Journal of Indonesian Applied Economics, Vol. 6 No.1, 2016: 123-141

TRANSMISSION MECHANISM OF MONETARY POLICY THROUGH ASSET PRICE IN INDONESIA IN THE PERIOD 2002-2011

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ABSTRACT

The objective of this study is to identify the transmission mechanism of monetary policy through the assets price in Indonesia. In practice, Bank of Indonesia and the government implements monetary policies by reducing the Loan to Value ratio and by implementing expansionary policy through Housing Finance Liquidy Facility. The method used in this study is the Vector Autoregression First Difference (DVAR). The specific variables used in this study include long-term mortgage interest rates, housing price index, composite stock price index, hot money, money supply and Gross Dometic Product with the observation period starting in 2002:1-2011:12. Some procedures that will be used to support VAR specification including stationary test, cointegration test, Impulse Response Function, and Variance Decompositiion. Based on the DVAR estimates, the asset prices affect the output through the money supply. These results suggest that asset prices do not directly affect output but through some transmission mechanism. The contraction monetary policy implemented by the monetary authority is therefore effective enough to anticipate economic heating caused by the change in asset price.

Keywords: Transmission mechanism, Monetary policy, DVAR

JEL Classifications: E52, E61

INTRODUCTION

Monetary policy, which is one of the macroeconomic policies in the country, has an important role to maintain the stability of the economy, particularly the low inflation and the high economic growth. To achieve these objectives, the central bank (Bank of Indonesia) created a series of policies and necessary tools in its implementation through multiple channels. The work process of the monetary policy is called the transmission mechanism of monetary policy. As pointed by Warjiyo and Agung (2002), this transmission mechanism works through several channels, such as direct channel, expectation channel, interest rate channel, exchange rate, credit and asset price. This study focuses on the transmission mechanism of monetary policy through asset price.

One of the important objective of the monetary policy is to slow down or speed up the pace of the economy. When the economy is predicted to heat up, therefore the monetary policy can be used to reduce or slow the economy down. On the other hand, if the economy is predicted to decrease, then the central bank will usually increase the money supply so that the country can avoid economic recession.

The subprime mortgage in United States in 2008 is one of the example how the transmission mechanism of monetary policy might affect the whole economy of the country. The Global Financial Crisis (GFC) caused by the subprime mortgage was happened because too many substantial credits given to the people including people that is having difficulties to return the credits and was also affected by decreasing in the interest rate. This condition caused domino effect and finally become the overheating economy. This phenomena showed that transmission mechanism of monetary policy through asset price might greatly affect to the economy of the country.

In contrast to the US, the economy crisis in Indonesia in 1998 was caused by the exchange rate crisis that slow the economy down. This crisis caused a slowdown in several sectors including construction sector (property). As pointed by Yudanto and Santoso (1998), the construction sector in Indonesia during the crisis slowed down by -24.2%. Moreover, the coefficient correlations of the construction sector with the depreciation factor and interest rate are relatively high of 0.52 and 0.57, suggesting that interest rate has an important role in the decrease of the construction sector in that era.

A decade after the economic crisis 1997-1998, property investments in Indonesia are now starting to wake up. The high expectations of asset price to increase in the future leads to the higher demands of property each year in Indonesia. According to the Real Estate Indonesia (REI), housing demand every year is recorded of 2.6 million units. If it is not controlled, then the demand for houses would become unmanageable and it would heats the economy up. In this case, Bank of Indonesia as the monetary authority in Indonesia has detected the increasingly unreasonable property prices (and also the rise in loans for vehicle). To anticipate the economic heating, therefore, Bank Indonesia introduces contactionary policies by reducing the ratio of the Loan to Value (LTV).

LTV is the ratio between the values of credit that can be granted by the bank to the value of the collateral at the time of beginning of the loan. Beleid sets a maximum LTV ratio of 70 percent, meaning that the maximum credit that can be obtained by debtors is at about 70 percent of the value of the house that will be purchased. Besides regulating the LTV, beleid also regulates the amount of the down payment for motorcycle loans which is at about 25 percent of the value of sales, 30 percent for cars, and 20 percent for four-wheeled or more vehicles used for productive purposes (Johansyad, 2012). As pointed out by Kurnia (2012), LTV reduces the speculation motive particularly when it is combined with other rules such as fiscal and macroprudential regulation.

Singapore is one example of country that applies the LTV with a combination of fiscal rules. In January 2011, for example, Singapore's LTV tightens rules for mortgage filled by non-individuals. For non-individuals mortgage, the maximum ratio is 50 percent, while for the second mortgage and the following mortgage, it is reduced from the maximum LTV of 70 percent to 60 percent. Meanwhile, for the first mortgage of the individual mortgages, the maximum LTV is at 80 percent, while mortgages granted by the government (Housing Development Board), is fixed at 90 per cent.

In Indonesia, there are also governmental programs that provide housing loans with low interest rate or subsidized mortgages particularly for young people. The program is called Housing Finance Liquidity Facility (*Fasilitas Likuiditas Pembiayaan Perumahan/FLPP*). However, according to Indonesian Property Watch (IPW), the FLPP recently is used only IDR 691 billion compared with the total budget of IDR 4.7 trillion. In fact, the program is facing obstacles when the absorption is only around 20 percent of the target, despite the lending rates offered are relatively low, even there is also a plan that the FLPP loan interest rates will be equal to the SBI (Bank of Indonesia interest rate) of around 6.5 percent.

This two different policies (LTV and FLPP) adopted by Bank Indonesia and the government are aimed at the different targets. The policy issued by the central bank is to reduce the LTV ratio (particularly for housing loans larger than 70 m^2) aims to anticipate the economic heating, while the government policy in the form of Housing Finance Liquidity Facility (FLPP) intends to address the backlog to meet the housing needs for low-income people with relatively low interest rate.

This study specifically tries to identify the transmission mechanism of the monetary policy through asset prices and to determine the speed of this transmission influencing the economy. By looking at this transmission mechanism, we can see how these policies will influence the economy and how fast the policies can affect or influence the whole economy.

The content of this paper is as follow. The second part of this paper discusses the literature review used in this study. The third part is the research methods, i.e. Vector Autoregression First Difference (DVAR). The fourth section is the empirical results and discussion. Finally, the final section is conclusion.

LITERATURE REVIEW

Xu and Chen (2011) examined the effects of monetary policy variables, money supply growth, and some housing credit policy indicators on the real estate price growth in China. Using Granger causality and autoregressive models, this study showed that the monetary policy expansion through decreasing in interest rate, money supply growth, and decreasing housing down payment tend to faster the housing price growth, while in contrast the contractionary monetary policy through increasing interest rate, decreasing money supply and increasing the down payment policy tend to slow down the housing price growth.

Koivy (2010) studied the transmission mechanism of monetary policy through wealth channel. This study analysed the wealth channel through two stages. First, monetary policy should first affect the wealth value. Second, the change in wealth will cause a change in their consumption. Using *Structural Vector Autoregression* (SVAR), as a result, this study found that the expansionary monetary policy through wealth channel caused an increase in asset price.

Wesche and Gerlach (2008) studied about the respond of property on equity price, inflation, and economy activities on monetary policy changes across 17 countries. Using panel VAR, they concluded that monetary policy is important to balance the asset price change and keep from financial instability that might influence the economic activities.

In Indonesia, a study by Goeltom (2008) showed that the role of asset price in transmission mechanism of monetary policy before the economy crisis was not significant. However, after the crisis period, the transmission mechanism of monetary policy through asset price is significant, particularly by affecting the number of investment.

Based on the previous studies, the role of the asset price is important in transmission mechanism of monetary policy particularly to make stable the economy. Compared to the previous studies, this study is looking at the transmission mechanism of monetary policy through asset channel with some modified variables and some monetary instruments that used by Bank of Indonesia recently.

Definition of Asset

According to Siregar (2004: 178), definition of asset is a good, which is in a legal sense is called as object. Goods may include immovable goods (land, buildings), both tangible and intangible, which is included in the assets or property or possessions of companies, corporations, institutions, or even individuals.

According to Mishkin (2001), there are three categories of asset prices seen as important channels in which monetary policy might affect the economy.

1. Stock price

   Transmission mechanism includes the stock market which consists of the stock price on investment, the company balance security sheet, the company household wealth security, and the company liquidity.

2. Real Estate Prices

   Real estate prices can affect the aggregate demand through three ways. They are the direct effect to the household spending. Monetary expansion (M) in the form of lower interest rates, the decreasing of financing cost of the house which increase the price (P). The higher relative prices of the house compared to the cost of construction, the construction companies gain more profits to build homes. Therefore the housing expenses will rise (H), so that the aggregate demand will increase (Y). The next point is the household wealth. House prices are an important component for the household wealth which affects consumption expenditure. Therefore, the expansive monetary policy (M) which raise the price of the home (P), also raise the household wealth (W) They also raise the consumption expenditure (C) and aggregate demand (Y). Then, the last point is the bank's balance sheet.

3. Exchange rate

   The exchange rate impacts on the exports and balance. Expansionary monetary policy affects the exchange rate by causing domestic interest rates goes down. The deposits denominated in domestic currency become less attractive when compared to deposits denominated in foreign currencies. Consequently, the value of domestic savings relatively declines or falls compared to the deposits in foreign currency. The exchange rate also depreciates. The value of domestic currency goes lower and it makes the price of domestic goods cheaper than the price of foreign goods (imports). Thereby it causes the increase of net exports and the aggregate of expenditure.

Mechanism of the Monetary Policies

According to Taylor (1995), transmission mechanism of monetary policy is "the process through which monetary policy decisions are transmitted into changes in real GDP and inflation". Monetary policy is transmitted via two channels, the direct channel and the indirect channel. While the direct channel is a direct way to the GDP and inflation, the indirect channel is transmitted into five ways; the interest rate channel, exchange rate channel, lines of credit, lines expectations, and asset price.

Price transmission mechanism goes through the changes in asset prices and the wealth of society, which will affect the investment and consumption spending in the future. If the central bank uses contractionary monetary policy, then it will lead to an increase in interest rates and it will reduce the price of the company's assets. The decline in asset prices can result in two things. First, it reduces the ability of the company to expand. Second, it lowers the value of wealth and income, which in the future will reduce the consumption of expenditure (Warjiyo and Solikin, 200 4:81).

RESEARCH METHODS

This study is a descriptive study with quantitative analysis. The data used in this study is secondary time series data with a period of study from 2002: 1 to 2011: 12. The data is obtained from the Indonesian Financial Statistics published by Bank Indonesia.

Vector Autoregression (VAR)

The method used in this study is the VAR (Vector Autoregression), particularly because the cointegration between the variables used in the study is not found. This study will also present the result of the cointegration test due to the fact that if the data is cointegrated, then Vector Error Correction Model (VECM) will need to be applied instead. VAR specifically is non-structural model or non-theoretical model. All of the variables used in this study are assumed in the same position that all of the variables considered as endogenous variables. Before estimating the VAR model, firstly we need to do the stationarity test to see stationarity of data and to determine the degree of integration. As pointed out by Gujarati and Porter (2009), the advantages of VAR are: (1) simple, as we do not need to differentiate which variable is exogenous and which variable is endogenous. All variables in the VAR model can be regarded as an endogenous variable, (2) estimating VAR model is easy, i.e using OLS on each equation separately, (3) forecasting using a VAR model in some ways better than using a simultaneous equation models with more complex equation.

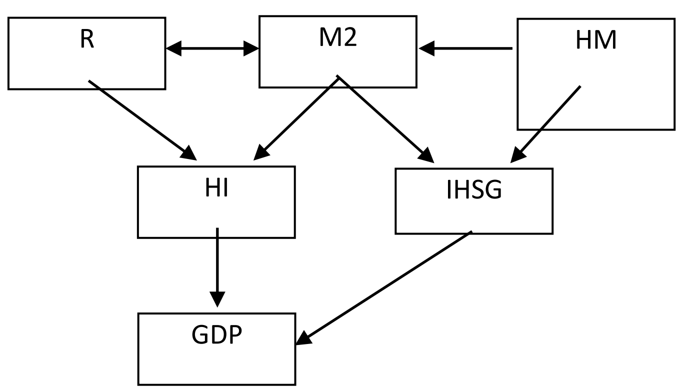
However, VAR model also have some disadvantages, among others, as follows. (1) VAR model is more non-theoritical model because just using a relatively little information, (2) VAR model is less suitable for policy analysis, (3) The number of lag used in the equation can also cause problems. Suppose we have three independent variables with each has lag of 8. It means we have to estimate at least 24 parameters. Therefore, in this case, we need to have relatively much data or observations, (4) All variables in the VAR model must be stationary, if not stationary, it must be transformed first. (5) The interpretation of the coefficients obtained from the VAR model is not easy, so we need to use impulse response function to estimate. Some procedures that will be used to support VAR specification including stationary test, cointegration test, Impulse Response Function, and Variance Decomposition. The specification of the VAR used in this study is as follow.

$$\begin{bmatrix} GDP \\ HI \\ IHSG \\ HM \\ M2 \\ R \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \\ \alpha_{50} \\ \alpha_{60} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} & \alpha_{16} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} & \alpha_{26} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} & \alpha_{35} & \alpha_{36} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} & \alpha_{45} & \alpha_{46} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & \alpha_{55} & \alpha_{56} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & \alpha_{66} \end{bmatrix} \begin{bmatrix} GDP_{t-1} \\ HI_{t-1} \\ IHSG_{t-1} \\ HM_{t-1} \\ M2_{t-1} \\ R_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (1)$$

where:

1. Interest rates on long-term loans (R).
2. Money Supply (M2).
3. Housing price index (HI).
4. *Hot money* (HM).
5. Composite Stock Price Index (*Indeks Harga Saham Gabungan*/IHSG).
6. Gross Domestic Product (GDP).

Figure 1. Research Framework



Source: Author Illustration

The relationship among those variables are explained in the research framework in Figure 1. Firstly, the interest rate (R) is predicted to affects simultaneously to the money supply (M2). Capital flow from overseas or hot money (HM) also predicted to influence the interest rate in the open economy such as Indonesia. Moreover, interest rate and money supply are predicted to affect housing consumption, therefore both variables are predicted to influence the housing price. Housing price then is predicted to affect the total consumer price and influence the output (GDP). On the other side, money supply is predicted to affect non-real sector if people choose to invest their capital in the stock market. Therefore money supply might influence the composite stock price index (IHSG). Stock price then is predicted to influence the stability of macroeconomy or output (GDP).

Stationarity test

According to Engle and Granger (1987), one of the important concepts in econometrics using time series data is the stationarity assumption*.* Statistically, a stationary time series of data exists when the average and variance of the data is constant over time, and the value of the covariance between the two time periods depends only on the distance or lags between these two time periods and not depends on the actual time when covariance is calculated.

The most common stationarity test conducted is by using the Dickey-Fuller Test (DF-Test), which later developed into the Augmented Dickey-Fuller Test (ADF- Test*)* and Phillips Perron (PP Test). The test is conducted by comparing the value of the ADF statistic with the critical value of Mackinnon statistical distribution. If the absolute value of the ADF statistic is greater than the critical value, then the observed data indicates stationarity. In contrast, if the absolute value of the ADF statistic is smaller than the critical value, the data then is not stationary.

If the data is not stationary, the regression becomes spurious. To avoid non-stationary data, there is a need to process the data differentiation test or the so-called degree of integration test, particularly if the data in level I(0) is not stationary. If the absolute value of the ADF statistic is greater than the critical value at the first level differentiation I(1) , then we can say that the data is stationary at the degree of one. However, if the value is smaller, then the degree of integration test should be continued at a higher differentiation (second level differentiation) in order to obtain stationary data.

Moreover, determining the optimum lag length also becomes an important issue, particularly in the VAR model. Ascarya (2012) argues that testing the optimal lag length is useful to eliminate the problem of autocorrelation in the VAR system. The first step of this method is to determine the maximum length of lag of the VAR system that is stable. A VAR system is said to be stable (stationary), if all of its roots have smaller modulus than one and they lie on the circle unit. The determination of length of lag in the VAR model is determined by some criterias, such as Akaike Information criterion (AIC) and Schwarz Information Criterion (SIC). The lag selected should has the smallest value of AIC and SIC.

Cointegration Test: Johansen's Method

The cointegration test is conducted to determine the existence of cointegration between variables. If there is a cointegration, VECM then should be used to estimate the short-term and long term relationships. If there is no cointegration, the VAR should be conducted and it means that the VAR can only estimate the short-term relationship. The cointegration test is conducted by using the optimum lag used in accordance with the previous test. From the cointegration test, the rank of Johansen cointegration (r) will be obtained. Specifically, if the obtained cointegration rank is more than zero, then VECM will be used, but if the cointegration rank equals zero, then the VAR model will be used.

Impulse Response Function

Impulse Response Function (IRF) is used to see response of the endogenous variable in the VAR system because of the shocks from the other variables or the changes in the residual. IRF can be used to track various shocks in the current and past periods (Sim, 1980). Using IRF, we can also understand how long the shocks in one variable caused by another variable (transmission speed) until it reachs the equilibrium level. The general equation of IRF presented in the matrix form is as follow.

$Y_t = \alpha_{10} + \alpha_{11}Z_t + \beta_{11}Y_{t-1} + \beta_{12}Z_{t-1} + \varepsilon_{1t}$

$Z_t = \alpha_{20} + \alpha_{21}Y_t + \beta_{21}Y_{t-1} + \beta_{22}Z_{t-1} + \varepsilon_{2t}$

$$\begin{bmatrix} 1 & -\alpha_{11} \\ -\alpha_{21} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ Z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

$$\gamma = \begin{bmatrix} 1 & -a_{11} \\ -a_{21} & 1 \end{bmatrix} \qquad \delta_1 = \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix}$$

$X_t = \begin{bmatrix} Y_t \\ Z_t \end{bmatrix}$ $\delta_0 = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix}$ $X_{t-1} = \begin{bmatrix} Y_{t-1} \\ Z_{t-1} \end{bmatrix}$ $\varepsilon_t = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$ (2)

or

$\gamma X_t = \delta_0 + \delta_1 X_{t-1} + \varepsilon_t$

$\gamma X_t = \delta_0 + \delta_1 L X_{t-1} + \varepsilon_t$

$(\gamma - \delta_1 L) X_t = \delta_0 + \varepsilon_t$

$X_t = \delta_0 / \gamma - \delta_1 L + 1 / \gamma - \delta_1 L \varepsilon_t$ (3)

where ε_t is a shock of X_t that can not be anticipated. It shock affect the variable itself and other variables.

Variance Decomposition

The objective of the variance decomposition is to predict the contribution of each variance of variable because of the change in other variables in the VAR system. As pointed out by Enders (1995), the variance decomposition provides information on the movement proportion caused by shock of the variable itself or shock of the other variables. Therefore, the variance decomposition will show how important the role of shocks of each variables (including the variable itself) in explaining the economic shocks and other economic variables.

EMPIRICAL RESULTS AND DISCUSSIONS

Stationarity Test Results

As mentioned above, time series data required stationarity indicating the data has a constant mean and variance. If the data is not stationary, the estimates will be spurious suggesting that the regression is significant but the result tend to be biased and can not be used for forecasting. To find whether data is stationary or not, the unit root test is required to be conducted using the Augmented Dickey-Fuller Test (ADF-Test). To see the results, the *Augmented Dickey-Fuller statistic* (*ADF statistic*) will be estimated with MacKinnon critical value of 1%, 5%, and 10%. If the value of the *ADF statistic* is greater than the critical value of MacKinnon, then the data is said to be stationary, *vice versa*. Moreover, if the data is not stationary in *level*, the data will need to be transformed by performing *first-difference* I(1) or *second-difference* I(2). If the data is stationary in the *first-difference*, then the data will have *one* degree of integration.

Based on the stationarity test in table 1, we can see that there is no stationarity in level or I(0), but all variables are integrated at one degree of integration or I(1). As the data is not stationary in levels and has the same degree of integration at I(1), then the cointegration test will be conducted to see possible long-term equilibrium relationship.

Table 1. Stationarity Test results with Augmented Dickey Fuller

Variables	ADF Statistic (I (0))	Variables	ADF Statistic (I (1))
R	-2.592462	DR	-4.030536
LHM	-2.071468	DLHM	-12.18799
LHI	-2.331381	DLHI	-10.60777
LIHSG	-2.371622	DLIHSG	-8.690075
LM2	-2.926614	DLM2	-10.99123
LGDP	-2.579163	DLGDP	-4.675642

Source: Author' Calculations

Optimum Lag Test Results

Based on optimum lag test, the results are presented in the table 2. Table 2 presents several alternatives to determine the optimum lag, including *Schwarz Information Criterion* (SIC), *Akaike Information Criterion* (AIC), *Likelihood Ratio Test* (LR), *Final Prediction Error* (FPE), dan *Hannan-Quinn* (HQ). As presented in table 2, four methods or criterias show asterisks are found at lag of one including SIC FPE, HQ and AIC, while one asterisk is found with the lag of three. As most criterias show the lag of one, then the selected of the optimum lag is one, suggesting that the response of one variable to the other variables is conducted for one period of time.

Table 2. The Result of Optimal Lag Test

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	404.4918	NA	7,64e-12	-8.569716	-8.406323	-8.503743
1	1158.137	1393.839	**1,52e-18 ***	**-24.00295 ***	**-22.85920 ***	**-23.54114 ***
2	1193.147	60.23175	1,57e-18	-23.98165	-21.85754	-23.12400
3	1220.906	**44.17536 ***	1,92e-18	-23.80442	-20.69995	-22.55093
4	1256.837	52.54438	2,01e-18	-23.80294	-19.71810	-22.15360

Source: Author' Calculations

Cointegration Test: Johansen method

Table 3 summarizes the results of cointegration tests. Based on the unit root test, all variables have integrated at one degree of integration I(1). To determine the existence of a long-term equilibrium relationship, it can be determined by comparing the value of the trace statistic with the critical value. When the value of the trace statistic is greater than the critical value, then there is a long-term equilibrium relationship. If the value of the trace is smaller than the critical value, then there is no long-term equilibrium relationship. The cointegration test results using the Johansen method shows there is no cointegration relationship, as shown by r = 0 as the trace statistic value is smaller than the critical value. Similarly, the value of *the trace statistic* at r = 1 to r = 5 indicates that the value is smaller than the critical value. Thus, the test results indicate that there are no long-term equilibrium relationships between variables. As the cointegration relationship is not found, then the model used is Vector Autoregression with first-deifference (*VAR first difference/*DVAR).

Table 3.Results of Johansen Cointegration Test Based on *Trace* and *Eigenvalue*

Null hypothesis	Eigenvalue	Trace Statistic	5 Percent critical value
r = 0	0.295395	99.45219	117.7082
r = 1	0.181744	64.44041	88.80380
r = 2	0.153006	44.38244	63.87610
r = 3	0.123234	27.77642	42.91525
r = 4	0.079742	14.62467	25.87211
r = 5	0.061193	6.314571	12.51798

Source: Author' Calculations

Vector Autoregression *first difference* (VAR *first difference*)

Based on the previous section, the stationarity and cointegration tests show that the data has a first degree of integration I(1) and no evidence of long-term equilibrium relationship. Therefore, the Vector Autoregression at first difference (DVAR) will be estimated in this study. The result of DVAR is presented in table 4.

Table 4. Estimates of *Vector Autoregression First Difference* (DVAR)

	DLGDP	DLHI	DLIHSG	DLHM	DLM2	DR
DLGDP (-1)	0.280074 [2.62078]	-0.047856 [-0.62785]	0.027902 [0.04404]	0.044908 [0.09630]	0.313103 [2.64908]	0.473101 [0.35717]
DLHI (-1)	-0.101709 [-0.69973]	0.040576 [0.39138]	-1.581448 [-1.83528]	-0.670629 [-1.05735]	-0.149595 [-0.93055]	3.221206 [1.78795]
DLIHSG (-1)	-0.021238 [-1.23474]	0.000459 [0.03743]	0.201124 [1.97244]	0.220640 [2.93977]	-0.035880 [-1.88608]	-0.122609 [-0.57511]
DLHM (-1)	-0.038137 [-1.65477]	-0.013805 [-0.83985]	0.064523 [0.47227]	-0.211187 [-2.10004]	-0.015654 [-0.61415]	-0.304146 [-1.06474]
DLM2 (-1)	-0.176440 [-1.82052]	0.097958 [1.41710]	-0.487400 [-0.84832]	-0.331655 [-0.78424]	-0.239624 [-2.23552]	1.183935 [0.98558]
DR (-1)	0.007073 [0.93132]	0.008918 [1.64631]	-0.022124 [-0.49141]	0.053659 [1.61924]	0.017671 [2.10384]	0.306835 [3.25967]

Source: Author' Calculations

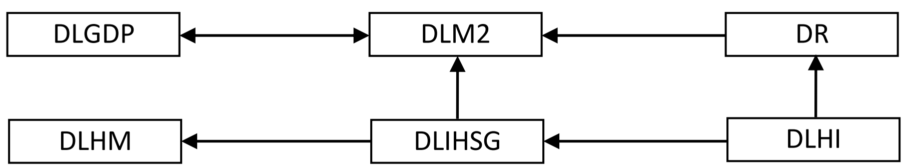
Table 4 presents the dynamic relationship across variables, particularly for the short term. Determining the relationship between these variables can be conducted by looking at the significance. If the relationship between variables is significant, therefore the direction of these relationships can be clearly identified, for example whether the relationship between variables are one-way relationship (*unidirectional causality*), two-way relationship (*bilateral causality*), or even no relationship (*independence*).

Firstly, it shows that DLM2(-1) and DLGDP have a significant relationship at 10% confidence level, while on the opposite, it also indicates that DLGDP(-1) is significant to DLM2. Based on these results, it can be concluded that both variables have a two-way relationship (*bilateral causality*).

Secondly, DLHI (-1) is significant to DLIHSG at 10% level, but in the second column, DLIHSG(-1) is not significant to DLHI, meaning that there is a one-way relationship (*unidirectional causality*) of DLHI to DLIHSG. Moreover, DLIHSG(-1) is significant to DLHM, but DLHM(-1) is not significant to DLIHSG, suggesting a one-way relationship (*unidirectional causality*) between DLIHSG and DLHM.

The *uninderectional causality* is also found for DLIHSG and DLM2, where DLIHSG is significant at the 10% confidence level to DLM2, but DLM2 is not significant to DLIHSG. Finally, *unidirectional causality* is also found for DR(-1) to DLM2 and DLHI(-1) to DR (with α = 10%). Figure 1, summarizes the direction of each variables used in the study.

Figure 1.Monetary Policy Transmission Mechanism through Asset Price



Source: Author' Illustration

Impulse Response Function

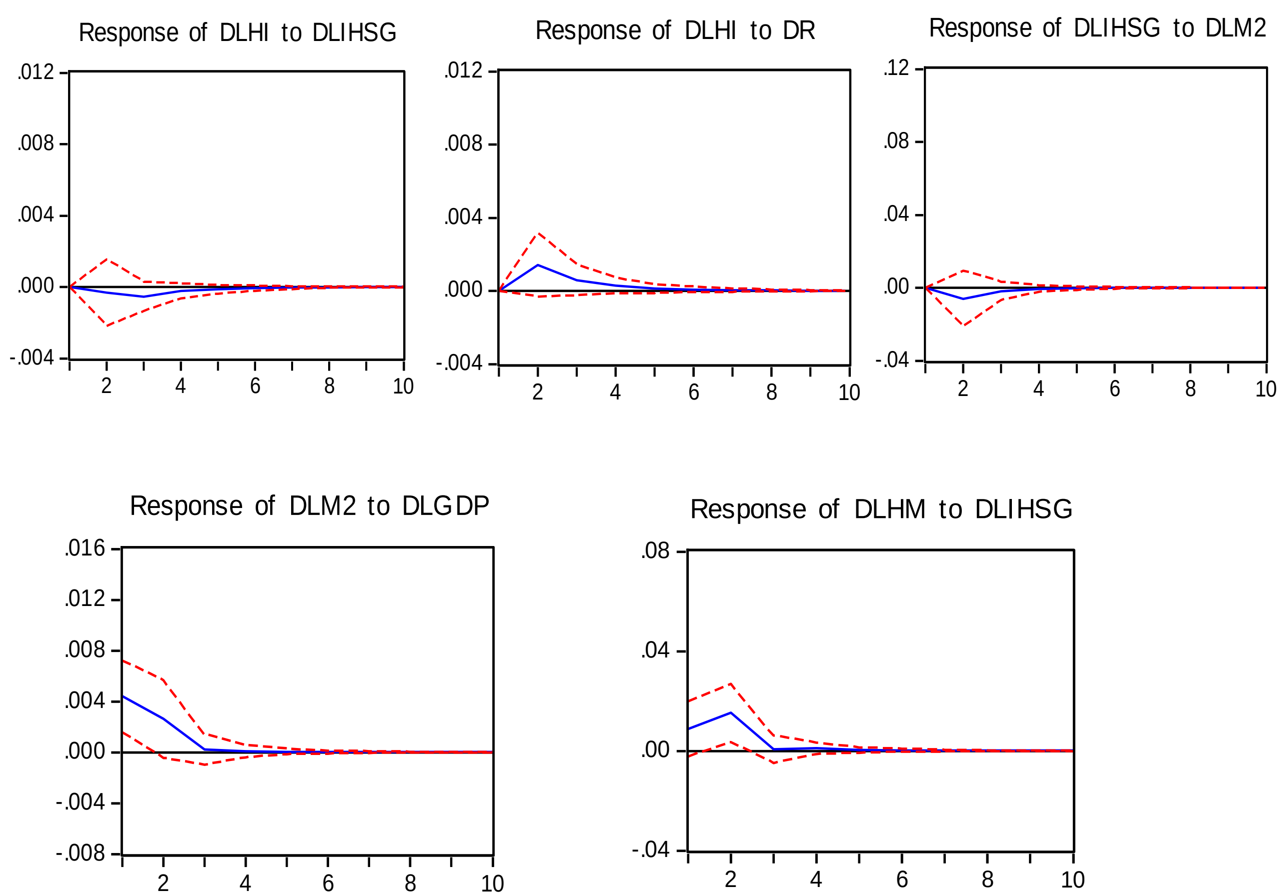
To understand the response of the variables to the shock and the speed of transmission across variables, the detailed of the IRF results are presented in figure 2. Firstly, the unanticipated shock of DLIHSG causes DLHI to increase in the second period, and then gradually decrease and reach an equilibrium in the fifth period until the tenth period. The response of DLHI due to this unanticipated schocks is relatively weak and the time limit that is necessary to response this schock is one period of time, while the time required by DLHI to reach equilibrium is three month period.

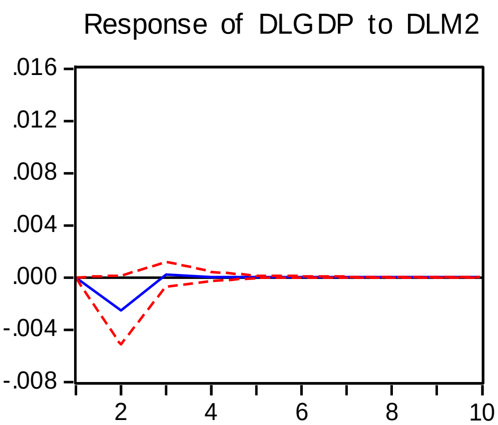
The one standard deviation unanticipated shock of DR causes a decrease in DLHI from the beginning period until the fifth period, where DLHI reach equilibrium in the fifth period. The response of DLHI due to the shock that occurs is relatively weak with the time limit required to reach the equilibrium of 4 months. Moreover, in the third panel, it shows that the unanticipated shock in the beginning period causes a decrease in DLIHSG until it reaches the equilibrium in the third period. The response of the variable to this unanticipated schock is relatively weak. The limit time needed in response this shock to the equilibrium point is three months.

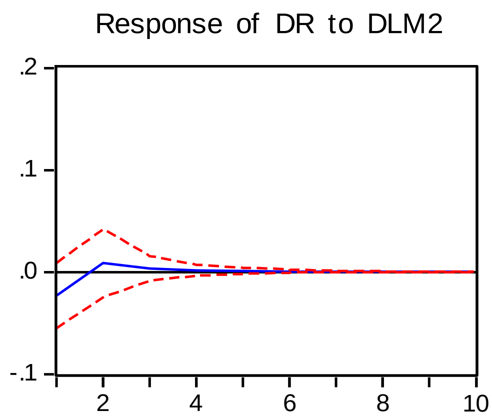
Based on the fourth panel, the one standard deviation unanticipated shock causes a decrease in DLM2 and gradually reach the equilibrium. In this case, DLM2 reachs the equilibrium in the fourth period. The response of DLM2 due to the shock is relatively strong and the time limit required to reach an equilibrium is 4 months.

Moreover, the IRF shows that the unanticipated shock causes DLHM rises and reachs the highest point in the second period. DLHM then moves and achieves the equilibrium in third period. The response of the DLHM due to the shock is relatively weak and the required time limit to response the shock is one month.

Figure 2. Impulse Response Function







Source: Author' Calculations

In the sixth panel, the unanticipated shock is responded negatively by DLGDP. DLGDP gradually reachs the equilibrium in the third period. The response of DLGDP is relatively weak, while the time limit to response the shock required by DLGDP is one month.

Finally, In the last panel, one unanticipated standard deviation shock of DLM2 causes a decrease in DR, but then reach the equilibrium in the second period. The unanticipated shock in this case is responded positively and then gradually reachs the equilibrium in the third period. The response of DR due to this shock is relatively weak and needs one month to respond to the shock occurs.

Variance Decomposition

The determination of the shock contribution in influencing the variables in DVAR is presented in table 5 by using the variance decomposition. Based on the variance decomposition result, the DLGDP schock is able to explain itself by 92.6% and it shock is also able to explain DLIHSG, DLM2, and DLHM in both short term, medium term, and long term. For example, in the second period (short term), DLIHSG is 1.57% , DLM2 is 3.29%, and DLHM is 1.59%. Similarly, the contribution for those three variables is no much different in the medium term and long term.

The shock of DLHI also predominantly only able to explain itself by 94% in the second period (short tem), and the results are not different to the medium term and long term. On the other side, the shock of DLHI is only able to explain DR by 2.20% in the short term and increase slightly to 2.67% in the medium term and long term. Moreover the shock of DLHI is able to explain DLGDP by 1.45% and DLM2 by 1.32% in the short term.

Similarly, the shock of DLIHSG is predominantly only able to explain itself by 94.69%. The shock of DLIHSG is only able to explain the DLHI contribution by 3.48% and 3.67% in both short term, medium/long term respectively. Moreover, DLHM explains itself in both short term, medium term, and long term by around 85%. For other variables, DLHM explains DLHI by 3.68% and DR by 2% in the medium term and long term.

Next, the shock of DLM2 explains the contributions to all variables with the most contribution is dominated to the DM2 itself of 77.92% in the short term and slightly decrease in the medium term and long term. However, the contribution of DLM2 to DLGDP is quite high at 10.69% and 10.57% in the short term and medium/long term respectively. Finally, DR predominantly also explains itself by more than 90%, while the contribution to DLM2, DLHI, DLIHSG, and DLHM is around 1% and 2%.

Table 5.Variance Decomposition

Dependent Variables	Horizon	SE	Described by shocks					
			DLGDP	DLHI	DLIHSG	DLHM	DLM2	DR
DLGDP	2	0.013822	92.60028	0.278291	1.577700	1.587921	3.296578	0.659231
	6	0.013896	91.65935	0.566014	2.199556	1.592446	3.288451	0.694186
	10	0.013896	91.65796	0.566252	2.200196	1.592507	3.288422	0.694660
DLHI	2	0.009528	1.451253	94.02464	0.105563	0.894302	1.318734	2.205510
	6	0.009579	1.454961	93.15080	0.499739	0.913667	1.309032	2.671803
	10	0.009579	1.454942	93.14721	0.501697	0.913895	1.309034	2.673219
DLIHSG	2	0.081318	0.798230	3.477818	94.69627	0.294343	0.544546	0.188788
	6	0.081488	0.788543	3.667583	93.90205	0.378209	0.589423	0.674193
	10	0.081491	0.788561	3.668452	93.89829	0.378625	0.589472	0.676603
DLHM	2	0.061348	0.161224	3.683526	8.200471	85.17819	0.850462	1.926124
	6	0.061471	0.160649	3.686679	8.210264	85.07068	0.865170	2.006559
	10	0.061471	0.160654	3.686732	8.210427	85.07028	0.865171	2.006733
DLM2	2	0.015597	10.69271	2.704377	3.919894	1.530149	77.92108	3.231789
	6	0.015705	10.56836	3.123943	4.418701	1.682214	76.91282	3.293962
	10	0.015705	10.56795	3.124475	4.420351	1.682400	76.90958	3.295247
DR	2	0.172312	0.972491	1.963019	1.080926	1.131108	2.075735	92.77672
	6	0.175811	0.978143	2.378633	2.334731	1.297321	2.036055	90.97512
	10	0.175827	0.978157	2.381111	2.342239	1.298209	2.035911	90.96437

Source: Author' Calculations

Based on the results of variance decomposition, it can be generally described that the shock of DLGDP, DLHI, DLIHSG, DLHM, DLM2 and DR predominantly affects themselves. They are also able to explain the shock to other variables, although the effects are not as high as the contribution for itself.

CONCLUSIONS

The policy of the monetary authorities to lower the LTV ratio for housing loans are larger than 70 m^2 and the government policies such as Housing Finance Liquidity Facility (FLPP) with low interest rates are two different policy objectives. BI policies aiming at reducing the high mortgage will trigger economic heating, while the government policy aiming at reducing the backlog FLPP (the shortage of homes) expected to be absorbed optimally will actually trigger an increase in consumption that allows the heating of the economy anyway. Two different policies would affect the transmission mechanism of monetary policy, so both of them need to be identified.

Through a series of data testing process, it is known that the research data are integrated on the first degree of integration {I(1)} and it has no long-term equilibrium relationship so that the estimation of data using DVAR which indicates that the asset affect the money supply (DLM2) and lending rates (DR) which then also affect the money supply and in the end the money supply (DLM2) affect output (DLGDP).

The result of the impulse response function and variance decomposition shows that the shock of the money supply is relatively strong in influencing output (DLGDP) when it is compared to asset price shocks (DLIHSG and DLHI) against DLM2. This indicates that the money supply is still a major factor affecting DLGDP, but also it is known that the transmission mechanism through asset prices is relatively weak. Thus, it can be concluded that the monetary contraction policy implemented by the monetary authorities in anticipating the economic warming quite effective. Deadlines or time lag required by a variable in influencing the final target (DLGDP) is five months.

As the influence of the money supply to output is still strong, it is expected that the monetary authorities keep controlling the use of monetary aggregates. The authorities should still consider the other variables that can affect the money supply and they should be more careful in making the necessary policy and moral appeal to the community so that the goal can be achieved easier.

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