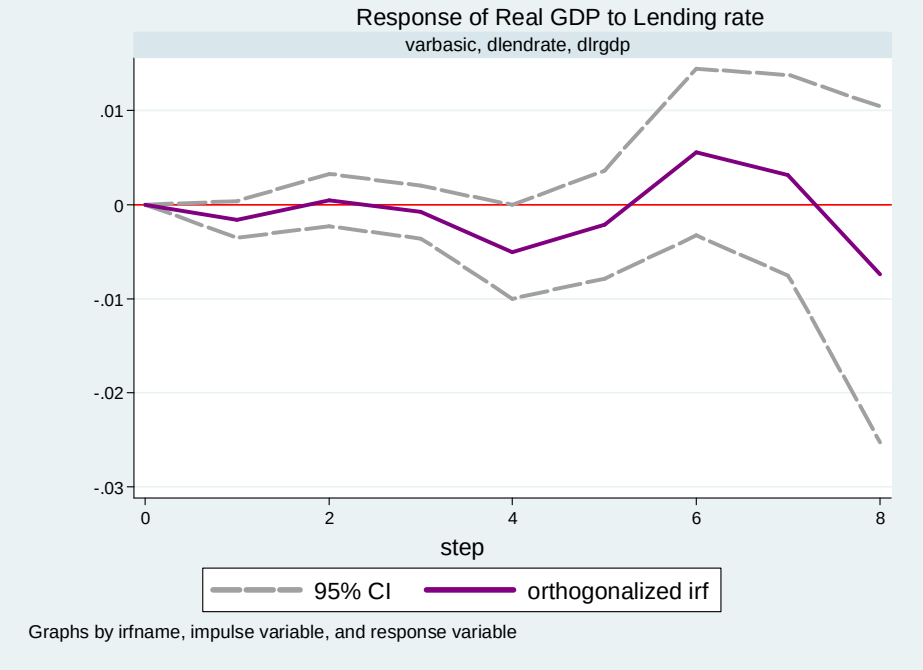


Figure 8: *Response of Real GDP to interest rate*

Classical economic theory implies a negative relationship between interest rate (as a cost of investment) and output i.e. a higher interest rate discourages investment and thereby lower output. However, in the case of Vietnam, the 95% confidence band in figure 8 is roughly around 0 so that there is mild evidence to conclude about the effect of interest rate on output. It is not until quarter 4 that real GDP seems to decrease when the SBV raises interest rate but this relationship explains for less than 3% of decline in GDP.

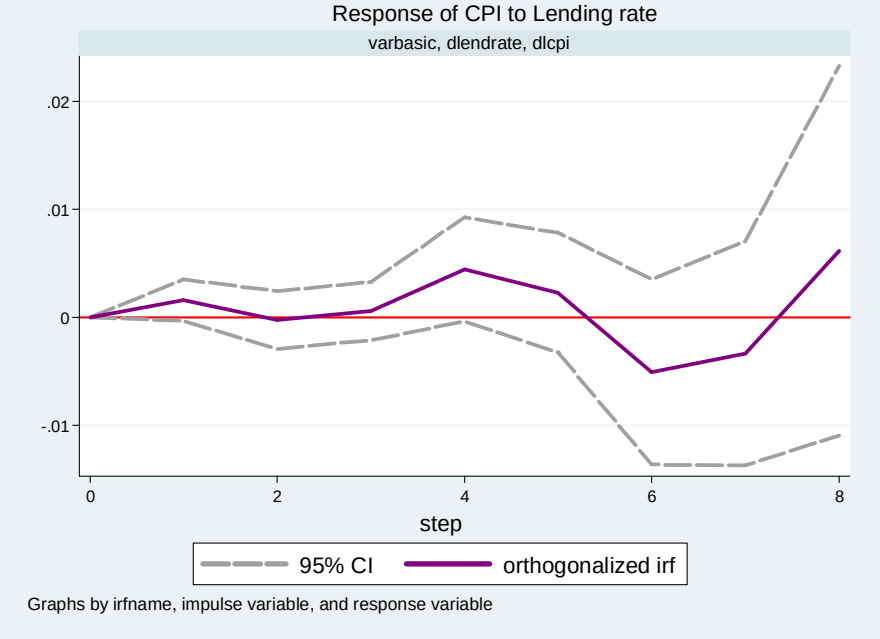


Figure 9: *Response of CPI to interest rate*

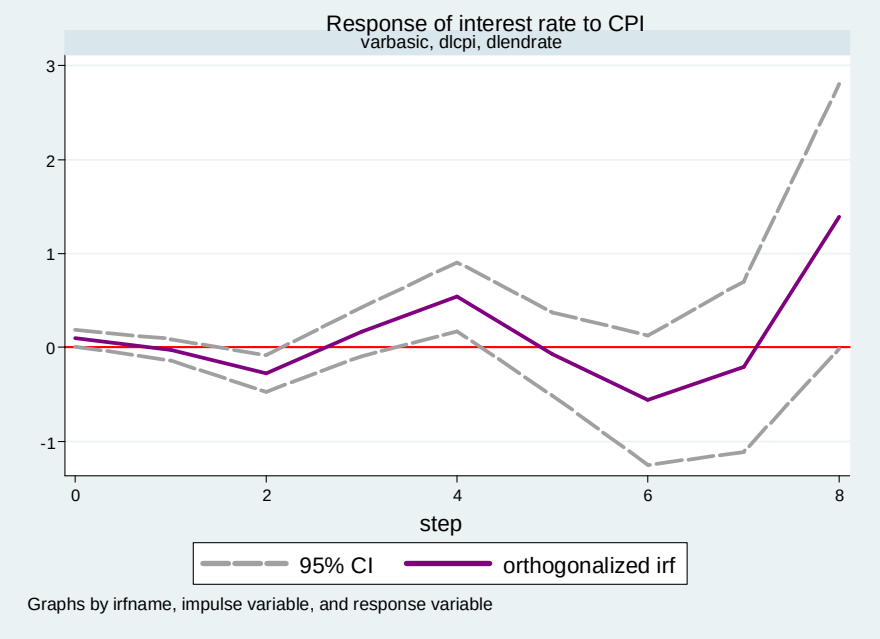


Figure 10: *Response of interest rate to CPI*

The same pattern is true for the response of inflation to lending rate changes. The fluctuation of 95% confidence band around 0 gives mild evidence on the response of CPI to interest rate. In quarter 4, there is clearer proof that inflation increase when lending rate is set higher but the percentage of the variance of

CPI due to interest rate shock is just above 2% base on the FEDV table 6. Most of the changes in real GDP and inflation are still own shocks.

This may because of the fact that interest rates in Vietnam were strictly controlled for a long time until recently and may not fully reflect the demand and supply for money in the economy. Hence, interest rate does not seem to be an effective monetary policy channel of the State bank to intervene the macro economy.

According to Taylor rule, a rise in inflation should follow by an increase in interest rate but it is not until quarter 4 that interest rate is set higher due to positive inflation. Moreover, only 11.1% of change in interest rate is explained by fluctuation in inflation, showing that interest rate that set by the SBV is not likely sensitive to inflation. A drawback of interest rate policy is that its effect is not contemporaneous but often becomes effective one year later.

Response variables	Impulse variables				
	Quarter 4				
	Real GDP	CPI	M2	Interest rate	∑
Real GDP	64.89	6.67	26.07	2.37	100
CPI	67.13	4.29	26.36	2.22	100
M2	12.7	3.23	69.5	14.56	100
Interest rate	31.29	11.1	34.9	22.7	100
	Quarter 8				
Real GDP	70.92	7.88	8.66	12.54	100
CPI	71.44	8.06	8.45	12.05	100
M2	55.52	17.5	17.12	9.86	100
Interest rate	46.87	6.95	17.08	29.1	100

Table 6: *FEVD for model with interest rate*

Variance decomposition shows that when interest rate is considered, broad money has more effects on change in real GDP and output in the first year but less in the second year than in the basic model.

5.1.3 Model with Domestic Credit

The next instrument of monetary policy is considered is the credit to economy. The variable *dlcredit* is then added to the basic model to run a VAR model on 4 variables *d2lgdp, dlcpi, dlm2, dlcredit.* The suggestion from the various criteria for the optimal lag length is shown in appendix 2 and base on the Akaike Information Criterion (AIC), I choose 8 lags for this VAR model.

Equation	Excluded	chi2	df	Prob > chi2
dlrgdp	dlcpi	71.814	8	0.000
dlrgdp	dlm2	28.07	8	**0.000**
dlrgdp	lcredit	88.883	8	**0.000**
dlrgdp	ALL	249.08	24	0.000
dlcpi	dlrgdp	75.217	8	0.000
dlcpi	dlm2	25.211	8	**0.001**
dlcpi	lcredit	94.818	8	**0.000**
dlcpi	ALL	279.01	24	0.000
dlm2	dlrgdp	50.793	8	0.000
dlm2	dlcpi	47.176	8	0.000
dlm2	lcredit	39.858	8	**0.000**
dlm2	ALL	199.28	24	0.000
lcredit	dlrgdp	54.693	8	0.000
lcredit	dlcpi	53.2	8	0.000
lcredit	dlm2	22.663	8	0.004
lcredit	ALL	144.66	24	0.000

Table 7: *Granger-causality test*

The Granger test suggests a bilateral relationship between all the variables. The added variable, credit

causes output, inflation and money supply while those variables still cause each other same as in the basic model. This result contradicts a previous research by Le and Wade (2008) that credit only significantly Granger causes M2 but not output and inflation at the 95% confidence level. The specific effect of domestic credit on real GDP and other variables can be considered by the IRF graph and FEVD calculation.

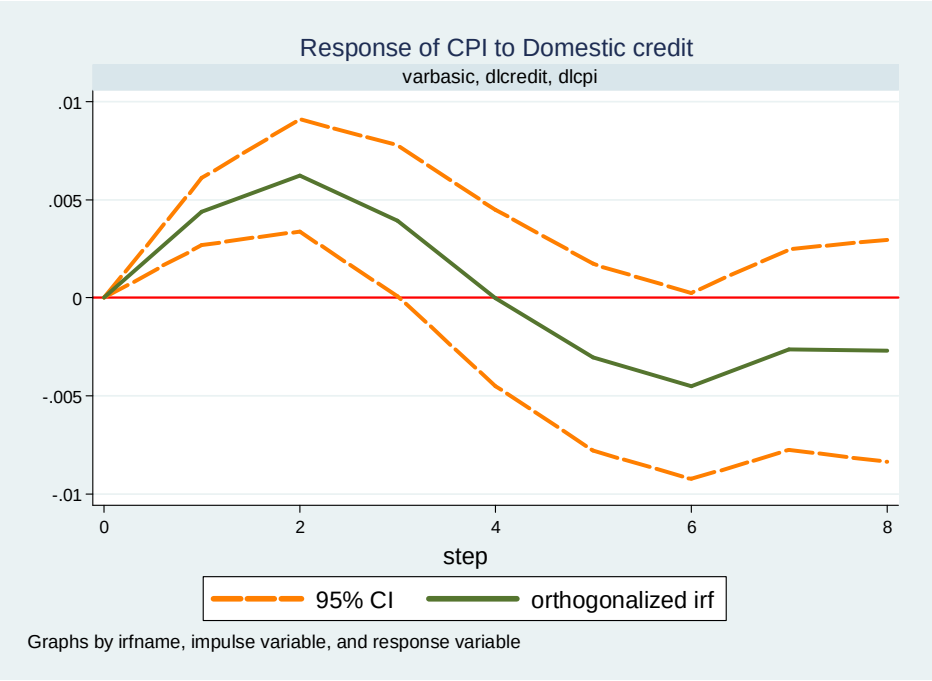


Figure 11: *Response of CPI to domestic credit*

It is likely that credit channel affects the economy directly and contemporaneously after authorities create shocks in domestic credit. The IRF demonstrates clearly the positive relationship between price level and credit to the economy during the first 3 quarters. Inflation increases as a result from growth in domestic credit and reaches the highest level after half a year. Regarding the Cholesky variance decomposition, in the 3rd quarter, nearly half of the change in price level is due to change in domestic credit. This explanation percentage stays approximately the same for the whole 2 years and is approximately 43.11% in the end of the second year while according to the table 8, lending rate only contributes almost 3% to the explanation of change in inflation. Taken together, it implies that credit to the economy is an important variable to clarify the movement of inflation. This conclusion is consistent with the paper by Camen (2006) that domestic credit, among other variables is the most significant factor to explain the CPI

index after 2 years for the period from Feb 1996 to Apr 2005 even though in his paper credit only explains for 18% change in price level.

Response Variables	Impulse variables				
	Quarter 3				
	Real GDP	CPI	M2	Domestic credit	∑
Real GDP	46.67	6.52	0.01	46.8	100
CPI	47.14	5.18	0.25	47.43	100
M2	3.48	5.57	66.83	24.12	100
Domestic credit	12.86	5.3	25.64	56.2	100
	Quarter 8				
Real GDP	31.95	21.34	3.6	43.11	100
CPI	28.92	24.8	3.91	42.37	100
M2	26.6	22.28	32.95	18.17	100
Domestic credit	29.46	33.34	12.36	24.84	100

Table 8: *FEVD for model with domestic credit*

However, the response of price level quickly dissipates and from quarter 4 onward, it is not significant as the 95% confidence brand fluctuates around 0 so that we cannot have a clear conclusion about the relationship between price level and domestic credit later on.

A more complicated case applied when the relationship between domestic credit and output is considered. When replacing the variable of real GDP by nominal GDP, keeping other variables the same and regress a similar VAR model with 8lags, we can get an IRF graph in figure 12, showing a positive response of nominal GDP to credit during the first 3 months and then starts to response negatively in the second quarter. At least, when policy authorities implement an expansion on credit, the nominal output replies positive to this policy. However, when it comes to response of real output, the relationship is totally

different. It can be seen from figure 13 that a rise in domestic credit will obviously lead to a remarkable reduction in real output.

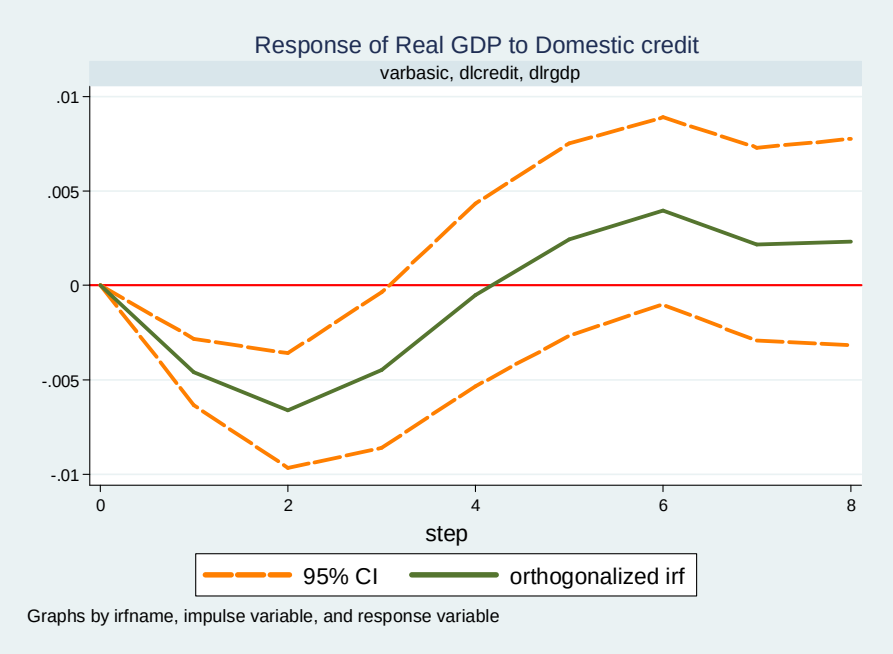


Figure 12: *Response of nominal GDP to domestic credit*

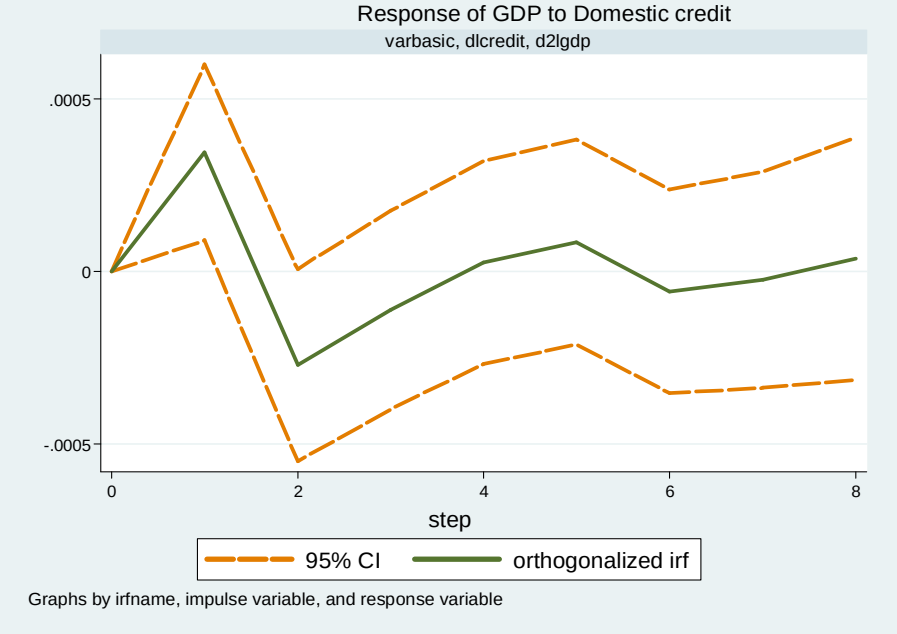


Figure 13: *Response of Real GDP to domestic credit*

This can be explained as the distortion of price level to the nominal GDP. As in the first 3 quarters after a rise in domestic credit, both nominal output and inflation increase but the growth in nominal output is offset by the rise in inflation rate so that real output decreases. Both inflation and output response quickly to shocks in credit and the implementation comes to an end after 3 quarters indicate that this is a short-term monetary policy instruments.

It is obvious from table 8 that when the credit variable is included in the model, the relationships between output and M2 as well as inflation and M2 have been weakened. Broad money explains only a small proportion of forecast error variance of real GDP and CPI. The IRF graph in figure 14 also shows consistent results as the 95% confidence interval in both cases are about 0.

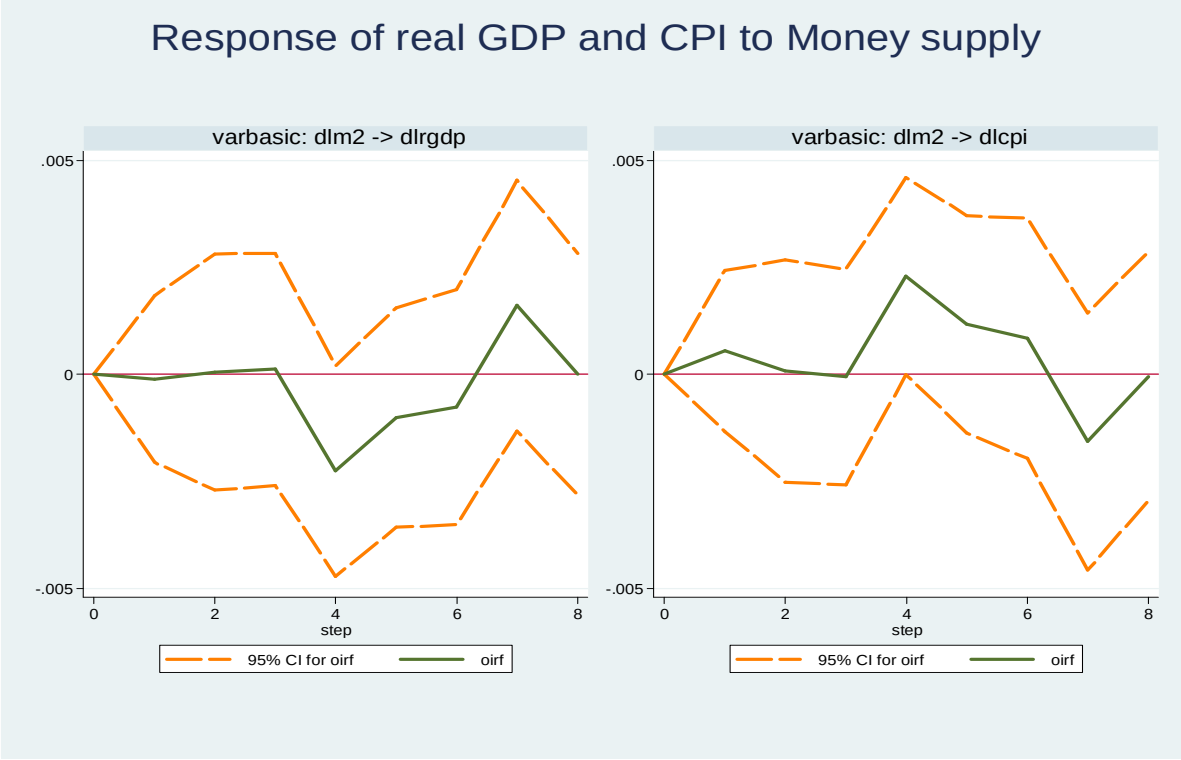


Figure 14: *Response of real GDP and CPI to money supply*

5.1.4 Model with exchange rate

The final instrument that is considered is the exchange rate. A new variable *exrate* is then added to the basic model to do a VAR model on 4 variables *d2lgdp*, *dlcpi*, *dlm2*, *dlexrate* with 8 lags chosen as suggestion from AIC criteria (appendix2)

Equation	Excluded	chi2	df	Prob > chi2
dlrgdp	dlcpi	67.96	8	0.000
dlrgdp	dlm2	63.589	8	0.000
dlrgdp	dlexrate	54.789	8	0.000
dlrgdp	ALL	186.03	24	0.000
dlcpi	dlrgdp	81.952	8	0.000
dlcpi	dlm2	69.604	8	0.000
dlcpi	dlexrate	58.392	8	0.000
dlcpi	ALL	204.55	24	0.000
dlm2	dlrgdp	29.365	8	0.000
dlm2	dlcpi	31.537	8	0.000
dlm2	dlexrate	62.223	8	0.000
dlm2	ALL	261.55	24	0.000
dlexrate	dlrgdp	49.199	8	0.000
dlexrate	dlcpi	49.999	8	0.000
dlexrate	dlm2	30.096	8	0.000
dlexrate	ALL	93.577	24	0.000

Table 9: *Granger causality Wald tests*

According to the Granger test, all the endogenous variables are bilateral causality. It means that exrate affects not only money supply but also inflation and GDP and vice versa. Le and Wade (2008) also conclude that exchange rate and other variables Granger caused output, helping to build up a link between output and exchange rate but no variable caused the exchange rate, which means that changes in output was not likely to contain any predictive information on changes in exchange rate. A leading reason for this difference in results were that in Vietnam, the main export goods are mostly agricultural products and maritime products such as rice, vegetable, fruit and fish which do conclude in real GDP but do not recognized in industrial output index in the research of Le and Wade. Another cause might be the differences in the exchange rate ratio used as Le and Wade use the NEER while this research bases on the VND/USD ratio.

The IRF graphs in figures 15 and 16 illustrate no significant relationship between real GDP, CPI and exchange rate in the first 6 quarters when there are shocks in exchange rate. Only in the 6th quarter, there is an obvious positive response of real output to changes in exchange rate. This is consistent with the theoretical research that when the depreciation in domestic currency leads to output growth.

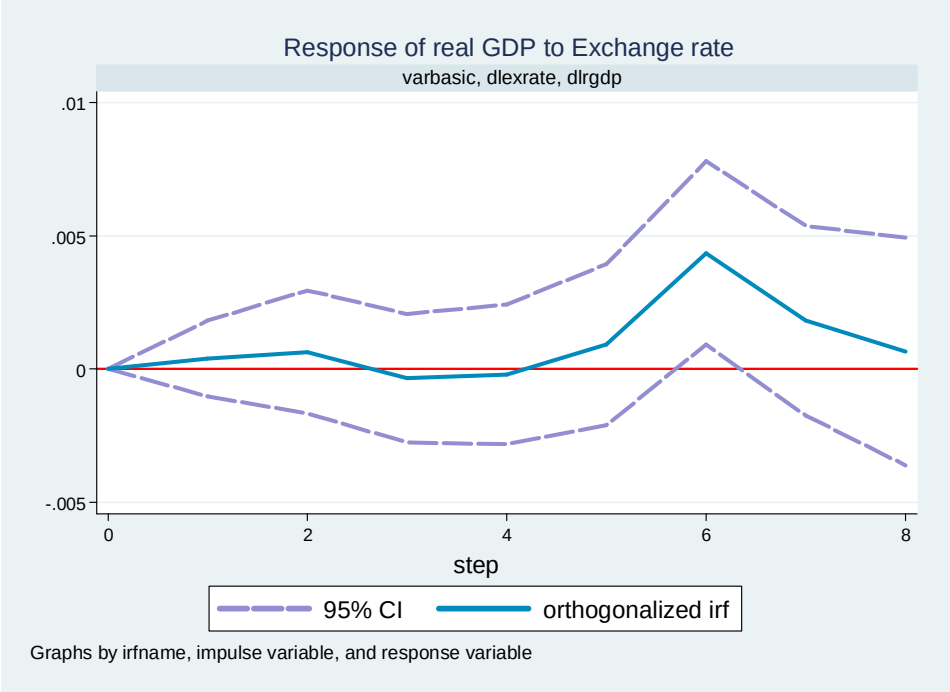


Figure 15: *Response of real GDP to exchange rate*

However, as shown in the variance decomposition in table 10, exchange rate accounts for only 0.77% of the rise in output, suggesting that exchange rate channel has already been a monetary tool of SBV to stimulate the economic growth but its effect has not been effective. Although the exchange rate ratio contributes a higher explanation to the output growth in quarter 8; 7.58% to be precise, it is still small compare to other factors.

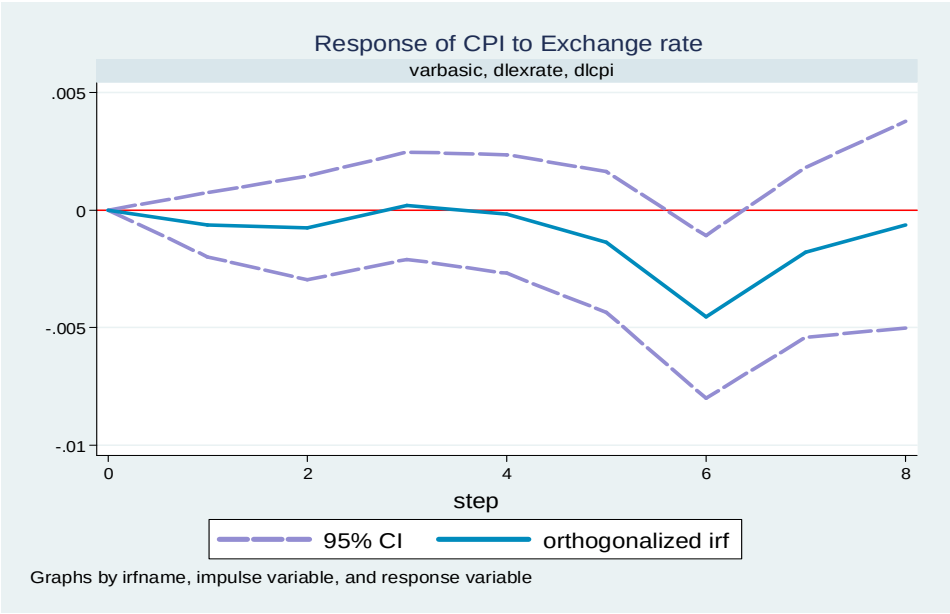


Figure 16: *Response of CPI to exchange rate*

Response of inflation to changes in exrate is quite similar to that of output but in a contradict way. It is not until quarter 6 that the response of CPI to shock in exchange rate becomes significant. A depreciation of VND accounts for 1.42% change of the forecast variance of a lower inflation rate in quarter 6, and more than 8% in quarter 8. In a research paper, Camen (2006) also concluded that the VND/USD exchange rate is an important explanatory factor of price level in Vietnam, explaining for about 19% of the CPI movement. Regarding the relationship between exchange rate and inflation, Vo (2009) also indicated the problem of exchange rate pass through into inflation due to the raising dollarization in Vietnam. Many goods are priced formally or informally in USD, people prefer to keep gold and dollar and many of the invoices for valuable commodities are in dollars. Consequently, price of goods may be directly influenced by changes in exchange rate and thereby causes increasing inflation.

The result from FEVD shows that exchange rate contributes to more than 13% of M2 movement and it is significant as seen from Granger-causality test. However, Vo, *et al.* (2000) confirmed that changes in money supply did not due to depreciation rate.

Response Variables	Impulse variables				
	Quarter 6				
	Real GDP	CPI	M2	Exchange rate	∑
Real GDP	36.55	39.61	23.07	0.77	100
CPI	33.43	42.65	22.5	1.42	100
M2	13.8	12.92	59.65	13.63	100
Exchange rate	7.58	20.38	20.47	51.87	100
	Quarter 8				
Real GDP	36.64	40.91	14.87	7.58	100
CPI	33.7	44.32	13.93	8.05	100
M2	25.16	15.77	41.29	17.78	100
Exchange rate	9.2	23.66	22.44	44.7	100

Table 10: *FEVD for model with domestic credit.*

Although in the model with exrate, response of real GDP to its own shocks reduces by a half of that in the basic model, the results continue to show that current real GDP and inflation are largely predicted by their past movements. In particular, own shocks account for more than 36% change in real output and over 33% change in price level.

5.2 Policy implication

The regression result analysis as well as the IRF of output and inflation to different monetary policy instruments demonstrated above give right to some important conclusions.

Firstly, it is quite obvious that in general, the past value of output and inflation themselves make the largest contribution to the current change in real GDP and CPI. In the basic model, 70% of the output movement is explained by its own shocks. This explanatory value becomes smaller in extended models but still accounts for the largest part, meaning that if the current value of the output is high, it is often expected that the future value of output will be high as well. There might be two main reasons for this: First, the behaviour of the economy follows a business cycle of boom and bust periods and each period

lasts for several years, hence the past output can be used to forecast the future. Second, the tardy response of monetary policy also slows down the policy's sensitiveness to changes in the macro economic environment. As a result, inflation rate often stays high for a long time before being controlled by the State Bank.

Secondly, from the analysis above, both inflation and output have very little response to fluctuation in interest rates. This observation implies that interest rate, as a monetary policy instrument, has not been used effectively. The strict control of the SBV is the main reason for this and it is suggested that the interest rate should be liberalised more so that it can reflect the supply and demand of the money market better. Furthermore, it is after 4 quarters that interest rate is raised as a response to an increase in inflation indicating a slow response of policy authorities. Interest rate should be controlled in a more responsive way to catch up with inflation rate as well as to reduce bad effects to the economy.

Thirdly, similar to interest rates, both output and inflation respond slowly to the exchange rate policy. As mentioned in part 5.1.4, it is not until quarter 6 after the shocks that there is a significant response from the macro economy. It means that when using exchange rate instruments, policy makers should consider carefully the lag of the effect. In addition to that, exchange rate policy does not show any remarkable effect on macroeconomic variables. This maybe because Vietnam has kept the exchange rate fixed for a long time and it is now still not flexible enough to adjust itself to output shocks. According to Ghosh *et. al.* (1996), floating exchange rates bring higher economic growth rates, it appears that for a small, open economy like Vietnam, widening the trading band for the official exchange rate is appropriate.

Furthermore, among the instruments of monetary policy in Vietnam, domestic credit, which accounts for more than 40% of change in output and inflation on average, seems to be the channel that has the largest influence on the economy. It also explains for about 20% of shocks in money supply - the highest impact in comparison to interest rate and exchange rate. However, the response of the economy to changes in domestic credit is not as expected because it is distorted by high inflation rates. Therefore, although it is widely accepted that economic growth and inflation often go together, in order to stimulate the economy using the credit tool, SBV also needs to control inflation rates more closely so that real GDP agrees with nominal GDP.

Another important explanation for the negative response of real GDP to domestic credit is ineffectiveness in credit allocating and firms' investment. Until recently, the priority of approaching the credit is still given to the state-owned firms, whose efficiencies are often lower than those of other types of enterprises. An example of this is the recent collapse of Vinashin, a huge state-owned enterprise which receives many preferential treatments especially in credit access as well as investment priority from the Vietnamese Government and State Bank. This company now ends up with more than 80.000 billion VND debt (approximately 4 billion USD) which is roughly 5% of GDP. The ineffectiveness of capital usage is reflected by the high ICOR (Incremental Capital-Output Ratio) index of Vietnam which is about 4.6[8] on average, implying that for every unit of output, Vietnamese firms needs approximately 4.6 units of input. Generally, during the reform process, in order to stimulate the economic growth and achieve a stable development, besides maintaining suitable monetary policies, Vietnamese authorities need to implement a set of policies to improve the investment efficiency. Particularly, priorities to credit access should be given to the firm's efficiency but not its ownership.

Last but not least, by analysing the banking system in Vietnam, it is noted that a main reason that causes the limitation in conducting and implementing monetary policy is the lack of the independence of the SBV. Radzyner and Riesinger (1997) in the research for some transition countries in Europe claim that "*high degree of legal central bank independence in the CEEC-5…was and still necessary to build up the needed credibility of monetary policy in a period of economic transformation and stabilization*". This suggests the need for a more independent, responsible and powerful State Bank of Vietnam in planning and conducting monetary policy.

6. Conclusion

6.1 Summary

Vietnam is now considered a transition country that is facing many difficulties and challenges. After the 2008 financial crisis, there is a need for a better understanding of monetary and fiscal policies, which are "visible hand" that could help the country to get over the challenges to achieve the target.

This study focuses on the relationship between output and monetary policy to clarify the way that each

[8] Statistic from the General Statistics Office of Vietnam

instrument of the policy affects the GDP. It comes to the conclusion that credit channel is the tool that has strongest impact on output and inflation. An increase in domestic credit has positive effects on nominal GDP and price levels but negative impact on real GDP. This suggests the need of a system of policies that not only manage the credit channel in the right way to stimulate economic growth but also control inflation rates efficiently.

Interest rate channel has been found to be a very important channel of monetary transmission mechanism in other countries but it is not really significant in Vietnam. After 4 quarters, it explains only more than 2% of the changes in output and price level and also responses slowly to fluctuation of inflation rate. This means that interest rate policy has not been implemented in an effective way.

There is also mild evidence of the response of real GDP to changes in exchange rate. The VND/USD ratio explains less than 1% of changes in real output after a year, showing that it does not seem to be an important instrument of monetary policy as well. This is because a narrow trading band has been applied for the exchange rate in Vietnam for a long time and it leads to the regidity of the exchange rate movement. A posible solution is to increase the trading band of the official exchange rate.

6.2 Limitation of the study

This study is limited in a way that some important data is not available. Due to the missing of past data on output and money supply, the research can only be carried out since 1995 until 2009. More important, in the regression model, due the lack of data on Nominal Effective Exchange Rate (NEER) and the Real Effective Exchange Rate (REER), the exchange rate ratio between VND and USD has been used instead but sometimes this ratio does not perfectly represent the true NEER. According to Tran (2009), there were two period during the years which are 1992-1996 and 2004-2007 that the exchange rate ratio between VND and USD was quite stable while the NEER and REER had dramatic movement. Hence, the result might be different if NEER is used. Furthermore, the narrow band of fluctuation of nominal VND/USD pegged by the State Bank of Vietnam to keep the stable value of the Vietnamese currency for foreign trade is also a limitation of using this ratio as a measure.

6.3 Suggestion for further research

This study brings a base for further studies on monetary policy in Vietnam and also in other countries. Further studies can work on longer horizon time scale if the data is found available. With supportive data,

more lags can be applied to have a clearer picture of how output and inflation response to monetary policy shocks. Moreover, other exogenous variables such as oil price in the world, the Federal Fund Rate may be considered in the model. Additionally, researches can clarify the effect of monetary policy in the relationship with fiscal policy.

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APPENDIXS

Appendix 1: Dickey-Fuller tests

Variable	Number of difference	t-statistic	P_value
Lrgdp	1	-4.390	-2.924
Lcpi	1	-4.434	-2.924
Lm2	1	-6.513	-2.924
Lendrate	1	-4.75	-2.929
Lcredit	1	-8.507	-2.924
Lexrate	1	-6.73	-2.924

Appendix 2: Optimal lag length checks for VAR models

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	310.749				1.0e-11	-13.9431	-13.883	-13.7809
1	370.059	118.62	16	0.000	1.5e-12	-15.9118	-15.611	-15.1008
2	406.886	73.655	16	0.000	5.7e-13	-16.8585	-16.3171*	-15.3987*
3	422.765	31.757	16	0.011	6.1e-13	-16.8529	-16.071	-14.7444
4	440.078	34.627	16	0.004	6.3e-13	-16.9127	-15.8901	-14.1553
5	457.434	34.711	16	0.004	7.0e-13	-16.9743	-15.7111	-13.5681
6	483.245	51.623	16	0.000	5.9e-13	-17.4202	-15.9165	-13.3653
7	513.192	59.894	16	0.000	4.9e-13*	-18.0542	-16.3098	-13.3504
8	530.442	34.499*	16	0.005	9.5e-13	-18.111*	-16.126	-12.7584

Table 1: Optimal lag length checks for VAR model with dlendrate

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	535.893				6.8e-15	-21.2757	-21.2175	-21.1228
1	602.991	134.2	16	0.000	8.8e-16	-23.3197	-23.0284*	-22.5548*
2	618.157	30.331	16	0.016	9.2e-16	-23.2863	-22.762	-21.9096
3	636.449	36.584	16	0.002	8.7e-16*	-23.378	-22.6207	-21.3894
4	645.256	17.615	16	0.347	1.2e-15	-23.0903	-22.1	-20.4899
5	668.581	46.648	16	0.000	1.0e-15	-23.3832	-22.16	-20.171
6	683.373	29.586	16	0.020	1.3e-15	-23.3349	-21.8787	-19.5109
7	710.252	53.757	16	0.000	1.1e-15	-23.7701	-22.0809	-19.3342
8	733.423	46.342*	16	0.000	1.2e-15	-24.0569*	-22.1347	-19.0092

Table 2: Optimal lag length checks for VAR model with dlcredit

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	567.588				1.2e-15	-23.0036	-22.945	-22.8491
1	623.999	112.82	16	0.000	2.3e-16	-24.653	-24.3601	-23.8809*
2	642.356	36.713	16	0.002	2.1e-16	-24.7492	-24.2219	-23.3593
3	659.441	34.171	16	0.005	2.1e-16	-24.7935	-24.0318	-22.7859
4	675.673	32.463	16	0.009	2.2e-16	-24.803	-23.8069	-22.1776
5	709.028	66.711	16	0.000	1.2e-16	-25.5114	-24.2809	-22.2682
6	725.567	33.078	16	0.007	1.5e-16	-25.5334	-24.0686	-21.6725
7	756.283	61.431	16	0.000	1.1e-16*	-26.134	-24.4348*	-21.6554
8	772.638	32.71*	16	0.008	1.6e-16	-26.1485*	-24.215	-21.0522

Table 3: Optimal lag length checks for VAR model with dlexrate

Appendix 3: The impulse response function

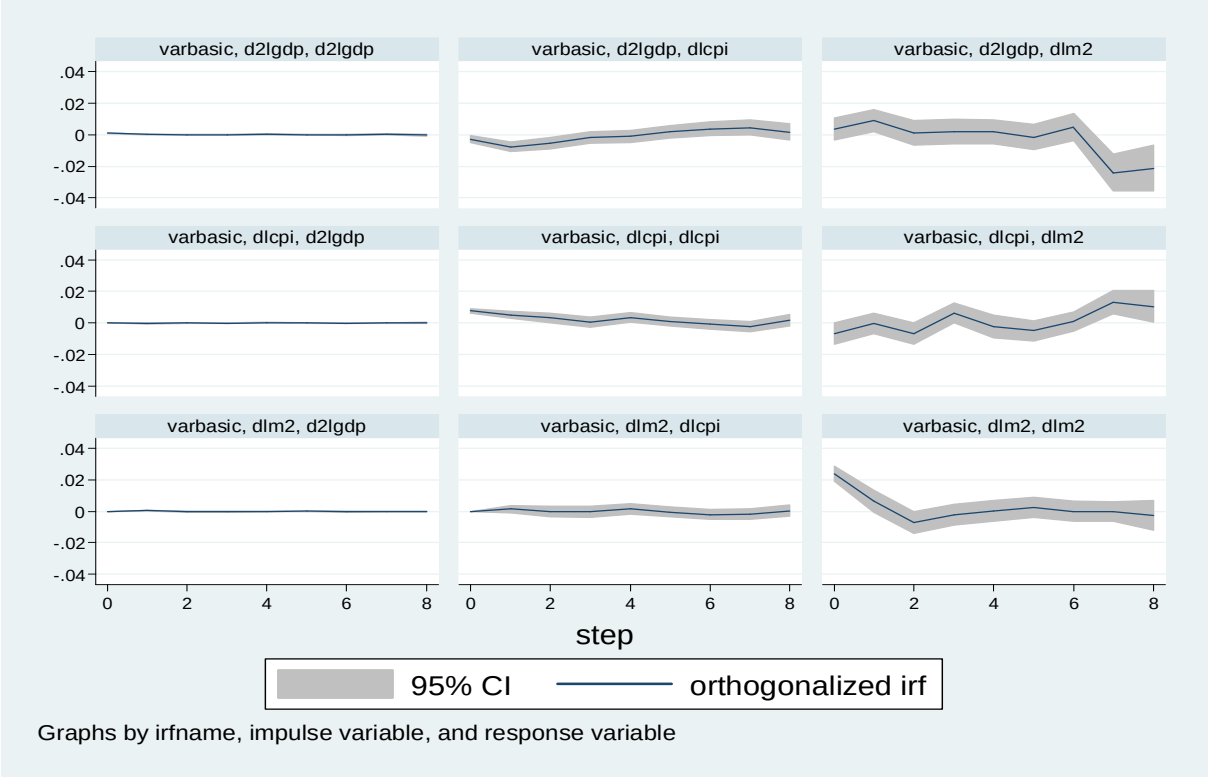

Figure 1: The impulse response function graph for the basic model

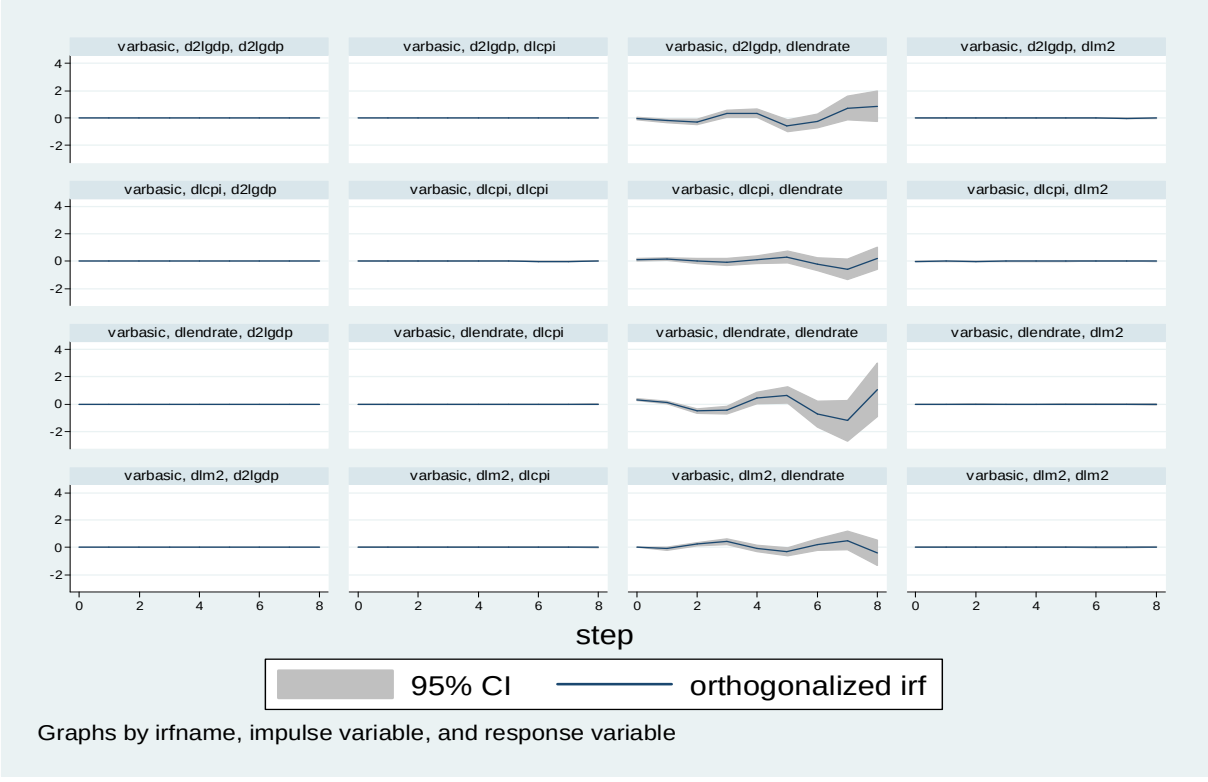

Figure 2: The impulse response function graph for the model with lending rate (8 lags)

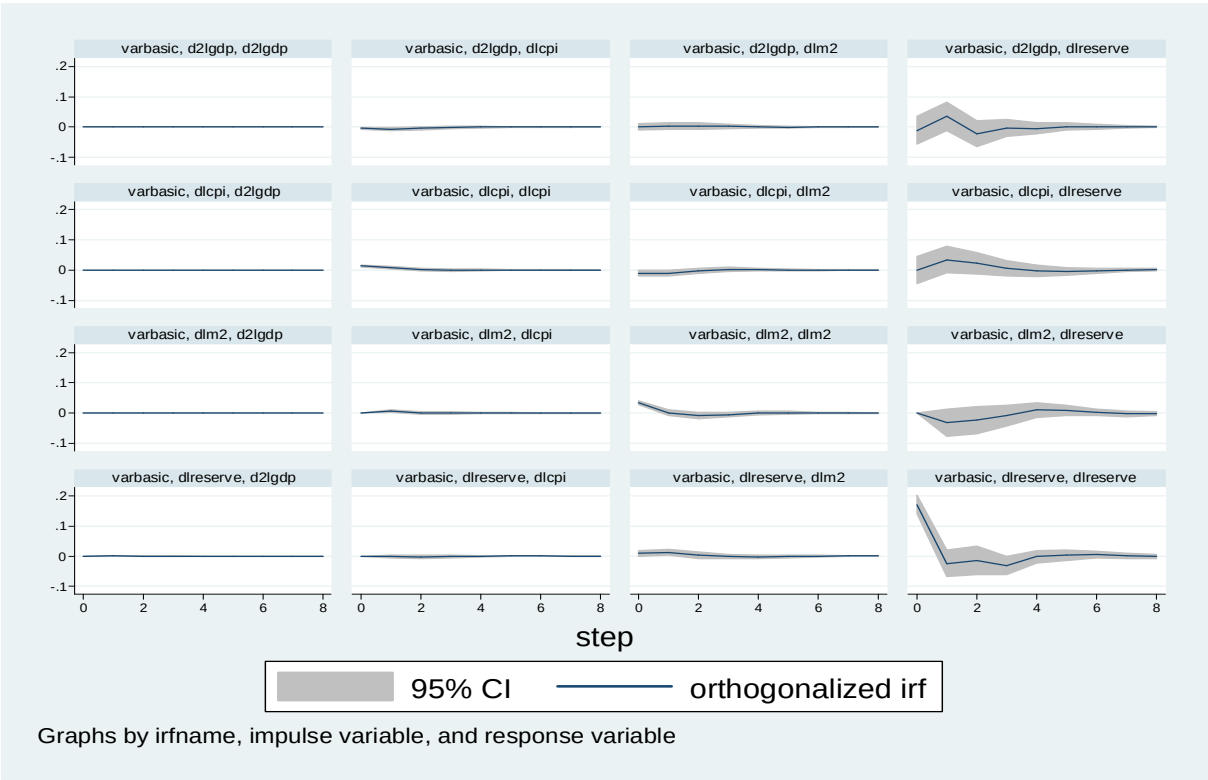

Figure 3: The impulse response function graph for the model with Reserve money (2 lags)

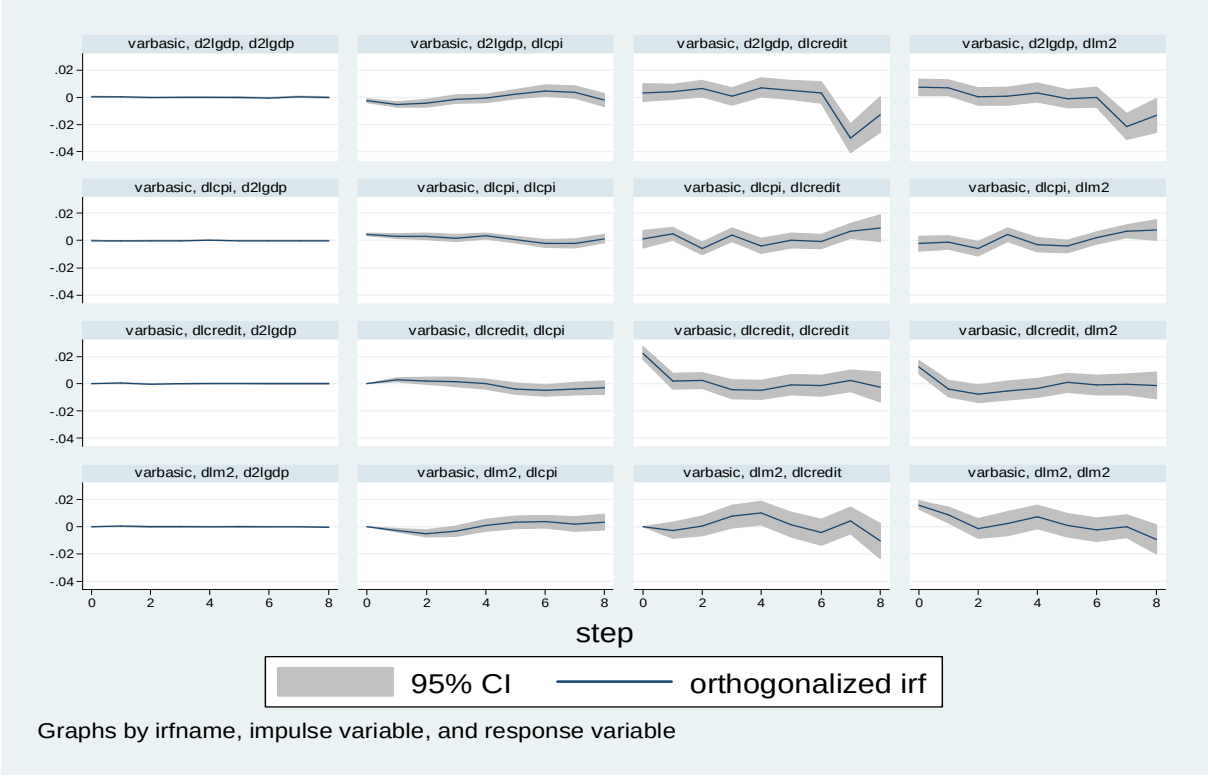

Figure 4: The impulse response function graph for the model with Domestic credit (8 lags)

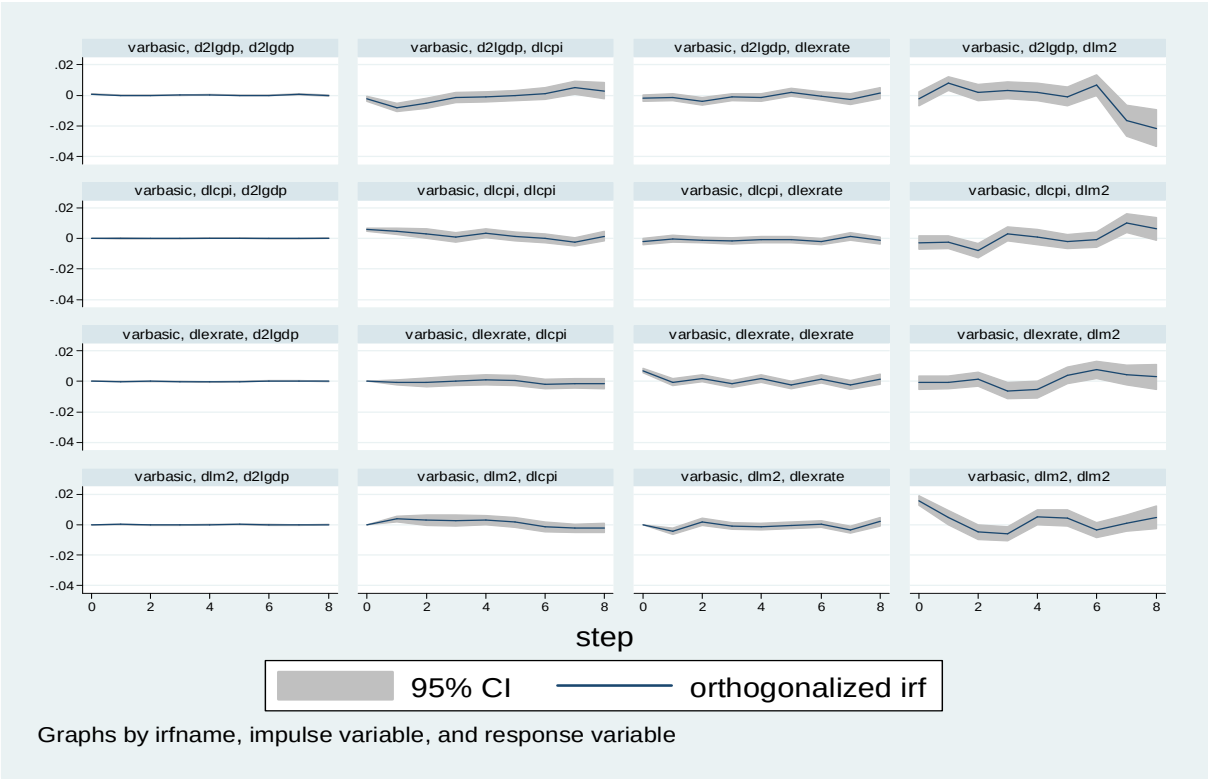

Figure 5: The impulse response function graph for the model with Exchange rate (8 lags)