# Identifying the Effects of Monetary Policy Shock on Output and Prices in Thailand

Jiranyakul, Komain

National Institute of Development Administration

December 2016

# Identifying the Effects of Monetary Policy Shock on Output and Prices in Thailand

**Komain Jiranyakul**
School of Development Economics
National Institute of Development Administration
Bangkok, Thailand
Email: komain_j@hotmail.com

**Abstract**

This paper attempts to identify the effects of monetary policy shock on output and price level in Thailand during 2005Q1 and 2016Q2. Recently available policy rate is used as a monetary policy variable. The structural VAR methodology is employed to identify the monetary policy shock. To enhance the precision of the model specification, the short-run restrictions are imposed on the specified structural model of cointegrated variables to allow the levels of variables to interact simultaneously with each other. The results from the analysis of the structural model reveal that a shock to monetary policy drives cycles for both real GDP and the inflation rate.

*Keywords*: Monetary policy shock, structural VAR, impulse response
*JEL Classification*: C32, E52

## 1. Introduction

Monetary policy can affect both real activity and price level. The efficacy of monetary policy might be enhanced by an implementation of inflation targeting. Clarida et al. (1998) give evidence indicating that some form of inflation targeting can be a nominal anchor for monetary policy rather than fixing exchange rates. Recently, researchers employ structural vector autoregressive (SVAR) models to estimate dynamic responses of macroeconomic variables due to monetary policy shocks. Canova and de Nicolo (2002) find that monetary shocks significantly drive output and inflation cycles in all G-7 countries. In addition, monetary shocks are the dominant sources of macroeconomic fluctuations in three of the seven countries. Mountford (2005) finds contradictory evidence indicating that monetary policy shocks play only a small role in the total variations of macroeconomic variables. Only supply shocks impose permanent effect on output, which is consistent with previous finding by Blanchard and Quah (1989). Using the US data, Uhlig (2005) finds that contractionary policy shocks have no clear effect on output. Furthermore, prices fall gradually in response to a contractionary monetary shock.

For some developing economies, Bhuiyan (2012) finds that monetary policy shocks are not the dominant source of fluctuations in industrial production in Banglades. Furthermore, industrial production responds to monetary shocks with a lag of over half a year while inflation responds with a lag of more than one year. The lagged responses of output and price level are consistent with the notion proposed by Obstfeld and Rogoff (1995). Using monthly data for the period from 1978 to 2005 to examine the effects of interest rate, money growth and the movements in nominal exchange rate on growth and inflation in Sri Lanka, Amrasekar (2008) finds that inflation does not decline following a contractionary monetary policy shock. Furthermore, this shock also leads to exchange rate appreciation, which always leads to a rise in growth. Using annual data for a sample of 105 developing countries to identify the impacts of monetary policy shocks on output growth and inflation, Kandil (2014) finds that monetary policy shocks cause output growth and inflation to increase.

This study makes use of policy rate and real money supply to reflect the exercises of monetary policy tools.[1] The specified SVAR model is used to identify the impacts of monetary policy shocks on real GDP and price level. Monetary policy shocks from the estimated SVAR model of cointegrated variables in Section 2 are shown in Figure 1.

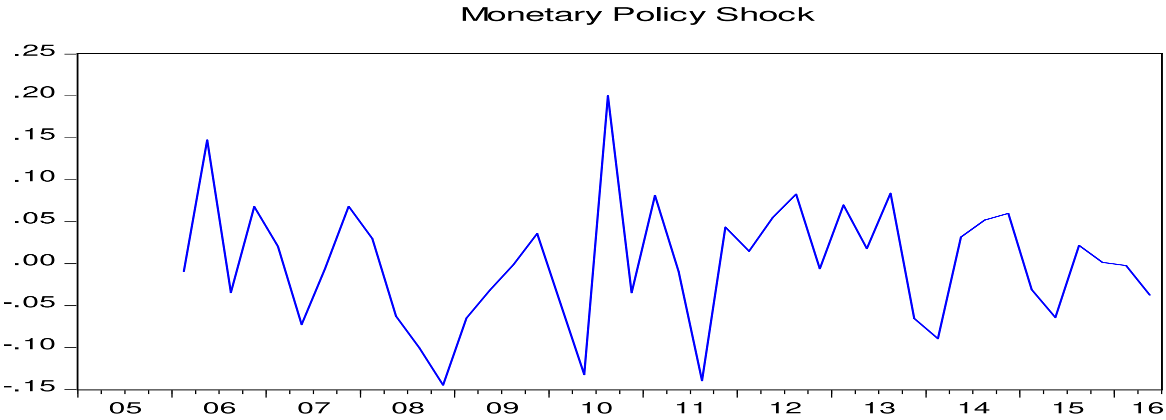


**Fig. 1** Monetary Policy Shocks from the Estimated SVAR model.

The plot of monetary policy shock with the policy rate as the monetary policy variable in Fig. 1 can be defined as the unanticipated monetary policy. The sizes of both positive and negative shocks are quite small with the highest absolute size of shock occurred in the third quarter of 2010. The plot of monetary policy shock using real money supply as the policy variable is similar. However, real money supply is not cointegrated with real GDP and price level.

The remainder of the paper is organized as follows: Section 2 describes the data and the SVAR model used in the analysis, Section 3 presents empirical results, and the last section draws conclusion.

## 2. Data and Methodology

### 2.1 Data

For empirical investigation, this paper retrieves the dataset from various sources. The policy rate as a measure of monetary policy is obtained from the Bank of Thailand website. Real GDP series is obtained from the Office of National Economic and Social Development Board while the consumer price index series is obtained from the website of Ministry of Commerce. The period of investigation is during 2005Q1 and 2016Q2, which is period of implementing inflation

[1] According to International Monetary Fund, the policy rate is the rate used by the central bank to implement or signal its monetary policy stance. In Thailand, the decisions on the policy rate are taken by the Bank of Thailand monetary policy committee. The committee will lower the policy rate when the growth rate of the country is low and inflation tends to fall. The committee will leave the policy rate unchanged when it considers that the current monetary policy is appropriate to support the economic recovery and does not pose risks to financial stability.

targeting. The number of observation is 46.[2] The ADF test with constant only is used to test for unit root in all series, which are expressed in logarithmic series. The results of unit root tests are reported in Table 1.

**Table 1** Results of Unit Root Tests.

| Variable | ADF statistic |
|---|---|
| a. Level | |
| y (real GDP) | -0.459 [6] |
| p (consumer price index) | -1.792 [2] |
| r (policy rate) | -2.189 [1] |
| b. First Difference | |
| Δy | -4.108***[5] |
| Δp | -6.665***[1] |
| Δr | -3.632***[0] |

**Note**: The number in bracket is the optimal lag length determined by Akaike Information Criterion (AIC). *** indicates significance at the 1% level.

The results in Table 1 show that all variables are integrated of order 1 or they are I(1) series because they contain unit root in level, but contain no unit root in first differences.

### 2. 2 Structural VAR Model

The structural vector autoregressive (SVAR) model to cointegration is used to examine the impact of monetary policy shock to output and price level. This model is estimated by the approach proposed by Blanchard and Quah (1989). However, Sims (1980) and Sims et al. (1990) suggest that all variables in level should enter into the VAR model in order to preserve the degree of freedom when the sample size is relatively small.[3] Furthermore, the variables in their first differences can throw away information from the data and thus make the interrelationships among variables inaccurate. The structural form VAR model of order $p$ can be expressed as:

$$AX_t = C(L)X_{t-1} + Be_t \tag{1}$$

where $X_t$ is the 3 dimensional vector of endogenous variables, namely the log of real GDP, the log of CPI and the log of policy rate at time $t$, $e_t$ is the 3 dimensional vector of structural innovations, which is identically and independently distributed with mean of zero and positive variance. The matrix A is the 3 x 3 matrix of structural coefficients, and $C(L)$ is the polynomial operator $L$ of order $p$. An infinite set of different values of parameters of matrices $A$ and $C(L)$ for a given dataset cannot be obtained without imposing identifying restrictions because different structural forms are able to give the same reduced form VAR model. From Eq. (1), the reduced form model can be expressed as:

$$X_t = D(L)X_{t-1} + Eu_t \tag{2}$$

[2] The policy rate series is available from 2005Q1 to 2016Q2, and thus the number of observations is limited by this series.

[3] For a large structural model, the Bayesian analysis should be used (see for example, Kociecki et al., 2012).

where $D(L) = A^{-1}C(L)$, and $Eu_t = A^{-1}Be_t$. The error term $u_t$ in Eq. (2) is identically and independently distributed with zero mean and positive variance, which is the innovations or shocks that have no direct economic interpretation. This reduced form can be estimated by the ordinary least squares (OLS) method. According to Enders (2004), an estimator from OLS method is asymptotically unbiased and efficient.

By imposing restrictions on the short-run behavior of the VAR system in Eq. (2), the random stochastic residual $Eu_t$ can be estimated from the residual $e_t$ of the estimated unrestricted VAR model by the following expression:[4]

$$Eu_t = e_t \tag{3}$$

Since $E = A^{-1}B$, reformulating Eq. (3) will give $A^{-1}Bu_tu_t^{'}B^{'}A^{'-1} = e_te_t^{'}$. Since $u_tu_t^{'} = I$, thus

$$A^{-1}BB^{'}A^{'-1} = e_te_t^{'} \tag{4}$$

Let $k$ be the number of variables in the system. The symmetry property of Eq. (4) requires imposing $k(k+1)/2$ restrictions on the $2k^2$ unknown elements in matrices A and B. Therefore, additional k(3k-1)/2 restrictions must be imposed. The restriction scheme is expressed as:

$$Ae_t = Bu_t \tag{5}$$

The short-run restrictions are imposed in terms of the vector of residuals, $e_t$, which is obtained from the estimate of an unrestricted VAR model. Also, the vector of the fundamental random error, $u_t$, is obtained from the structural system. The results from the estimated SVAR model can be used to analyze the impulse responses.

## 3. Empirical Results

Since all variables are I(1) series as shown by the results of unit root test reported in Table 1, Johansen and Juselius (1990) and Johansen (1991) conintegration tests without deterministic trend are performed with the lag of 4 determined by AIC and the results are shown in Table 2.

**Table 2** Results of Cointegration Tests.

| | | | |
|---|---|---|---|
| A: Trace Test | | | |
| Coint. Rank | Trace statistic | 5% Critical value | p-value |
| None* | 36.397 | 35.193 | 0.037 |
| Almost 1 | 10.928 | 20.262 | 0.549 |
| Almost 2 | 2.674 | 9.165 | 0.643 |
| B: Max Eigenvalue Test | | | |
| Coint. Rank | Max-Eigen statistic | 5% Critical value | p-value |
| None* | 25.471 | 22.299 | 0.017 |
| Almost 1 | 8.255 | 15.892 | 0.518 |
| Almost 2 | 2.674 | 9.165 | 0.643 |

**Note**: * denotes rejection of the hull hypothesis of no cointegration at the 5% level, p-values are from MacKinnon et al. (1999).

[4] Sims (1986) and Leeper et al. (1996) also use short-run restrictions to identify shocks.

The results in Table 2 show that there is one cointegrating relationship among the log of real GDP, the log of price level and the log of policy rate. Therefore, it should be more meaningful for the estimated SVAR model with cointegrating relation of the variables.[5] In performing the estimation of the SVAR model, all variables in their levels are used. The results of the analysis of impulse responses are shown in Figure 1.

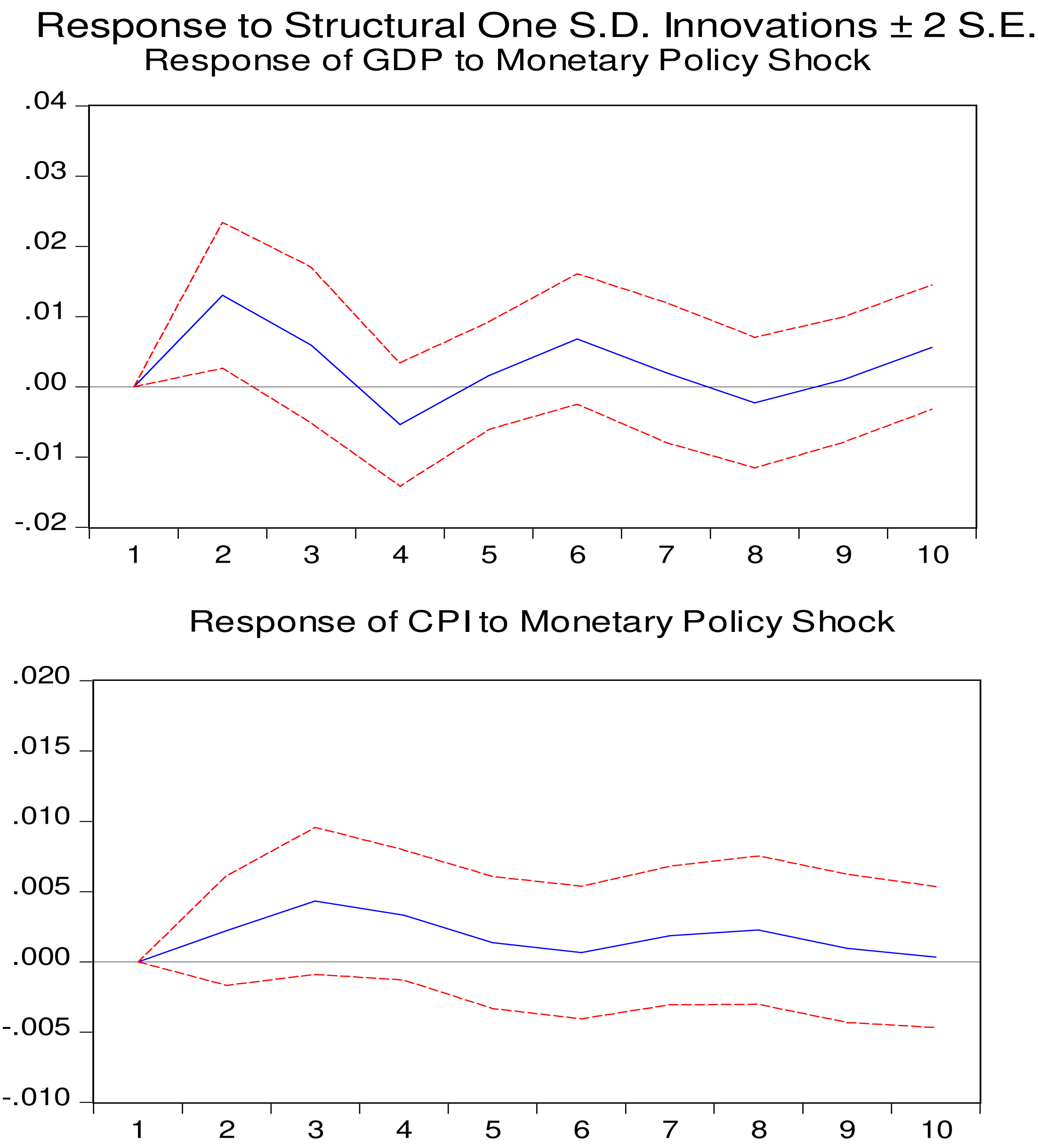


**Fig. 2** Impulse Responses of Output and Prices due to Monetary Policy Shock.

In Fig. 2, the solid lines are point estimates of the impulse responses of output and prices due to a one-standard-deviation shock to the policy rate. The dashed lines contain the 95% error bands. The response horizon is in quarters. The response of output due to monetary policy

[5] Cointegration among real GDP, prices and real money supply (M2) is also tested. The results of the trace test shows one cointegrating relation, but the maximum eigenvalue test indicates no cointegration. Therefore, it cannot be concluded that cointegration among these three variables exists. However, the results of impulse response analysis are somewhat similar.

shock shows that output increases with a lag of about a half quarter. The rising of output does not last long enough because the output starts falling in just one quarter and becoming negative. The output tends to fluctuate during the horizon of 10 quarters. The response of price level due to monetary policy shock shows that price level also increases with a log of about a half quarter. The price level starts to decline within three quarters and the pattern of fluctuations is evidenced. The findings are in line with the findings by Canova and de Nicolo (2002) in that monetary policy shock drives output and inflation cycles. However, the findings is contradictory to the findings by Kandil (2004) because monetary shock does not always cause output and inflation to increase. It should be noted that the implementation of inflation targeting by the Thai monetary authority might be a nominal anchor for monetary policy as mention by Clarida et al. (1998). Otherwise, the output and inflation cycles might be more turbulent.

**4. Conclusion**

This paper employs a structural VAR model to identify the impacts of monetary policy shock on output and price level in Thailand during the period that inflation targeting has been implementing. The policy rate and real money supply (M2) are used as monetary policy variables. Since the main purpose of this study is to identify structural shocks of cointegrated variables, the system analysis should use the policy rate as the monetary policy variable. The impulse responses generated in this paper indicate that monetary policy shock drives output and inflation cycles. Without inflation targeting, the variations of output and prices might be larger. Even though monetary policy tools can have stabilization effects on the economy, there are other important factors that policymakers should take into account for economic stability. The exchange rate and oil prices are not included in this study due to a relatively small sample size. Therefore this study has some limitations. The analysis of the structural model with a larger number of variables is left for future research in the case of this small open economy.

**References**

Bhuiyan, R., 2012. "The Effects of Monetary Policy Shocks in Bangladesh: A Bayesian Structural VAR Approach," International Economic Journal, 26(2), 301-316.

Blachard, O. J. and Quah, D. T., 1989. "The Dynamic Effects of Aggregate Demand and Supply Disturbances," American Economic Review, 79(4), 655-673.

Canova, F. and de Nicolo, G., 2002. "Monetary Disturbances Matter for Business Fluctuations in the G-7," Journal of Monetary Economics, 49(6), 1131-1159.

Clarida, R. H., Gali, J. and Gertler, M. L., 1998. "Monetary Policy Rules in Practice: Some International Evidence," European Economic Review, 42(6), 1033-1067.

Enders, W., 2004. "Applied Econometric Time Series, New York, John Wiley & Sons, Inc.

Johansen, S., 1991. "Estimation and Hypothesis Testing for Cointegration Vectors in Gaussian Vector Autoregressive Models," Econometrica, 59(6), 1151-1580.

Johansen, S. and Juselius, K., 1990. "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money," Oxford Bulletin of Economics and Statistics, 52(2), 169-210.

Kandil, M., 2014. "On the Effect of Monetary Policy Shocks in Developing Countries," Borsa Istanbul Review, 14(2), 104-118.

Kociecki, A., Rubaszek, M. and Ca' Zorzi, M., 2012. "Bayesian Analysis of Recursive SVAR Models with Overidentifying Restrictions," Working Paper No. 1492, European Central Bank, Germany.

Leeper, E. M., Sims, C. A., Zha, T., Hall, R. E. and Bernanke, S., 1996. "What does Monetary Policy do?," Brooking Papers on Economic Activity, 2, 1-78.

MacKinnon, J. G., Haug, A. A. and Michelis, L., 1999. "Numerical Distribution Functions of Likelihood Ratio Tests for Cointegration," Journal of Applied Econometrics, 14(5), 563-577.

Mountford, A., 2005. "Leaning to the Wind: A Structural VAR Investigation of UK Monetary Policy," Oxford Bulletin of Economics and Statistics, 67(5), 597-621.

Obstfeld, M. and Rogoff, K., 1995. "Exchange Rate Dynamics Redux," Journal of Political Economies, 103(3), 624-660.

Sims, C. A., 1980. "Macroeconomics and Reality," Econometrica, 48(1), 1-48.

Sims, C. A., 1986. "Are Forecasting Models usable for Policy Analysis," Federal Reserve Bank of Minneapolis Quarterly, 10(1), 2-16.

Sims, C. A., Stock, J. H. and Watson, M. W., 1990. "Inference in Linear Time Series Models with Some Unit Roots," Econometrica, 58(1), 113-144.

Uhlig, H., 2005. "What are the Effects of Monetary Policy on Output? Results from an agnostic Identification Procedure," Journal of Monetary Economics, 52(2), 381-419.