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Measuring the Stance of Monetary Policy in Vietnam: A Structural VAR Analysis

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Abstract

This study aims deriving the State Bank of Vietnam's operating procedures based on a model that considers three channels of monetary transmission, including interest rate channel, the exchange rate channel, and the money channel. There are 4 main finding in this study. *Firstly*, the reactions of the money demand, exchange rate and interest rate to diverse innovations are generally consistent in different periods, but there were some changes in the period after the global financial crisis. *Secondly*, instead of concentrating particularly on one target, the monetary policy implementation has become more effective and pervasive, if the central bank attempts to control a combination of these targets. *Thirdly*, the stance measure derived from the model consistently reflects the historical performance of monetary policy which the central bank implemented to affect the GDP growth and inflation in Vietnam. Among three policy variable, the exchange rate comprises the remarkable amount of information about the policy stance. *Finally*, this study also examines the relationship between the stance and inflation and output growth and realizes that the theory about these relationships is statistically held in Vietnam under assumption that there is no other shock or the policy dominates other.

Keywords: Monetary policy, SVAR, Monetary stance, Monetary policy index, Monetary transmission, Operating procedure
JEL-Classification: E52, E58.

Contents

1. Introduction

One of the most important challenges for policy makers as well as monetary authority is to determine how to conduct the monetary policy to meet development goals of a country. Among them, measuring a stance of monetary policy has become an increasingly important issue which is the premise to not only help precisely evaluate policy impacts but keep the economy in the line with objectives. As indicated by Blinder (1998), a "tight", "neutral" or "loose" relative to a country's objectives could be quantitatively measured as the stance of monetary policy. Therefore, if the stance of monetary policy is accurately measured, it will help policy makers come up with some ideas of policy transmissions; as well as estimate impacts of policy on macroeconomic variables. However, there have been a lot of difficulties that economic researchers have faced when they attempt to measure the stance of monetary policy. One of the greatest challenges is to determine which a policy indicator should be implemented in the manner that changes in this policy indications only represent shift in the policy stance and do not affect non-policy variables. Moreover, it is toilsome to analyze influences of monetary policy on the economic performance due to many other external shocks.

Several previous studies have invested their time in an effort of finding out the optimal indicator. For example, Bernanke and Blinder (1992); Christiano and Eichenbaum (1992a) regarded the federal fund rate and non-borrowed reserves as an appropriate measure of policy stance, respectively. However, one of the biggest limitation of these studies is they only consider a single variable as a measure of policy stance. Recently, many authors have illustrated that the combined indicators is a better one. Specifically, Bernanke and Mihov (1997; 1998) considered total reserves, non-borrowed reserves and the federal funds rate as policy variables when they investigated in the United States, before expanding their model to Germany. Other researchers like (Fung and Yuan, 1999) suggested that the interest rate (overnight rate), term spread, an exchange rate and money reserve should be included in the policy blocks to measure the monetary stance in Canada. A composite indices, rather than individual indicator which better measure the stance of monetary policy, is one of the main conclusion in the study of Shun (2014) in the People's Banks of China.

Nevertheless, this area of monetary stance has mostly focused in some developed countries, and their approaches as well as conclusions could not be simply applied to others, especially in some developing economies where measurement is regime dependent and the operating procedures of central bank in these countries are different. Moreover, another culprit of this shortage could be partly the paucity of reliable and long span data in these countries. So, it is imperative to measure the stance of monetary policy in these economies with adjustments corresponding with their operating procedures.

Meanwhile, Vietnam has struggled with a lot of macroeconomic instability, which has become increasingly serious, especially when Vietnam internationally integrated in the world market and become the official member of World Trade Organization (WTO) in 2007. The external negative shocks, including the soaring of commodity and gasoline price in the world market and the global financial crisis in 2008 has been prompt to main question that how economic researchers and policy makers can encounter these problems or the same thing in the future. Looking at the past, although the main purposes of monetary policy are to control the issue of inflation, make sure a sound economic development and stabilize currency, they are seemingly inconsistent overtime and partly aggravate the current macroeconomic instability in Vietnam. Therefore, the study of policy, especially measuring the stance of monetary policy has been extremely important.

However, no pragmatic studying to date about this area is performed in Vietnam. Following the above arguments, conducting the research which measure the stance of monetary policy, has become a mandatory requirement for a purpose improve the quality of monetary policy implementation. This study is also in an effort to fill the gaps of previous studies in some developing countries like Vietnam. The specific question to be handed here are: (i) Which policy indicators has the State Bank of Vietnam (SBV) been targeting to conduct the monetary policy? (ii) Could a single indicator or the composite indices effective measure the stance of monetary policy in Vietnam? (iii) What is the most effective and appropriate measure which SBV's operating procedures should follow to overcome difficulties when they face some external negative shocks, especially the Global Financial Crisis in 2008?

By adopting the Bernanke and Mihov (1997; 1998) approach and use two-stage structural auto-regression (VAR) model, this study attempts to examine the policy stance in Vietnam. At the first stage, I regression VAR model, incorporating two groups of variables namely policy and non-policy block. However, instead of employing total reserves, non-borrowed reserves and the federal funds rates as the policy variables in Bernanke and Mihov's study, I examine the real exchange rate, interest rate and the money aggregate. At the second stage, I construct a range of equations with the residuals in the first stage which characterize the State Bank of Vietnam's operating procedures. These equations are based on the theory and process of policy implementation in Vietnam during period 1996-2014.

The paper is organized as follows, besides introduction (chapter 1) the study begins with a brief literature review in chapter 2 which will describes the empirical methodologies as well as the evidence of measuring the stance of monetary policy in previous research. Chapter 3 briefly reviews backgrounds of Vietnamese monetary policy. Chapter 4 will represent the empirical methodology which could be applied in this study. Subsequently, the study will indicate and analyze some empirical evidences in Vietnam. Finally, chapter 6 will show some conclusion of main finding and policy implications.

2. Literature Review

2.1. The Single Measures of Policy Stance

There have been many studies which attempted to measure impacts of monetary policy changes on the economy. Traditionally, the previous studies employed one specific monetary instrument to reflect changes in monetary policy. The most archaic approach considered innovations of money stock to be an adequate indicator of monetary shocks. However, as Bernanke and Mihov (1998) indicated, this approach has some limitations because non-policy influences affect the growth of monetary aggregates. One of the most severe issues related to this traditional

approach is "liquidity effect" which implies increases in interest rates following innovations in money (Gordon and Leeper, 1992). Moreover, Bernanke and Mihov also suggested that this approach make us difficult to distinguish between changes in money demands and in money supply. With financial innovation, deregulation and other factors, the money growth alone are more unlikely a good instrument of policy.

Recognize the limitations of employing the money stock growth as a measure of monetary policy stance, the later studies has concentrated on alternative indicators. Bernanke and Blinder (1992) regarded the fund rates as a good indicator of monetary policy because it sensitively reflects shocks to the supply of bank reserves; and the fund rate innovations as a measure in monetary policy. By using 30-year data in the US, they concluded that the monetary policy works through credit and money channels.

Also adopting the VAR approach, the analysis of Christiano and Eichenbaum (1992b) employed different measures of open market operations, such as non-borrowed reserves, the monetary base, including M0 and M1 as well as different identifying assumption to measure shocks to monetary policy. They found that while the quantity of non-borrowed reserves is accepted as a good measure of policy stance, either using M0 or M1 led to the liquidity effects or implausible implication for real output. Strongin (1995) proposed and estimated the new measure of monetary policy stance using non-borrowed reserves. The result indicated a strong persistent liquidity effect with this specification. The alternative monetary instruments are mentioned in previous studies. Particularly, Armour *et al.* (1996) had examined whether an operational measure of monetary policy, the overnight rate, is a good measure of the Bank of Canada's policy over the past 35 years. By using 2 measures of overnight rate, including the day-loan rate and the current measure of overnight rate, the authors concluded that the innovations in the overnight rate reasonably account for the monetary policy shocks. Other authors, such as Fung and Kasumovich (1998) argued the important role of the stock of money in the transmission mechanism. The paper had investigated the monetary shocks by using VAR approach with over-identifying restrictions over six industrialized countries and shown that the innovation in money stock (M1) could be considered as the shocks to monetary policy.

In short, all aforementioned studies only considered a single variable as a policy indicator. However, there has been a heated controversy over the accuracy which the single-indicator model captures. Unfortunately, there are many disagreements that these models could precisely examine the stance of monetary policy. Therefore, we would need other models that combine the distinct policy instruments to explain the monetary policy actions.

2.2. The Composite Measures of Policy Stance

Bernanke and Mihov (1998) indicated that "there is evidently little agreement on which of the various measures most accurately captures the stance of policy, leading many authors to hedge by using a variety of indicators" (p.3). A single instrument model could hardly and inaccurately explain the stance of monetary policy. Instead, Bernanke and Mihov (1998) constructed a VAR methodology that consisted of all policy variables discussed in previous studies in the US. Not only would the new approach permit authors to perform statistical comparisons between potential measures, but it also helps to choose the optimal policy indicators which reflect the operating procedure and the market for bank reserves and other policy actions. A simple model of market for commercial bank reserves and the operating procedures of Federal Reserve were built to measure the stance of policy in the US over two different sample periods. With such policy variables as total reserves, non-borrowed reserves and the federal funds rate, the authors considered five alternative identifications of unrestricted model. This "semi-structural" VAR indeed provided a more precise method to measure the stance of policy.

This methodology has been widely recognized and applied to other countries. Bernanke and Mihov (1997) had investigated the stance of monetary policy in Germany. The author utilized a set of policy variables, including short-term interest rates and reserves measures. The authors found that the Lombard rate had proven as the most pertinent policy indicator as compared to the call rates. Furthermore, Kasa and Popper (1996) also applied this methodology to study operating procedures of the Banks of Japan between 1975 and 1994. The modified model considered total reserves, borrowed reserves, non-borrowed reserves and the use of moral suasion to be policy indicators to measure the stance of monetary policy in Japan. The authors represented some evidences reflecting that both the call money rate and non-borrowed reserves could be interpreted as good policy indicator and the Bank of Japan also utilized the "moral suasion" to counter shocks in the demand for borrowed reserves. Fung and Yuan (1999) had examined the stance of monetary policy in Canada using VAR based- approach with 4 policy instruments, including the overnight rate, the real money supply, the term spread and the price of foreign exchange. The result indicated that only overnight rate played a significant role.

Based on both recursive and structural specification, Amarasekara (2008) investigated the effects of interest rate, money growth and the nominal exchange rate on the real GDP growth inflation in Sir Lanka from 1978 to 2005. Like previous studies, Amarasekara also indicated that the interest rate was considered as the main monetary policy variable. In addition to interest rate, the exchange rate was also utilized as the policy indicators. Moreover, Amarasekara also impose identification restrictions on the policy block which represent the different targeting regime, including interest rate, monetary aggregate and the exchange rate. The monetary policy index was estimated for Sir Lanka and he concluded that a reduction in the GDP growth could be explained by the anticipated policy, whereas both anticipated and unanticipated components of monetary policy explained for a drop in inflation.

Recently, Shun (2014) examined the People's Bank of China's operating procedures by employing two-step auto-regression model in period 2000-2013. He indicated that composite indices, rather than individual indicator would help better measure the stance of monetary policy in China.

In short, determining that which policy indicator could be validly used to measure the stance of monetary policy has become increasingly important in the process of conducting the monetary policy. The two-step auto-regression model is becoming the most popular approach to derive a valid good policy indicator. However, a little bit different from previous studies, which mainly found the interest rate as a good indicator, the current study illustrate that the composite indicator could be perform better in measuring the stance of monetary policy, rather than a single component.

3. Monetary Policy Framework

3.1. Legal Framework

According to the article 1 of the "law on the state bank of Vietnam", the State Bank of Vietnam (SBV) is a body of the Vietnamese government and is directly governed by this law. The SBV is mainly responsible for issuing currency, managing monetary policy and giving some related advice for the Vietnamese government, such as exchange rate policy, interest rate policy, foreign reserves, laws on banking and credit institutions, the management of state-owned commercial banks and so on. On the other word, the main function of the SBV is to implement the monetary policy through different instruments and manage all banking activities.

The Government takes responsibility of preparing an annual plan for monetary policy, such as the prediction of the inflation rate as well as the economic growth, and then they submit these plans and wait for the approval of the National Assembly. National Assembly has the different roles. Firstly, they set the annual targets for the inflation rate with respect to the state's budget and objectives of economic growth. Moreover, they also directly supervise the implementation of monetary policy. Therefore, the State Bank, the National Assembly, the Government and National Monetary Policy Advisory together manage the process of monetary decisions in Vietnam.

The Independence of the SBV

However, there has been a heated controversy over the independence of the SBV in term of conducting the monetary policy in Vietnam. Firstly, in term of policy, the much independence of SBV on the Government is indicated through the Article of the State Banks Law that implies that "a ministerial agency of the Government which performs the State management of monetary and banking activities and acts as the Central Bank of the Socialist Republic of Vietnam, and performs the State management of public services under the jurisdiction of the State bank". That means that the Government employs an agency belonging to its body in order to issue additional money to compensate its deficit. As a result, it probably leads to an increase in the inflation in Vietnam. Moreover, the Government also has the power to adjust the interest rate and the exchange rate. The way of working could be considered as a "political based" operation rather than the "market-based" or "economic-based" way. Secondly, the SBV has a low position in term of adjust and regulate the financial market to obtain the particular target. Obviously, if the SBV has a higher controlling position, it can strongly make some adjustments. However, according the article 26, the Government is one that funds the financial activities of the SBV based on the State's budget. It makes us realize that the SBV is heavily depend on the both the Government and State's budget. Finally, the Law of State Bank also mentions that SBV is a part of the Government and the governor should be a member of the government (the Council of Ministers). These formalized links to the government mitigates the independence of the central bank in Vietnam once again. *In short*, the aforementioned reasons have indicated the limited interdependence of the SBV that is extensively controlled by the Government in various aspects. Clearly, it leads to its operational inefficacy, especially a stabilization of inflation, the money market and the financial system in Vietnam.

3.2. Implementation of Monetary Policy in Vietnam

3.2.1. The Inefficiency of Monetary Policy in Vietnam

The main objective of SBV when conducting monetary policies is to promote the propensity of economy, stabilize the value of currency and control the issue of inflation. However, this goal is seemingly unobtainable. The Vietnam economic growth has been mainly affected by the negative external shocks. In the period 1996-2014, Vietnam has been experiencing several negative external shocks, including the Asian Financial Crisis in 1997, an increase in the price of gasoline and commodity on the world market in 1997; and the global financial crisis in 2008; a surge of international petroleum prices in early of 2008. All of these shocks had resulted in disastrous consequence on Vietnamese economy. Specifically, they led to high inflation (over 23% in 2008 and 18.13% in 2011) accompanied by the low level of economic growth after experiencing a long period of stable economic development with average growth of 7% from 2000 to 2007.

The government as well as the SBV has proposed some measures in order to help Vietnam overcome difficulties caused by these external shocks. However, these policies sometime tend to be inconsistent overtime and partly contribute to macroeconomic instability in Vietnam. Particularly, some stimulus policies had been utilized when Vietnam faced the Asian financial crisis in 1997. On one side, these policies resulted in a higher growth rate in the following year. On the other side, the increase of price level was also triggered and the inflation rate reached a zenith of 12.63% in 2007.

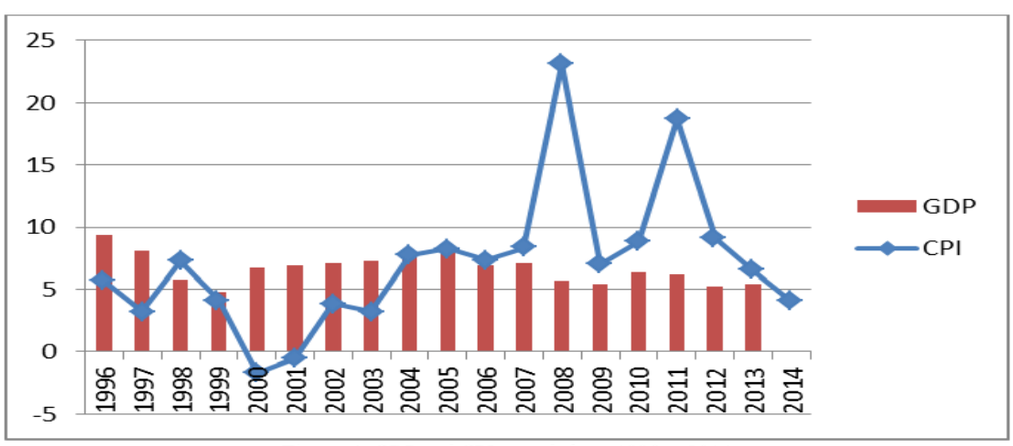

Figure-1. GDP and CPI growth from 1996 to 2014
Note: Data taken from International Financial Statistics (IFS)

Similarly, in order to cope with the external shocks of gasoline prices soaring in 2008; as well as a high inflation rate as a result of expansionary policy for a long period of time, the government had tightened monetary policy (also narrow the fiscal policy). A high rate of interest rate was ratified which led to many difficulties of economy. The interest rate was utilized as a main instrument to deal with these external shocks, but an inappropriate measure not only did not solve existed problems but also driven the inflation to higher level. A high interest rate had exerted many serious impacts on the whole economy. Difficulties of enterprises and a sluggishness and freeze of both stock market and real estate market were a direct result of impertinent policy.

The downward trend in 2008 because of ineffective monetary policy was strengthened when the global economic recessions had hit Vietnam. Under this circumstance, an expansionary monetary with large stimulus packages had been placed the narrow one. Although, Vietnam still experienced a low growth rate of 5.32% in 2009, the domestic economic had a sign in recovery in 2010. An expansion of policy in this period proved its efficacy. The recovery of the world economy in 2010 led to increasing demands for gasoline and other material which pushed the price of inputs up dramatically. The combination between these demand shocks and the expansionary policy in previous period had resulted a surge of inflation to 18.67%. During 2011 and early 2012, a tightening monetary policy had been implemented with a quick succession of rate cuts. Interest rate continued to be a main policy tool at this time. The policy rates were raised in 2011 and 2012. The SBV also publicly stated that the maximum of domestic currency depreciation would be limited from 2 to 3 percent in 2012 in the absence of adverse external shocks. The tightening policy directly led to a slight decrease of the growth rate to 5.24% in 2012. 2013 was considered as an impressive year with successes of monetary policy. A reduction of lending interest rate was ratified which recover the production and trading. It directly contributed to the national economic recovery accompanied with a drop in the inflation in Vietnam. *In short*, through the analysis the monetary strategy in Vietnam in period 1996-2014, some conclusions can be derived here. Firstly, SBV as well as the government employ interest rate as a policy tool to conduct monetary policy. In addition to interest rate, the exchange rate could be used to deal with the negative external shocks. Secondly, although the main goal of the SBV is to make a sound development and control the problem of inflation, if they implement the policy instruments inappropriately, they will adversely affect the domestic economy. Therefore, the effective and pertinent monetary policy implementation has become extremely important in order to face the negative shocks.

3.2.2. Vietnam's Monetary Instruments

Before the Global Financial Crisis in 2008

In 2000, Vietnamese economy experienced a low level of economic growth with a potential of deflation as the inflation in 1999 was only 0.1%. Under this circumstance, the SBV carefully loosed monetary policy to achieve objectives of money value stabilization, inflation control no more than 5%, and economic development. Due to the fact that the operating monetary policy adhered to targets, Vietnamese economy witnessed a low level of inflation accompanying with the gradual economic growth between 2000 and 2003.In order to accomplish the target of 5-year plan (2000-2005), the government mainly concentrated on the economic growth targets (8-8.5%) in 2004 and 2005. The open market operations (OMO) were considered as a main tool to stimulate the economic propensity and control inflation as targets set by the National Assembly. As a result, the economic growth was recorded at a high rate with 7.79% and 8.44% in 2004 and 2005, respectively. In the meantime, the State Bank also committed to keep a stable exchange rate (not decrease over 1%) which although probably brought some negative impacts on foreign market and exports, it was a reasonable choice at this moment. The stable exchange rate was executed through an increase in interest rate as well as a higher profit in VND deposit as compared to the foreign currency deposit.

After the Global Financial Crisis in 2008

Due to a huge amount of foreign currency in 2007 such as an increase in remittances from oversea, huge inflows of foreign direct investment, Vietnam potentially faced with severe challenges of inflation. Indeed, the consumer price index climbed to the zenith of over 23% in 2008, according the data compiled by the General Statistics Office. So, the primary purpose in this period was to control the issue of inflation by prudently implanting monetary policy to control total liquidity. What is more, the State Banks proposed some measures to reduce money in circulation, control credit growth. The monetary policy in the period after this period was much more complicated than the previous period. The SBV concentrated on tightening monetary in 2007 with different policy instruments, especially Open Market Operation (OMO). Some monetary policies were conducted to ensure the safety of system in this period, including withdrawing money from circulation, remaining the interest rate, reserve requirements and so on. Instead of pegging the exchange rate in previous period, the floating exchange rate regime under control was utilized to control the VND.

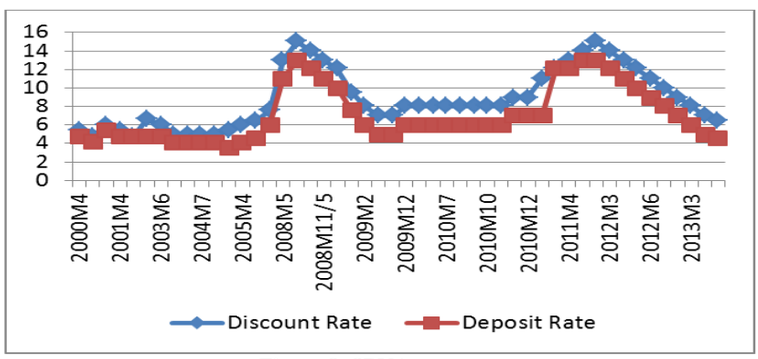

Figure-2. SBV interest rate
Source: SBV and press

The serious macroeconomic instabilities (the growth rate of Vietnam declined from 8.2% in the period 2004-2007 to nearly 6% in 2008-2011 period and inflation rocketed up to 23%), the dangerous rate of budget deficit (and Vietnam's budget deficit made up for 1.3% of GDP in 2003-2007 and almost double to 2.7% in 2008-2012 were the most popular issues in Vietnam in 2008. A variety of monetary policy was implemented to curb inflation and stabilize the macro-economy. Particularly, the money has been withdrawn from circulation through some ways. Firstly, the SBV enhanced the required reserve ratio by 1% and issued VND 20.300 billion required treasury bills. Secondly, the short-term loan was supported through OMO and short-term refinancing implementation. Furthermore, the SBV had also increased the rate of different interest rate such as the base rate, the refinancing rate and the discount rate.

The monetary policy continued to tighten but gradually loosened at the end of 2008. A multitude of monetary policies were carried out in hopes to improve the current economic situation in Vietnam, such as an adjustment of Treasury bills interest rates (from 7.8% to 13% per year); an increase in reserve requirements interest rates (from 1.2% in August to 10% in October); a reduction in the interest rate; a fall in the reserve requirement ratio for deposit in VND (11% to 6%) as well as the foreign currency (11% to 7%) and so on.

In the years after that, Vietnam continued to suffer from pressures in the global financial crisis. However, the positive sign of macroeconomic has appeared as a result of a range of monetary policy in 2009. The different instruments was utilized to stable the Vietnamese economy, including operating monetary policy instruments, exchange rate instruments, interest rate instrument and others. In 2010, the SBV has combined the monetary policy instruments and administrative measures to reduce the interest rate and promote the economic growth.

4. Methodology

4.1. Bernanke and Mihov's Methodology

Bernanke and Blinder (1992), and Bernanke and Mihov (1998) proposed the strategy for measuring the dynamic effects of monetary policy which assumes that the "true" economic structure would be described as follows:

$$Y_t = \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=0}^{k} C_i P_{t-i} + A^y v_t^y \quad (1)$$

$$P_t = \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + A^p v_t^p \quad (2)$$

Where t indexes time, and B, C, A^y, D, G, and A^p are used to be indicator vectors or square matrices of variables coefficient. The two equations describe the relationships between a vector of non-policy variables, Y, and a vector of policy variables, P. Particularly, non-policy variables consist of such macroeconomic variables as real output, price index and others. Y variables provide information about the state of the economy as well as the objectives of central bank. In order to achieve these purposes, the central bank has capacity to directly affect the variables included in P. The equation (1) represents a structural relationship in the rest of economy that non-policy variables depend on current and lag values of Y, but only on lagged values of P ($C_0 = 0$) (Bernanke and Blinder, 1992) and the equation (2) indicates the policy stance under impacts of lagged values of macroeconomic variables and policy variables. The v_t^y *and* v_t^p indicate mutually orthogonal random disturbances. As mentioned in Bernanke-Mihov method, I would concentrate on one element of vector of policy, v^s that reflects the unanticipated part of stance of monetary policy.

The study aims at measuring the dynamic response of variables to a policy shock, v^s. The equation (1) and (2) can be rewritten to reflect Y and P in term of only their past values. According to Bernanke-Mihov method, I assume u_t^p to be the part of VAR residual in the non-policy block which u_t^p satisfies $u_t^p = (I - G_0)^{-1} A^p v_t^p$. By dropping subscripts and superscripts, I can perform the relationship between the observable disturbances, u_t^p, and unobservable residual, v_t^p as below

$$(I - G)u = Av \rightarrow u = Gu + Av \quad (3)$$

The equation (3) depicts that the relationship between the observable disturbances, u and unobserved structural shocks, v which are derived from a standard structural VAR (SVAR). v_t^p contains the exogenous policy shocks, v_t^s. I also utilize the associated impulse-response functions to represent the dynamic responses of all variables to the policy shocks.

Then, the equation (1) and (2) would be transformed as below

$$Y_t = \sum_{i=0}^{k} H_i^y Y_{t-i} + \sum_{i=0}^{k} H_i^p P_{t-i} + u_t^y \quad (4)$$

$$P_t = \sum_{i=0}^{k} J_i^y Y_{t-i} + \sum_{i=0}^{k} J_t^p P_{t-i} + [(I - G_0)^{-1} D_0 u_t^y + u_t^p] \quad (5)$$

The equation (4) and (5) could be understood as a reduced-form VAR after moving all the contemporaneous term Y_t and P_t to the left-hand side. Hence, u_t^y, u_t^p are residual matrixes which could be derived by regressing equation (3) and (4), respectively. Like the research of Fung and Yuan (1999), I also impose a recursive casual ordering of the non-policy variables and restrict A^y to be diagonal. It means that the first ordered variable in non-policy block would not contemporaneously react to other variables in both policy and non-policy blocks (Fung and Yuan, 1999).

4.2. Modeling the Policy Blocks for Vietnam Monetary Policy

In order to apply Bernanke and Mihov's method, some modifications are made with respect to Vietnam's conditions. Particularly, the policy variables include the lending interest rate (IR); real broad money or high-powered money (M) which is the sum of money and quasi-money divided by CPI; and nominal exchange rate (ER). The

lending rate is considered as the Bank's policy instrument because the State Bank of Vietnam employs it as the monetary tool to acquire goals. Particularly, the SBV has controlled two lending facilities, including the discount rate and refinancing rate in which the refinancing rate can be regarded as the ceiling and the discount rate is the floor rate. Actually, another interest rate, which can be the monetary instrument, is the base rate. This base rate, however, has rarely changed overtime and have not reflect the supply and demand in the money market, thus it is not pertinent for purposes of this study. Furthermore, the broad money is utilized to supplant for the reserves variables in Bernanke and Mihov's study because this candidate consistently responses to effects of monetary shocks. Using this set of policy variables was implemented in some previous studies such as Fung and Yuan (1999) in Canada, Fung (2002) in East Asian, Amarasekara (2008) in Sir Lanka. With some changes, I construct the following set of equations:

Money demand: $u^M = -\alpha u^{IR} - \beta u^{ER} + \phi^M v^d$ (6)

Exchange rate: $u^{ER} = -\gamma^M u^M - \gamma^{IR} u^{IR} + \phi^{ER} v^e$ (7)

Interest rate: $u^{IR} = \phi^d v^d + \phi^e v^e + v^s$ (8)

The equation (6) illustrates the money demand, influenced negatively by innovations in the interest rate (u^{IR}) and exchange rate and positively demand disturbances (v^d). Looking at equation (7), the innovation of exchange rate (u^{ER}) can be explained by innovation in interest rate (u^{IR}) and money reserve shocks (u^M) as well as exogenous exchange rate shocks (v^e). Finally, equation (8) describes that the innovations in the interest rate could be explain by some unobservable structural disturbances such as money demand shocks (v^d); exchange rate shocks (v^e); and monetary policy shocks (v^s) within a given period. The impacts of these shocks on interest rate innovation is reflected by coefficients φ^d, φ^e, 1 respectively. The term v^s is extremely important because it contains information of exogenous monetary policy shocks that I want to measure in this study.

To solve the system including from (6) to (8) equations, I firstly make assumption to simplify it. Particularly, I restrict γ^M=0 which innovation in in money reserve plays relatively small role in explaining innovations in exchange rate. Shocks to money reserve can be influenced by shocks in exchange rate but the opposite side is not true. This assumption is similar to several previous studies, such as Fung and Yuan (1999).

Putting all three equations into a matrix form, we can rewrite these equations in term of (I-G)U = AV as follows

$$\begin{bmatrix} 1 & \beta & \alpha \\ 0 & 1 & \gamma^{IR} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u^M \\ u^{ER} \\ u^{IR} \end{bmatrix} = \begin{bmatrix} \phi^M & 0 & 0 \\ 0 & \phi^{ER} & 0 \\ \phi^d & \phi^e & 1 \end{bmatrix} \begin{bmatrix} v^d \\ v^e \\ v^s \end{bmatrix} \quad (9)$$

We can compute the exogenous monetary policy shocks by inverting equation and we have

$$V = (A^{-1})(I-G)U \quad (10)$$

$$\begin{bmatrix} v^d \\ v^e \\ v^s \end{bmatrix} = \begin{bmatrix} \frac{1}{\phi^M} & \frac{\beta}{\phi^M} & \frac{\alpha}{\phi^M} \\ 0 & \frac{1}{\phi^{ER}} & \frac{\gamma^{IR}}{\phi^{ER}} \\ \left(\frac{-\phi^d}{\phi^M}\right) & \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) & \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) \end{bmatrix} \begin{bmatrix} u^M \\ u^{ER} \\ u^{IR} \end{bmatrix} \quad (11)$$

Finally, we have

$$v^s = \left(\frac{-\phi^d}{\phi^M}\right) * u^M + \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) u^{ER} + \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) u^{IR} \quad (12)$$

$$v^s = w^M * u^M + w^{ER} * u^{ER} + w^{IR} * u^{IR} \quad (13)$$

With $w^M = \left(\frac{-\phi^d}{\phi^M}\right); w^{ER} = \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right)$ *and* $w^{IR} = \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right)$

Equation (12) depicts that the monetary policy could be explained by a linear combination of all residuals of variables in policy block, P. However, these residuals do not equally weight, but by some combinations of model parameter, as we can see in the equation (13).

Just-Identified Model

The number of required restrictions for just-identified model with 3-variable policy block is 12[1], but there are only 11 restrictions in the above matrix. Therefore, I would impose one more addition restriction to construct the just-identified model. In this study, I impose disparate restrictions to reflect different regime in Vietnam.

Just-identified model 1: Like (Bernanke and Mihov, 1998), I also base on Strongin's assumption, which the demand for total reserves do not react to the interest rate innovations in the short-run. It is tantamount to α=0 in this study. With this restriction, the monetary shock is now:

$$v^s = \left(\frac{-\phi^d}{\phi^M}\right) * u^M + \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) u^{ER} + \left(-\frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) u^{IR} \quad (14)$$

Just-identified model 2: Similar to Amarasekara (2008), I also impose a restriction to reflect an assumption that the exchange rate is not contemporaneously influenced by the interest innovations. It means that γ^{IR} = 0 and the structural shock would turn into:

$$v^s = \left(\frac{-\phi^d}{\phi^M}\right) * u^M + \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) u^{ER} + \left(\frac{-\alpha\phi^d}{\phi^M} + 1\right) u^{IR} \quad (15)$$

Over-Identified Model

Based on the approach of Amarasekara (2008), I construct three alternative identification of the unrestricted model to represent the disparate targeting regime, including the interest rate target, exchange rate target and reserve money target. These kinds of model need more than 1 restriction.

Over-identified model 1 (Interest rate target): As Bernanke Blinder' assumption, the central bank targets the interest rate to conduct the monetary policy. It corresponds to the restrictions: ϕ^d= ϕ^e=0. From (12), the monetary

[1] The number of required restrictions: $2K^2 - \frac{K(K+1)}{2} = K^2 + \frac{K(K-1)}{2} = 3^2 + \frac{3(3-1)}{2} = 12$

policy shock equation is now transformed into $v^s = u^{IR}$. *Over-identified model 2 (Exchange rate target):* the corresponding restrictions to reflect this target are $\gamma^{IR} = 0$ and $\phi^{ER} = 1$. So, we have

$$v^s = \left(\frac{-\phi^d}{\phi^M}\right) * u^M + \left(\frac{-\beta\phi^d}{\phi^M} - \phi^e\right) u^{ER} + \left(\frac{-\alpha\phi^d}{\phi^M} + 1\right) u^{IR} \quad (16)$$

and $v^e = u^{ER}$ (17)

Over-identified model 3 (Reserve money target): Many previous studies have provided evidences of reserve money target. For the purpose of examining this evidence in Vietnam, this study also impose restrictions to reflect the reserve money target. It is straightforward to see that the restrictions corresponding to this target are $\alpha = \beta = 0$ and $\phi^M = 1$; and we have

$$v^s = \left(-\phi^d\right) * u^M + \left(-\frac{-\phi^e}{\phi^{ER}}\right) u^{ER} + \left(-\frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) u^{IR} \quad (18)$$

and $v^M = u^M$ (19)

4.3. Estimation of Monetary Policy Index

From the given relationships described in equation (10) and the vector of policy variables, I can achieve the following vector of variables:

$$(A^{-1})(I\text{-}G)P \quad (20)$$

Following equation (20), the monetary policy index in the case of Vietnam could be calculated as bellows

$$\begin{bmatrix} \frac{1}{\phi^M} & \frac{\beta}{\phi^M} & \frac{\alpha}{\phi^M} \\ 0 & \frac{1}{\phi^{ER}} & \frac{\gamma^{IR}}{\phi^{ER}} \\ \left(\frac{-\phi^d}{\phi^M}\right) & \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) & \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) \end{bmatrix} \begin{bmatrix} M \\ ER \\ IR \end{bmatrix}$$

$$= \left(\frac{-\phi^d}{\phi^M}\right) * M + \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) ER + \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right) IR \quad (21)$$

$$v^s = w^M * M + w^{ER} * ER + w^{IR} * IR$$

$$\text{With } w^M = \left(\frac{-\phi^d}{\phi^M}\right); w^{ER} = \left(\frac{-\beta\phi^d}{\phi^M} - \frac{-\phi^e}{\phi^{ER}}\right) \text{ and } w^{IR} = \left(\frac{-\alpha\phi^d}{\phi^M} - \frac{\gamma^{IR}\phi^e}{\phi^{ER}} + 1\right)$$

Equation (19) depicts that the monetary policy index is a linear combination of money supply (M), exchange rate (ER) and interest rate (IR). In order to analyze signs of w^M, w^{ER}, and w^{IR}, I base on theory as well as pragmatic evidences of monetary implementation in Vietnam. A change in a variable belonging policy block (P), which leads to an increase in the MPI, reflects the "easing" of monetary policy. On the other hand, a "tight" of monetary policy is reflected in a decrease in the MPI as a block of policy variables changes. Theoretically, I expect w^M and w^{ER} to be negative. Particularly, an augmentation of money supply or a depreciation of exchange rate leads to a decline in the MPI, which indicates an "easing" of monetary policy. Conversely, the sign of w^{IR} is expected to be positive because an increase in interest rate is considered as a "tight" in monetary policy.

4.4. Data Description

The study consists of policy variables (P) and non-policy variables (Y) in VARs. The vector Y includes variables which indicate either the ultimate policy objectives or information about these targets that the central bank would affect directly the policy variables to achieve. The non-policy vector Y used in model consists of 3 variables which are real output (GDP), Consumer Price Index (CPI), the world commodity prices (WCPI). The real output proxied by monthly indicator like the industrial production. Due to the fact that since 6/2011, General Statistic Office of Vietnam has been reporting the Industrial Production Index, thus I cannot have data of Industrial Output from 6/2011 to the present time. Instead of using this indicator, I have transformed quarterly real GDP into the monthly series by using quadratic match sum method. The real GDP and CPI are chosen since they might be better representative indicators of macroeconomic conditions. I also include the index of commodity price to capture expectations about future price as suggested by Sim (1992) in order to avoid the price puzzle effects. Another assumption is employed in this study is that Vietnam is considered as a small open economy which means that Vietnam plays a relative important role in the world economy and is unable to affect the world commodity price. Therefore, the order of variables in the model should be WCPI, GDP, CPI to reflect this assumption.

The variables which the central bank has some degree of direct control should be included in the vector P and the relationships between these variables are described in equation (6) through (8). The study utilizes the real broad money (M), interest rate (IR) and nominal exchange rate (ER) as policy variables. In addition to these variables, the study also includes such other foreign variables as real GDP, CPI and the federal fund rate in the US as the exogenous variables to reflect impacts from outside world on Vietnamese monetary policy.

The data for this research is collected from disparate sources. Most Vietnamese data are taken from General Statistic Office of Vietnam and State bank of Vietnam, ranging from 1996 to 2014 in monthly frequency. Other variables such as the world economy price index, foreign output is from the International Financial Statistics (IFS) of the International Monetary Fund. All variables except for interest rate performed in VAR model are in logarithm form. The data should be monthly due to the fact that it is difficult to defend the assumption of no feedback within the period if we utilize quarterly or annual data (Bernanke and Mihov, 1998).

Test for Stationarity of Variables

In applied econometrics in solving time series, one of the most important things is to check whether variables are stationary or not. There have been a lot of controversies over the question whether a stationary or non-stationary variable should be utilized in the applied model. Technically, if variables are integrated of order one or more, they

will lead to some serious problems such as coefficient bias and spurious results. However, if the linear combination between non-stationary variables is stationary, it is no longer problematic. In order to stave off from mistakes, this study strictly test and control all of problems relating to this kind of issues. Some methods like Augmented Dickey Fuller (ADF), KPSS test could be employed to check the stationarity of variables. The below table reports the results

Table-1. ADF and KPSS test

Variables	ADF Unit Root Test				KPSS Test	
	Level		Difference		Level	Difference
	k	t-statistic	k	t-statistic	t-statistic	t-statistic
Vietnam						
WCPI	2	-0.782	1	-7.034***	0.276	0.152***
GDP	12	1.575	11	-5.445***	0.219	0.294***
CPI	2	-1.922	1	-4.789***	0.467	0.539***
M2	1	-0.448	0	-11.340***	0.399	0.211***
REER	0	-0.402	0	-13.808***	1.132	0.169***
IR	2	-3.453*			0.288	

Note. k is the lag length in ADF test which utilize Schwartz Bayesian Criterion (SBC). All variables except for interest rate are in logarithm form. The model used in the test includes intercept. (*), (**) represent the statistically significant at 5% and 1% level.

The table illustrates that all variables in logarithm form are non-stationary except for interest rate, and after taking the first different, these variable become stationary.

5. Results

5.1. Semi-Structural VAR Estimates

By applying Bernanke-Mihov method with restrictions for disparate regimes, the stance of monetary policy could be measured with the full sample (from 1996M1 to 2014M8), the pre-crisis sub-sample (from 1996M1 to 2008M9) and the post-crisis sub-sample (from 2008M10 to 2014M8). All results are reported in the table 4. In this section, I discuss in detail about the sign as well as the significance of parameters in each model. Generally, α and β could be interpreted as the short-term interest rate and exchange rate elasticity of money demand, respectively; and ϕ^M represents the impact of demand shocks. Similarly, while ϕ^{ER} is considered as the influences of exchange rate shocks to exchange rate, parameters γ^M and γ^{IR}in the exchange rate equation illustrates the impact of interest rate and money reserves on the exchange rate, but here I assume that γ^M=0 for the simplicity reason, thus I just consider and analyze γ^{IR}. Finally, $\phi^d$and ϕ^e indicate the reaction of the interest rate to money demand and exchange rate shocks. Interestingly, the parameter α in all regimes carries the positive sign in the regression of full sample and the pre-crisis period, whereas it is negative as expected in the post-crisis period. However, it is extremely small and not statistically significant in all models. This result is fairly similar to Bernanke and Mihov (1998), Amarasekara (2008) and Shun (2014). Fung and Yuan (1999) indicated that this parameter was positive but also is not statistically significant. All of studies seem pertinent as Strongin's assumption in his study which assumes that the short-run demand for money reserves is rigid and inelastic with respect to changes in the short-run interest rates. The results indicate that the just-identified model 1 in my study, which assume that α=0, is acceptable model in both theory and practice. The sign of β is also positive in the full sample and sub-sample 1, but it is negative in the post-crisis period as predicted by theory. This coefficient is considerably large in all models, but the small impact of exchange rate is recorded in the exchange rate regime. In the period starting from September 2008, the depreciation in exchange rate elasticity seemingly leads to a decline in the money reserves. The same thing in three samples is a statistical insignificance in almost models except for the interest rate regime where the magnitude and size of impact β are consistent with results of all regimes. The negative sign of β implies

Table-3. Parameter Estimates for All structural VAR Model

Parameter Estimates for All Structural VAR Models									
Sample	Model	α	β	γ^{IR}	ϕ^M	ϕ^{ER}	ϕ^d	ϕ^e	For OIR
Full Sample (1996:01-2014:08)	JI_1	0	1.00338 (0.0000)	-0.0036 (0.9646)	0.0214 (0.0000)	0.0103 (0.0000)	-0.0126 (0.8707)	-0.0071 (0.9991)	386.4354
	JI_2	0.0007 (0.9960)	0.9911 (0.5038)	0	0.0214 (0.0000)	0.0105 (0.0000)	-0.0072 (1.00000)	0.1108 (0.1039)	381.9528
	OI_1	0.0015 (0.3242)	1.0473 (0.0000)	-0.0032 (0.0017)	0.0212 (0.000)	0.0101 (0.0000)	0	0	393.1445
	OI_2	0.0037 (0.9998)	0.1637 (0.9599)	0	0.0231 (0.0000)	1	-0.0007 (1.00000)	0.8851 (0.0000)	-530.136
	OI_3	0	0	-0.0036 (0.1720)	1	0.0103 (0.0000)	-0.2579 (0.0001)	-0.0022 (0.9659)	-352.3955
Sub-Sample 1 (1996:01-2008:09)	JI_1	0	0.9352 (0.1285)	-0.0018 (1.0000)	0.0249 (0.0000)	0.0099 (0.0000)	-0.0372 (0. 8708)	0.0560 (0.4916)	246.5895
	JI_2	0.0029 (0.9959)	0.9215 (0.7212)	0	0.0241 (0.0000)	0.0098 (0.000)	0.0031 (1.00000)	0.0559 (0.4918)	245.6652
	OI_1	0.0029 (0.1515)	0.9802 (0.0000)	-0.0016 (0.0413)	0.0246 (0.000)	0.0097 (0.000)	0	0	250.5605
	OI_2	0.0042 (0.9996)	0.1481 (0.6858)	0	0.0260 (0.000)	1	0.0015 (1.0000)	0.3778 (0.0000)	-381.2800
	OI_3	0	0	-0.0019 (0.0754)	1	0.0098 (0.0000)	-0.7468 (0.0623)	-0.0327 (0.8096)	-234.2261
Sub-Sample 2 (2008:09-2014:8)	JI_1	0	-0.7651 (0.4950)	-0.0048 (0.9991)	0.0103 (0.0000)	0.0057 (0.0000)	0.0586 (0.9994)	0.0109 (0.9997)	227.8232
	JI_2	-0.0041 (0.9259)	-0.702 (0.9706)	0	0.0102 (0.0000)	0.0060 (0.0000)	0.0009 (0.9990)	0.1216 (0.3038)	224.5824
	OI_1	-0.0042 (0.0055)	-0.6747 (0.0000)	-0.0043 (0.0056)	-0.0100 (0.0000)	-0.0056 (0.0000)	0	0	230.4739
	OI_2	-0.0078 (0.9994)	0.0950 (0.7817)	0	0.0110 (0.0000)	1	-0.0014 (1.0000)	0.5303 (0.0000)	-113.9271
	OI_3	0	0	-0.0046 (0.0000)	1	0.0056 (0.0000)	1.4655 (0.0000)	-0.0151 (0.9485)	-65.1792

that under exogenous negative impacts shocks of the global financial crisis, Vietnamese policy makers can tighten the monetary policy to promote the domestic demand. The parameter ϕ^M carries a positive sign as expected and

statistically significant is all regimes. The impact of demand shocks on monetary reserves approximates 0.02 in the full sample and in the period before the crisis. This coefficient, however, are considerably lower in the post-crisis period.

In the exchange rate equation, the response of exchange rate to the interest rate shocks is consistent for what is predicted by theory. The parameter γ^{IR} is negative in all models running with disparate samples. Although, in almost case this coefficient is statistically significant, its magnitude is remarkably small just -0.003; -0,001 and -0.004 in the full sample, the first and second sub-sample, respectively. Similarly, the sign of ϕ^{ER} is reasonable in both theory and practice. In all regimes utilizing diverse samples, the external shocks positively affect the exchange rate but the magnitude is not significant. Moreover, ϕ^{ER} in smaller in the second sub-sample compared to results in other periods.

Subsequently, I look at the interest rate equation to analyze the reaction of interest rate to the money demand shocks and exchange rate innovations. In general, the impacts of these innovations are not statistically significant. The table 3 illustrates that in the exchange rate target regime, only ϕ^{e} is large in both number and statistic, whereas ϕ^{d} has a vital role in the Monetary Reserve target regime. However, all regimes indicate that ϕ^{d} and ϕ^{e} accounted for a very small part in explaining the changes of interest rate. This result coincides with impositions of Fung and Yuan (1999). In their study, they imposed a restriction that demand and exchange rate shocks have no impact on the exchange rate. The results here seemingly advocated the idea that the model with over-identified restrictions reflecting the interest rate regimes has been the most effective one to measure the stance of monetary policy in Vietnam. What's more, the significance of other parameters in the tables is also depicted in this regime. Probably, Vietnamese policy should target interest as a priority instrument to conduct monetary policies. However, until now we still say nothing about it.

In short, although the over-identifying test proves futile because all tests reject specific models, the analysis of magnitudes and signs of parameters have indicated some main implications. Firstly, there are some changes between two sub-sample and these impacts become more serious in the sub-sample 2 as a result of the global financial crisis. Secondly, after all things, although Interest Rate target might be a more reasonable regime rather than the Exchange Rate regime or Money Reserve regime, it is better if the central bank in Vietnam combine the different policy instruments to conduct the monetary policy.

5.2. Exogenous Monetary Policy Shocks

In this section, we will analyze the exogenous monetary policy shock v^{s} which can be derived from the estimated model discussed above. As mentioned in the study of Fung and Yuan (1999), Amarasekara (2008), v^{s} is very volatile, thus I computed the 18-month moving average of v^{s} instead of normal one and plot it here. The cogent reason to explain for using 18-month moving average is that the monetary policy needs take approximately from 18 months to 24 months in order to affect the economy (Bernanke and Mihov, 1998), (Fung and Yuan, 1999). The zero line is considered as the benchmark at which all policy actions are fully predicted. Inflation and Industrial Output is expected to stay on the long-run trend if no further monetary shock happens. As explained in previous studies, if the policy is tighter than anticipated if v^{s} is higher than zero-line, whereas it is easier than anticipated if v^{s} is below the zero line.

Furthermore, in order to analyze the impact of exogenous monetary policy shocks on inflation and industrial output growth, I will plot each of them in the same graph and review how changes in monetary shocks affect the main macroeconomic variables. To make it more simple, I will divide the full sample into 4 small period, including period 1(1997-2000), period 2 (2001-2005), period 3 (2006-2009) and period 4 (2010-2014). Looking at the figure 3, I have found out some evidences. Firstly, the top panel of figure depicts that the period 1 and period 3 were mostly easier than expected, whereas the tighter than expected was recorded in the period 2 and period 4. Secondly, if I compare the exogenous monetary policy shocks with industrial output and inflation, these shocks are seemingly consistent with the trend of inflation in the whole period. For industrial output, although in the first two periods, there was no clear relation between them, in the period 3 and 4, the relationship between the trend of industrial output and the derived policy shocks has become more consistent.

Period 1 (1997-2000)

The derived monetary shocks was generally lower than zero which implied that policy stance was easier than expected in general except for period from mid-1998 to near end of 1998. Only in this period indicated a remarkable higher than zero line which depicted a tightened monetary policy of SBV. This was extremely reasonable because Vietnam just experienced the first Asian financial crisis in 1997, a tightened of monetary policy was reasonable to limit the impacts of these exogenous shocks. Unsurprisingly, the CPI growth tended to decrease considerably as a result of a tightness of monetary policy. If I considered the bottom panel of the figure, the GDP growth also decreased significantly, before being suddenly supplanted by a substantially upward trend. Everything was completely consistent to what had happened in Vietnam in this period. Admittedly, the Asian financial crisis had not brought serious consequences in Vietnam since Vietnam did not fully integrate into the world economy.

Period 2 (2001- 2005)

The second period was mostly tighter than expected as illustrated in the figure. Policy became increasingly tighter from 2000 before reaching the zenith in the early 2002. From this time onward, the level of tightness began to diminish. At the end of 2004, the policy was neutral and all policy activities were fully anticipated. In fact, from 2003 to 2005, the government and the SBV were loosening the monetary policy in order to pursue economic development. This partly explained a decrease in the level of tightness in this period. As a result of monetary strategies this period, there was a substantially upward trend of CPI growth in this period. In addition to the easing of monetary policy, a high growth of CPI in this period resulted from the domestically and internationally exogenous shocks, such as the soaring price of input and other goods (steel, coal, rice and others), a rise in instability of the

world economy which putted more and more pressure on CPI. However, the economic growth in this period gradually improved. This was mainly explained by the fact that the government as well as the SBV concentrated on the economic growth target in the 5 year plan (2000-2005). Through using the open market operations (OMO), the economic growth was recorded at a high rate with 7.79% and 8.44% in 2004 and 2005, respectively. The high percent of economic growth was the direct result of concentrating particularly on this target of 5 year plan.

Period 3 (2006-mid- 2008)

From 2006 to mid-2008, the policy was mostly easier than expected from early 2006 to early 2008, and then tighter than expected until at the end of 2010, based on the result of derived exogenous monetary shocks. Looking at the figure, Vietnamese economy experienced a high volatile of output as well as a recorded level of inflation. In order to explain what was going on in this period, I indicated some realistic evidences. Firstly, these were the first years of conducting the 5 year plan (2006-2010), the National Assembly continued to target the economic growth as the priority to conducting the monetary policy. Besides, they also set up other targets controlling the fluctuations of inflation. The easing of monetary policy stimulated domestic production, consumption and economic growth, but it was pushing the inflation greatly. Moreover, this period was remarked by an occasion which Vietnam has become an official member of World Trade Organization. This has brought a plenty of opportunities as well as challenges for Vietnam. Due to this fact, Vietnam was increasingly influenced by the global financial crisis which pushed more pressures on the inflation. Early 2008, the monetary policy was tightened by a plenty of strong policies such as (i) an increase of the required reserves by 1 percent (statement 187/2008/QD-NHNN); (ii) issuing the 20,300 billion VND Treasury bills (346/QD-NHNN); (iii) imposing restrictions to manager the stock market and others. As a result, the inflation reached a zenith of over 23% in 2008.

Period 4 (from 2009 to 2014)

The policy shocks depicted in the figure implies that policy was mostly tighter than expected and also rather volatile from mid-2008 to at the end of 2011, and then became easier than expected for about 3 years until at the end of 2014. In this period, Vietnam experienced high fluctuations of both inflation and the output growth. At the end of 2008, when Vietnamese economy had a sign of depression caused by the global financial crisis, the government and the central bank had loosened the monetary policy by lower interest rate, for instance slightly lower the interest rate; lower the required reserve ratio (from 8% to 6.5% and then to 3%). Since 2010, the central bank persistently pursued targets concentrating particularly on controlling the inflation by a growth of money supply. Therefore, the inflation was controlled at the low level in 8/2010, while the growth rate in the first 6 month was around 5.57% (lower than target). This led to the pressures of the

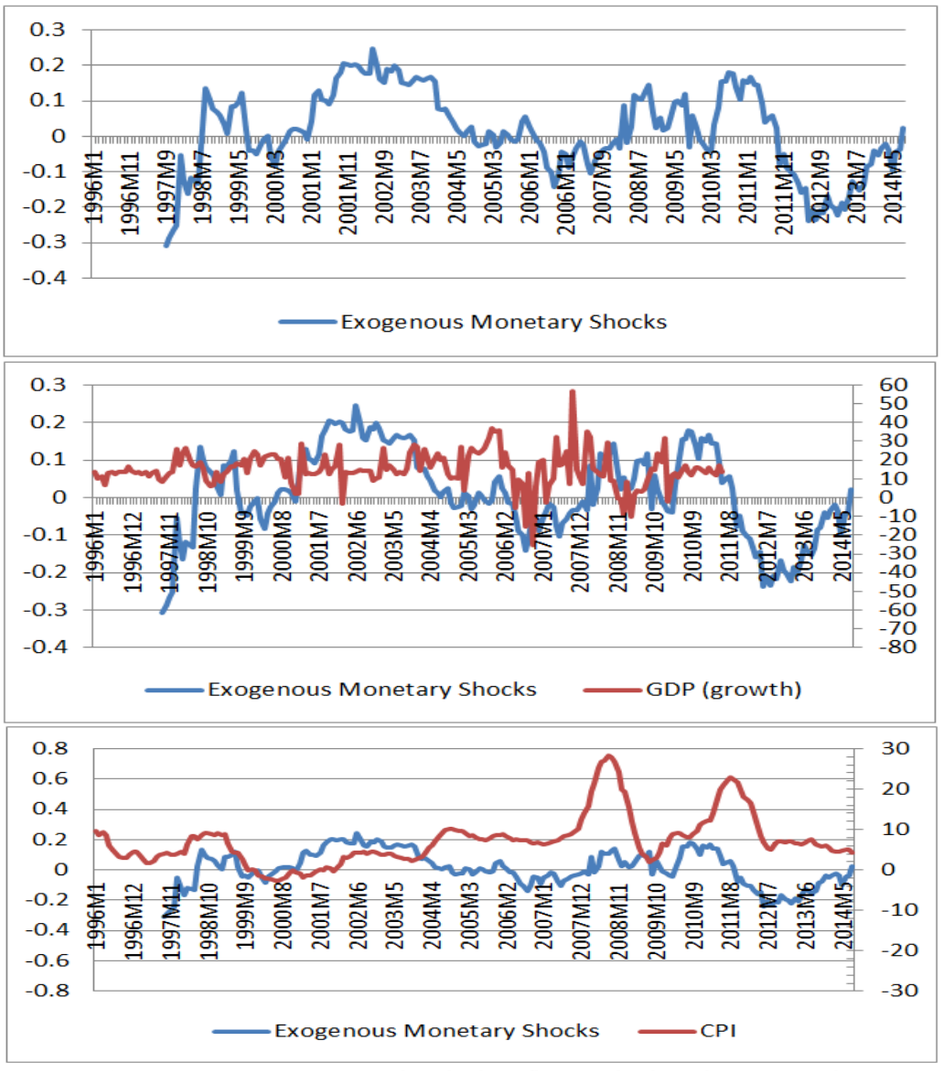

Figure-3. Exogenous monetary policy shocks, inflation and Industrial Output growth
Note: Data taken from GSO and author's calculation

Pursuing the high growth target. The policy has become more easing by a sanction of such policies as (i) decreasing the lending interest rate; (ii) refinancing some banks (such as 10,000 billion VND for the Commercial Banks and Vietnam Bank for Agriculture and Rural Development. Eventually, the money supply rocketed up which drove the inflation up. At the end of 2010, the easing policy was suddenly replaced by a tight one when the central increased base interest rate to 9%. By 2011, the central bank persistently pursued the targets controlling the inflation by a set of tight monetary policies. From at the end of 2011 to 2014, an easing monetary policy has been verified to acquire the targets.

In short, the changes of exogenous monetary policy shocks have been broadly consistent for which policies the SBV had historically implemented with respect to the development of GDP growth and inflation. The monetary policy has proved itself as the foremost medium which helps the central bank as well as the government to attain the goals.

5.3. Measure of the Monetary Policy Index

By applying the methodology discussed earlier, I calculate a monetary policy index for Vietnam. This index, however, is different from other studies such as Bernanke and Mihov (1998), Kasa and Popper (1996) or Fung and Yuan (1999) which have used the parameter from the just-identified model for the full sample, I will utilize an average of parameter estimate in all model to sever for this analysis. This method was applied in the study of Amarasekara in Sri Lanka in 2008. There are several plausible reasons to explain for this approach. Firstly, the author believes that the sole regime could not fully explain the structure of monetary policy in each country, thus this approach permit me to avoid concentrating solely on a specific regime. Secondly, in general, all estimated parameters are approximately equal, thus using the average parameter will help us precisely compute the Monetary Policy Index. By using this method, I come up the results as bellows

Table-5. Average Parameter Values for Monetary Policy Index

	α	β	γ^{IR}	ϕ^{M}	ϕ^{ER}	ϕ^{d}	ϕ^{e}
Full sample	0.0014	0.7744	-0.0034	0.0211	0.0103	-0.038	0.1978
	w^{M}	w^{ER}	w^{IR}				
	1.800	-17.814	1.0691				
	α	β	γ^{IR}	ϕ^{M}	ϕ^{ER}	ϕ^{d}	ϕ^{e}
Sub-sample 1	0.0017	0.7373	-0.0017	0.0243	0.0098	-0.0419	0.0991
	w^{M}	w^{ER}	w^{IR}				
	1.7249	-8.8662	1.0199				
	α	β	γ^{IR}	ϕ^{M}	ϕ^{ER}	ϕ^{d}	ϕ^{e}
Sub-sample 2	-0.0049	-0.2479	-0.0024	0.0066	0.0063	0.3345	0.1057
	w^{M}	w^{ER}	w^{IR}				
	-50.8259	-8.6373	1.2921				

Source: Author's calculations

As discussed earlier, I expect w^{M} and w^{ER} to be negative, whereas those of w^{IR} is positive. The table 5 illustrates that in the full sample, the sign of w^{ER} and w^{IR} is the same as predicted by theory, while the sign of w^{M} is different. Moreover, the exchange rate has a considerably larger weight than the money reserve and the interest rate. The result running on the pre-crisis sample is similar to those of full sample. Conversely, the sign of weights is the exactly same as expected when I run on the post-crisis, and weights of money reserve is significantly high as compared to others. Based on the results of the full sample, probably the exchange rate contains the most significant amount of information about the policy stance. The results seemingly advocated the idea of Packard (2005) or Le and Pfau (2009) who indicated that exchange rate was considered as an important channel in Vietnam.

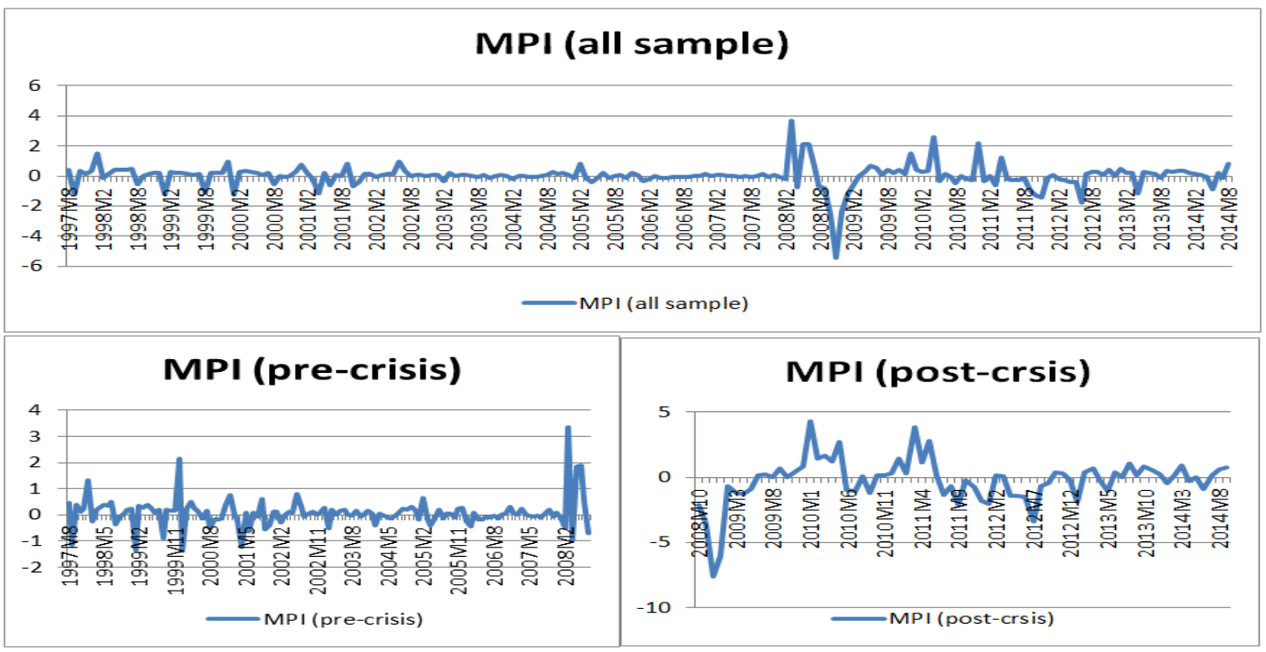

Figure-4. Money Policy Stance in Vietnam

Source: Author's calculation

Bernanke and Mihov (1998) suggested that the policy variables should be transformed by subtracting them from their own 36-months moving average before estimating the monetary policy index. Fung and Yuan (1999) applied this method with a small adjustment which take the difference form it an 18-month moving average of its past value. And then I measure the monetary policy index input the policy variables into the equation (21). As mentioned by Bernanke and Mihov (1998), zero is considered as the "normal" monetary policy which implies that policy does not deviate from the average stance in the past 36 months. Kasa and Popper (1996) also emphasized that "since only second moments are being used here, these plots cannot say anything about the stance of policy in some absolute sense. Only the stance of policy relative to the historical average is identified"(p.291).

Bernanke and Mihov (1998) and Like Fung and Yuan (1999) explained that the pressure on recent inflation can be captured by this normalized stance measure. Therefore, a positive stance implies the future inflation will decline to a point below the average inflation rate of the past 18 months in the absence of other shocks, vice versa. On the other hand, if the stance is neutral, inflation will go along its 18-month moving average, Additionally, I also compute inflation and GDP growth as the deviations from their 18-month moving average. Assuming that there is no other demand or supply shock or there is a domination of monetary shocks over others, thus a tight (easy) policy stance is followed by a decrease (increase) in inflation and output.

The second and third panel of figure 5 depicts the relationship between the monetary policy stance and inflation, and the GDP growth, respectively. This section aims mainly examining whether these relationships are held or not. Firstly, I check the relationship between the stance and CPI by looking at the second panel of figure. In the pre-crisis period, although the monetary stance seemed very volatile, this relationship generally held. For example, when policy was expansionary in mid and end 1998, the inflation rose above the past values; a contradiction of policy in 1999 and 2000 was followed by a fall below the past values. In the period after the global financial crisis, this relationship has become clearer. Specifically, when the policy stance became easier than its past average in mid-2008, inflation increased above the average values; and then when the policy become tighter in 2009, the inflation declined to a level targeted by the central bank.

Similarly, the relationship between the GDP growth and the stance has also been examined by the bottom panel of figure 5. A contradiction of policy such as in end 1997, early 1999, early 2001 and so on was followed by a reduction of the output growth to a point below the average past values. Generally, this relationship is not completely clear as seen in the CPI due to a limitation of data for GDP in Vietnam. Furthermore, the changes in inflation and output not only are determined by the monetary policy, but also other shocks. In the different points of time, impacts of these shocks probably outweigh the monetary policy.

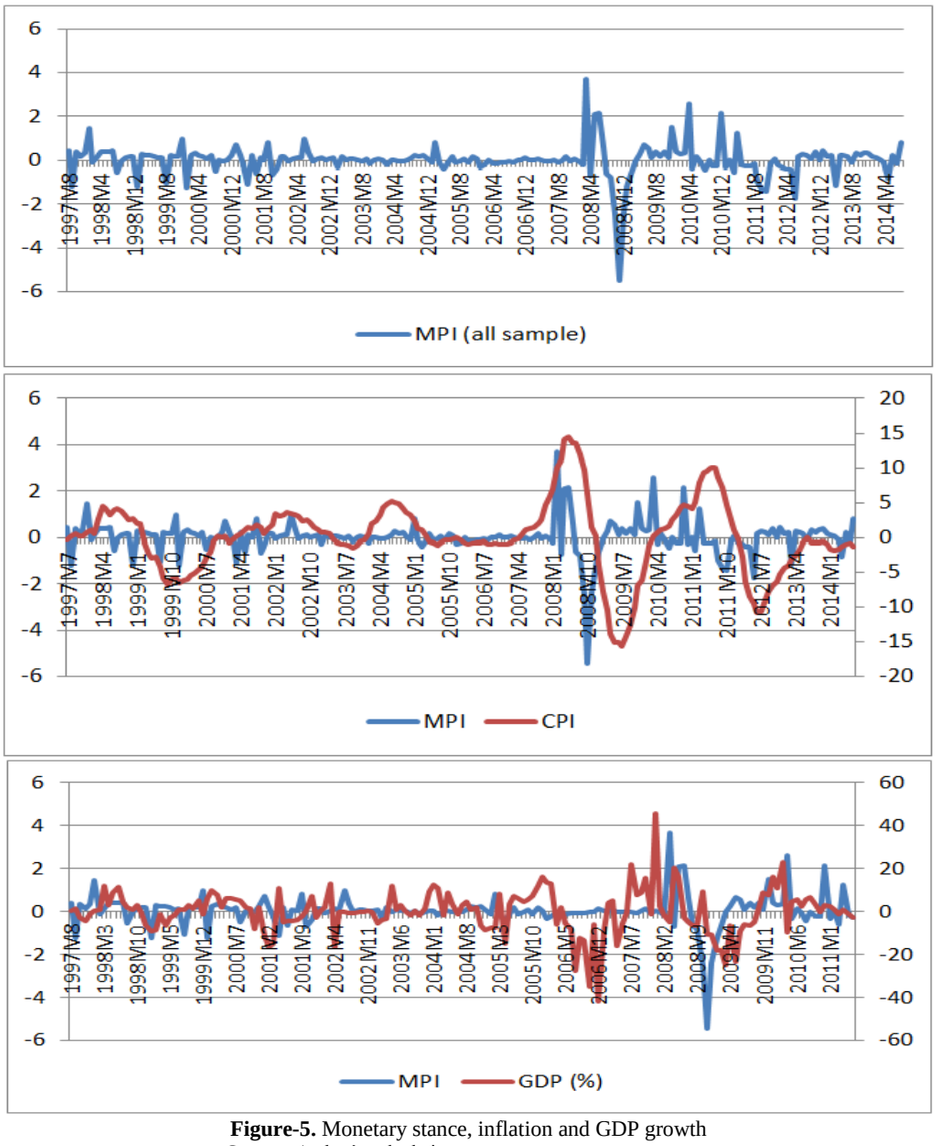

Figure-5. Monetary stance, inflation and GDP growth
Source: Author's calculations

In short, these relationships between the stance and inflation and output growth were generally held. However, the graph illustrates the stance of inflation more clearly than counterpart. More importantly, like previous study, I assume that there is no other shock or the policy dominates other, thus I just analyze the monetary stance and other macroeconomic variables. Realistically, this assumption is not guaranteed, thus it is essential to meticulously analyze these relationships.

6. Conclusions

By applying model of Bernanke and Mihov (1998) and Fung and Yuan (1999), this study mainly aims deriving a measure the stance of monetary policy in Vietnam. Some pragmatic findings are summarized as follows so as to answer main research questions in my study. *Firstly*, the reactions of the money demand, exchange rate and interest rate to diverse innovations are generally consistent in different periods, but there were some changes in the period after the global financial crisis, especially the response of money demand to exchange rate innovations; interest rate to money demand shocks. *Secondly*, instead of concentrating particularly on one target, the monetary policy implementation has become more effective and pervasive, if the central bank attempts to control a combination of these targets. *Thirdly*, the stance measure derived from the model consistently reflects the historical performance of monetary policy which the central bank implemented to affect the GDP growth and inflation in Vietnam. Among three policy variable, the exchange rate comprises the remarkable amount of information about the policy stance. Finally, this study also examines the relationship between the stance and inflation and output growth and realizes that the theory about these relationships is statistically held in Vietnam under assumption that there is no other shock or the policy dominates other.

Policy Implications

More importantly, after answering the research questions, I also give some recommendation for purposes of providing the fundamental theory for policy makers to design more appropriate policies. *Firstly*, the SBV should control a combination of different targets and utilize the monetary tool effective to obtain the goals. *Secondly*, the study also confirmed that the exchange rate and money have proven themselves as more effective medium to conduct monetary policy in Vietnam than interest rate channel. Moreover, in volatile conditions like the financial crisis, the policy makers should pay more attention to money channel to design monetary policies. *Thirdly*, due to the fact that the relationships between the monetary stance and output growth and inflation are held in Vietnam, policy makers can meticulously design policies.

Limitations of the Study

One of the greatest issues of this study is that all over-identifying restrictions are rejected by the model. Although this help me support the idea that the monetary history of Vietnam cannot be identified with only one target regime, but a combination of disparate regimes, it is essential to find out an exact regime which helps Vietnam to perform the monetary stance effectively. Furthermore, due to problems of data available for real GDP in Vietnam, I have to transform the quarterly data into monthly data and use it in my research.

Finally, although I employ three main channels, based on realistic evidences of Vietnam and theory, the quality of study can improve significantly, if I construct a model to examine unconventional channels. It is vital because it will provide more useful policy implications for the central bank and the government to better regulate the monetary and select alternative channel to improve the performance of monetary policy in Vietnam.

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