

12-31-2002

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Recommended Citation

Affandi, Yoga (2002) "THE OPTIMAL MONETARY POLICY INSTRUMENTS: THE CASE OF INDONESIA," *Bulletin of Monetary Economics and Banking*: Vol. 5: No. 3, Article 4.

DOI: [<https://doi.org/10.21098/bemp.v5i3.313>]

Available at: <https://bulletin.bmeb-bi.org/bmeb/vol5/iss3/4>

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THE OPTIMAL MONETARY POLICY INSTRUMENTS: THE CASE OF INDONESIA

Yoga Affandi)*

1. INTRODUCTION

In 1999, the central bank of Indonesia, Bank Indonesia, gained its independence. The new Central Bank Act has established a more explicit foundation for Bank Indonesia's independence. Firstly, goal independence, in which Bank Indonesia sets its own monetary target. Secondly, instrument independence, in which Bank Indonesia implements various policy instruments to achieve that target. The primary objective of Bank Indonesia (henceforth BI) is to achieve and maintain price stability reflected in a low and stable inflation rate.

Determining inflation as a primary objective for monetary policy is based on several considerations. Firstly, monetary policy can only affect real variables in the short run. However, in the long run, monetary policy can only be capable of influencing inflation, but not real sector variables, such as economic growth or the unemployment rate. Secondly, to pursue a low inflation rate is a prerequisite for attaining sustainable economic growth, that is for the economy not to grow faster than its capacity. Thirdly, determining inflation as a primary goal will provide a nominal anchor for monetary policy.

In order to achieve this inflation target, BI seeks to control the amount of money supply to the economy by using monetary policy instruments. In doing so, one of the key challenges of the monetary authority is to choose the optimal policy instruments. There are two options for monetary authorities to operate, either through interest rate changes or money stock changes, but not through both independently. Therefore, monetary authority must decide whether to use the interest rate or the money stock as the policy instrument.

BI currently uses base money as the policy instrument. In the framework of increasing the transparency and public accountability of monetary policy, the target for base money has been announced publicly on a weekly basis since April 1998. BI also monitors the factors that affect base money, namely: net domestic assets (NDA), which must be kept below a specified ceiling, and net international reserves (NIR), which must be maintained above a designated floor. Implementation of money stock target is mainly pursued through open market operations in the form of the sale of Bank Indonesia certificates and direct intervention in the money market.

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The effectiveness of monetary policy under money stock targeting has become one of the major areas in economic research in Indonesia, particularly among central bank, university and research institutions. The alternative approach, the interest rate targeting, suggests to be more effective in the framework of inflation targeting, especially under the new regime of flexible exchange rate adopted since July 1997¹. Deregulations in financial sectors, the rapid financial innovation, and the globalization of more integrated world, are some factors that have contributed to the ineffectiveness of monetary authority to control the process of money creation. As a result, it will be difficult for the monetary authorities to predict accurately what money growth is necessary to achieve the ultimate goal.

Thus, in the face of difficulties posed by financial changes, the basic problem of monetary targeting depends on whether the relationship among monetary aggregate, inflation rate and money multiplier could be predicted with relatively high accuracy. Under such uncertainties, the natural question for the policy makers is how they should conduct monetary policy. Should they abandon the use of a monetary aggregate as an intermediate target? Or should they continue to use a monetary aggregate as an intermediate target? Therefore, to develop a monetary policy framework in controlling future inflation, the central bank needs to choose the optimal monetary policy instruments.

This paper will address these issues. It will investigate empirically the optimal monetary policy instruments for Indonesia by identifying the source of output fluctuations. The economy is represented by two sectors, the real sectors, which consist of aggregate supply (AS) and real aggregate demand (IS), and the monetary sectors (LM). Then, we attempt to identify the dominant source of output fluctuations, in order to determine the optimal monetary instruments. As Poole (1970) suggested, if real sector is more dominant than monetary sector, then interest rate targeting is preferred, otherwise, money stock targeting is optimal.

The remaining section of this paper is organized as follows. The optimal policy instruments using Poole model is discussed in Section 2. The choice of instruments problem is clearly a consequence of uncertainty, it therefore requires a stochastic model. Section 3 presents a stochastic model pioneered by Obsfeldt (1985) in developing a small open economy model. Section 4 discusses the application of Vector Autoregressive approach in estimating the model. Following Clarida and Gali (1994) in identifying the sources of shock, this paper will apply the Blanchard and Quah (1989) long run restrictions. Section 5 analyzes the empirical studies, using the sets of data of Indonesia, USA and Japan. The last section presents a summary and conclusion.

¹ See Sarwono and Warjiyo (1998)

2. POOLE MODEL

Poole (1970) presents a stochastic version of the Hicksian IS-LM model to choose the optimal instrument policy. The model presented an assumption that the structure of economy is known, but it is subject to random real and monetary shocks, u and v respectively.

$$\text{IS} : Y = -aR + u \quad (1)$$

$$\text{LM} : M = Y - bR + v \quad (2)$$

$$\text{where } E[u] = E[v] = 0; \text{Var}[u] = s_u^2; \text{Var}[v] = s_v^2; \text{Cov}[u,v] = s_{uv};$$

The model has two equations and three unknown variables, output (Y), money stock (M) and interest rate (R). The price level is normalized to unity. Monetary authorities select either money stock or interest rate as the policy instruments to minimize the expected loss L , defined by quadratic loss function $L = E[(y - \bar{y})^2]$. If money stock targeting is chosen, the interest rate would adjust to clear the money market. Then, by eliminating variable interest rate R from equation 1 and 2, the following results could be derived.

$$y = (a\bar{M} + bu - av)/(a + b) \quad (3)$$

$$E[y] = \bar{y} = a\bar{M}/(a + b) \quad (4)$$

$$\text{Var}[y - \bar{y}] = (b^2\sigma_u^2 + a^2\sigma_v^2 - 2ab\sigma_{uv})/(a + b)^2 \quad (5)$$

In the second case, if interest rate targeting is chosen, the central bank lets the money stock adjust to the money demand shock. Since the central bank perfectly accommodates the demand shocks, there will be no impact of these shocks on output or inflation. Thus, the following results could be derived.

$$E[y] = \bar{y} = -a\bar{R} \quad (6)$$

$$\text{Var}[y - \bar{y}] = \sigma_u^2 \quad (7)$$

Therefore, the objective function, which is to minimize the expected loss function, can be represented in the model by minimizing equation 5 for the case of money stock targeting or equation 7 for interest rate targeting.

As a consequence, if real shocks dominate, that is when $\sigma_v^2 \rightarrow 0$, then money stock targeting will give a better result in minimizing expected output loss. The monetary authorities should set the money stock, letting the interest rates fluctuate as it will. In the implementation, the authorities can just simply set a constant growth of money stock. Another variant is that

the authorities can respond to the current state of the economy, causing the money stock to grow more rapidly during recession and less rapidly in times of boom.

On the other hand, if monetary shocks dominate, that is when $\sigma_v^2 \rightarrow 0$, then interest rate targeting is better. This approach will allow money supply to fluctuate as it will. Interest rates would be set lower by the authorities in response to the recession, and higher during the boom period.

The above two frameworks², the dominance of real shocks versus monetary shocks, would be used in determining the optimal instrument policy. Therefore, what we need is a stochastic version of small open economy model to identify which shocks dominate the economy.

3. OBSTFELD MODEL

The open economy model, used by Clarida and Gali in identifying the sources of real exchange rate fluctuations, is a stochastic version of the two countries, rational expectations model developed by Obstfeld (1985). Not only does the model have the short run properties, in which prices adjust sluggishly to demand, money and supply shocks, but also long run properties, in which macroeconomic equilibriums are achieved once the prices fully adjust to the shocks.

The basic model consists of four equations and all variables represents home relative to foreign levels. The first equation (8) is an open economy IS equation, in which the demand for home output relative to the foreign output is increasing in the real exchange rate and a relative demand shock d_t and is decreasing in the real interest rate differential.

$$y_t^d = d_t + h(s_t - p_t) - s(i_t - E_t[p_{t+1} - p_t]) \quad (8)$$

$$m_t^s - p_t = y_t - li_t \quad (9)$$

$$p_t = (1-q)E_{t-1}[p_t^e] + q p_t^e \quad (10)$$

$$i_t = E_t[s_{t+1} - s_t] \quad (11)$$

The second equation (9) is the standard real money demand (LM) function. The third one is a price setting equation (10). The price level in period t is an average of the market clearing price expected in $t-1$ and the price that would actually clear in period t , p_t^e . If θ is equal to one, prices are fully flexible and output is supply determined. If θ is equal to zero, prices are fixed and predetermined one period in advance. The last one (11) represents interest

² This paper would rule out the combination policy, in which the combination of both money stock and interest rate target is applied.

rate parity equation, in which the expected depreciation of nominal exchange rate is equal to domestic interest rate.

The stochastic processes are developed by determining that output supply, output demand and money are influenced by shocks. Assume that both y_t^s and m_t are simply random walk and therefore those shocks will only be permanent. This assumption is based on the long run macroeconomic properties, in which output is supply side determined, and money fluctuations will only affect prices. Demand d_t , however, will be subject to both transitory and permanent shocks. Based on this stochastic properties, therefore, the equations of 10a, 10b and 10 are derived.

$$y_t^s = y_{t-1}^s + z_t \quad (12a)$$

$$d_t = d_{t-1} + d_t - g d_{t-1} \quad (12b)$$

$$m_t = m_{t-1} + v_t \quad (12c)$$

To solve the model, substitute 11, 12a and 12b into 8, and derive an expression of real exchange rate q_t^e (13). This result shows that real exchange rates depreciates in response to supply disturbance and appreciates in response to a demand disturbance. Demand shock will create an excess demand to domestic goods which in turn will affect exchange rate to appreciate, so that output in the short run will also increase. In the long run, output will return to its full employment but exchange rate still appreciates.

$$q_t^e = (y_t^s - d_t) / h + (h(h+s))^{-1} s g d_t \quad (13)$$

$$p_t^e = m_t - y_t^s + l(1+l)^{-1}(h+s)^{-1} g d_t \quad (14)$$

$$y_t^e = y_t^s \quad (15)$$

Price level equation (14) which is derived by substituting 12a, 12b and 12c into 13, denotes that prices are affected by supply, demand and monetary shocks. The relative price level increases in proportion to the monetary shocks, decreases in proportion to the supply shocks, and rises in response to the temporary component in the demand shock. The last equation (15) is derived from the proposition of money neutrality, in which output in the long run is not demand determined, but supply determined.

To summarize, the system consists of three variables: output, real exchange rate and prices with three shocks: money, demand and supply. The system also forms a triangular model in the long run. Output is only influenced by supply shocks, whereas real exchange rates are subject to demand and supply shocks. Finally all three shocks are expected to affect the long run level of prices.

The long run restrictions in the triangular model provide the properties to obtain a structural identification, which is developed by Blanchard and Quah (1989). Using the method of Variance Decomposition from the Vector Autoregressive approach, this empirical study will try to identify the influence of money, demand and supply shocks on the behavior of the output, in order to determine the optimal monetary policy instruments.

4. VECTOR AUTOREGRESSIVE (VAR) AND BLANCHARD - QUAH DECOMPOSITION

Sims (1980) introduced the unrestricted VAR to macro-econometrics. It stands at the other extreme of the large-scale models and focuses on fitting the model to the data at the expense of theoretical consistency. Unlike simultaneous-equation model, a VAR model is atheoretic because it uses less prior information. According to Sims, if there is true simultaneity among a set of variables, they should all be treated equally. Thus, there should not be any prior distinction between endogenous and exogenous variables. The objective of VAR is to investigate the dynamic response of the system to the shocks without having to depend on 'incredible identification restrictions' inherent in structural model, or 'controversially restrictions' from economic theory.

Since the individual coefficients in the estimated VAR models are often difficult to interpret, it is useful to estimate the so-called impulse response functions (IRF). The IRF traces out the response of the dependent variable in the VAR system to shocks in the error terms for several periods in the future. The IRF has now become the centerpiece of VAR analysis.

In order to develop the IRF, it is necessary to impose additional restrictions since an estimated VAR is under-identified. One possible identification restriction is to use Choleski decomposition of the variance/covariance matrix of the model's shocks. Consider a simple bivariate VAR(1) of output (y_t) and real exchange rate (q_t).

$$\begin{bmatrix} y_t \\ q_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ q_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \quad (16)$$

A change in e_{1t} will immediately change the value of current output (y_t). It will also change all future values of y and q , since lagged y_t appears in both equations. If both shocks, $\{e_{1t}\}$ and $\{e_{2t}\}$, are uncorrelated, interpretation of the impulse response is straightforward, that is, $\{e_{1t}\}$ is the pure shocks for y_t and $\{e_{2t}\}$ is the pure shocks for q_t .

The shocks are, however, usually correlated, so that they have a common component

which cannot be associated with a specific variable. To solve this identification problem, it is defined pure shocks, $\{\varepsilon_{yt}\}$ and $\{\varepsilon_{qt}\}$, which are uncorrelated white-noise disturbances.

$$\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{qt} \end{bmatrix} \quad (17)$$

Choleski decomposition constrains the system such that an $\{\varepsilon_{qt}\}$ shock has no direct effect on $\{e_{1t}\}$, that is, b_{12} equals to zero on matrix B. Thus, an $\{\varepsilon_{yt}\}$ shock directly affects on $\{e_{1t}\}$ and $\{e_{2t}\}$, but an $\{\varepsilon_{qt}\}$ shock only directly affects $\{e_{2t}\}$. This identification, which requires one variable to be more exogenous than the others, provides some structure on the system.

By defining the identification restrictions, it is also possible to decompose the n-step ahead forecast error variance due to each one of the shocks. The variance decomposition provides the proportion of the movements in a sequence due to its "own" shocks versus shocks to the other variables. For example, if $\{\varepsilon_{qt}\}$ shocks explain none of the forecast error variance of $\{y_t\}$ at all forecast horizons, then $\{y_t\}$ could be said to be exogenous. In practice, it is useful to examine the variance decomposition at various forecast horizon. As n increases, the variance decomposition should converge.

Blanchard and Quah (1989) provide an alternative way to obtain a structural identification. This approach uses the restrictions on the long run impact of shocks to identify the impulse responses and the variance decomposition. Thus, instead of applying restrictions on matrix B as provided in the previous example, it is furthermore derived the Vector Moving Average (VMA) from VAR as $AR(1) = MA(\infty)$. In the long run, if one variable has no effect to other variables, then it must be the case that the cumulated effect is equal to zero. Hence, by recovering from the VMA, it would be possible to obtain exact identification within the following matrix, so called matrix C, by restriction $c_{12}(L)$ equals to zero.

$$\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \begin{bmatrix} c_{11}(L) & c_{12}(L) \\ c_{21}(L) & c_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{qt} \end{bmatrix} \quad (18)$$

The key to decompose the variable sequence is to identify one has a temporary effect and the other has a permanent effect. It is this dichotomy between temporary and permanent effects that allows for the complete identification of the structural shocks from an estimated VAR.

$$\begin{bmatrix} y_t \\ q_t \\ p_t \end{bmatrix} = \begin{bmatrix} c_{11}(L) & 0 & 0 \\ c_{21}(L) & c_{22}(L) & 0 \\ c_{31}(L) & c_{32}(L) & c_{33}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{qt} \\ \varepsilon_{pt} \end{bmatrix} \quad (19)$$

Recalling to the previous chapter, this structural identification provides similar strategy with the triangular open economy model. As presented in equation 19, only supply shocks are expected to influence the relative output in the long run. Real exchange rates would be affected only by demand and supply shocks since money shocks would not affect either exchange rates or output in the long run. Finally, prices are subject to supply, demand and money shocks.

5. EMPIRICAL RESULTS

The theoretical model implies that output, real exchange rate and price are non-stationary in levels but stationary in first differences. Therefore, before starting to estimate a VAR, it is necessary to investigate the order of the series. In doing this, we use the standard Augmented Dickey-Fuller (ADF) test statistics of the series. The ADF statistics are then compared to the McKinnon critical values. Unit root tests of all the series are presented in Table 1.

Table 1. Unit root tests for logarithm of all series

Variable	ADF (level)	ADF (first difference)	Integration
Indonesia			
Output (y_{ID})	-0.40	-6.94	I(1)
Price (p_{ID})	-2.37	-4.86	I(1)
US			
Output (y_{US})	-2.28	-3.76	I(1)
Price (p_{US})	-0.97	-3.77	I(1)
Japan			
Output (y_{JP})	-2.53	-41.46	I(1)
Price (p_{JP})	0.34	-4.03	I(1)
Real Exchange Rate			
USD/IDR (q_{USD})	-2.25	-4.63	I(1)
JPY/IDR (q_{JPY})	-2.67	-4.15	I(1)

Notes:

Unit root tests for all levels are in the form: $DX_t = a + bX_{t-1} + Si = 1, n$ gi $DX_{t-1} + nT + e_t$, where T=time trend and n is the number of lags, while those first difference are in the form: $D^2X_t = a + bDX_{t-1} + Si = 1, n$ gi $D^2X_{t-1} + nT + e_t$. McKinnon critical values for ADF tests: 1%=-4.09, 5%=-3.47, and 10%=-3.16. The result is estimated from econometric software E-Views 4.0. All data are quarterly and denoted in logarithm. Source of data is from CEIC, Bank Indonesia, Jakarta.

As can be seen in Table 1, we can not reject the null hypothesis of a unit root at 10% significance level for all the logarithms of the levels of output, exchange rate and price from Indonesia, US and Japan. Whereas we can reject the null hypothesis of a unit root at 5% significance level for the first difference of all variables. The fact that the levels are unit root and the first difference of series are stationary provides evidence that all logarithm of the series are integrated of order one, I(1). Accordingly, all variables are valid candidates for inclusion in a VAR using the Blanchard and Quah technique.

In estimating the VAR, this paper will present and use two different data. The first study will use data from the first quarter of 1983 to the second quarter of 1997, while the second will use all available data, which is from the first quarter of 1983 to the second quarter of 2000. Two sets of data is used because there is a significant change in the behavior of the variable, particularly the exchange rate. Since mid 1997, as the Asian financial crisis spread out, Indonesia adopted flexible exchange rate regime, following the severe pressure to the central bank's foreign reserves. Therefore, this paper will incorporate the effect of the change of variable of exchange rate into the VAR model. However, due to the limitation of data, this study will not include the estimation of VAR using the data from 1997:3 to 2000:2.

This study is conducted by estimating the trivariate VAR which includes a constant and four lagged values of Δy_t , the change in log ratio of Indonesia to foreign real GDP, Δq_t , the change in the log real exchange rate and Δp_t , the difference between Indonesia and foreign inflation. The ratio of domestic to foreign variable is used because it follows the two country open macro model of Obstfeld.

There are three sets of quarterly data: Indonesia, United States and Japan used in the model. The choice of US and Japan data is due to the fact that both countries are the biggest counter traders to Indonesia. It is also found from previous studies³ that the movements of the US Dollar and the Japanese Yen have a significant contribution to the movement of the Indonesian Rupiah, and as a consequence this will also affect the real sector through exports and imports.

Thus, following the two country model, there will be four set of results since there are two different time periods, 1983:1 to 1997:2 and 1983:1 to 2000:2, and two sets of data, one from the ratio of Indonesia to US data and the other from the ratio of Indonesia to Japan data.

A. Data 1983:1 to 1997:2

The result of variance decomposition exercises for log ratio of Indonesia to the two countries real GDP are presented in Table 2. In the first part, the conditional variance of the

³ See Siswanto and Waluyo (1998).

change in the log ratio of Indonesia to US output, Δy_t , is decomposed at various horizons k into fraction of the variance due to unforecastable supply shock z_{t+j} , demand shocks, d_{t+j} , and unforecastable structural monetary shocks, v_{t+j} , $j=1, \dots, k$. As the forecast horizon increases, these conditional variance shares converge to the shares of the unconditional variance of the change in output relative due to supply, demand, and nominal shocks. In our case, the forecast horizon of 20 quarters represents the unconditional variance.

Table 2.
Variance Decomposition of Output (Δy_t)

Horizon	Indonesia vs United States				Indonesia vs Japan			
	Forecast standard error	proportion of forecast error variance due to			Forecast standard error	proportion of forecast error variance due to		
		Supply	Demand	Money		Supply	Demand	Money
0	0.01700	98.73%	0.87%	0.41%	0.02082	98.80%	0.08%	1.12%
1	0.01775	94.93%	1.46%	3.61%	0.02313	95.76%	0.26%	3.98%
2	0.01874	92.82%	1.46%	5.72%	0.02401	93.83%	0.24%	5.93%
3	0.01888	92.90%	1.45%	5.65%	0.02424	93.64%	0.30%	6.06%
4	0.02247	94.14%	1.71%	4.16%	0.02995	95.43%	0.57%	4.00%
5	0.02265	93.50%	1.87%	4.63%	0.03147	93.64%	1.51%	4.84%
7	0.02366	93.05%	1.76%	5.19%	0.03258	91.43%	1.85%	6.72%
10	0.02629	92.75%	1.90%	5.35%	0.03849	89.84%	2.69%	7.47%
12	0.02769	92.93%	1.94%	5.13%	0.04167	90.94%	2.63%	6.43%
15	0.02846	92.42%	1.93%	5.66%	0.04332	88.36%	3.69%	7.95%
20	0.03015	92.32%	2.01%	5.67%	0.04866	88.24%	3.96%	7.79%

Notes:

The result is estimated from econometric software RATS 4.3 using program of VAR.src version 4 written by N. Morin (1998). The sample is quarterly data from 1983:1 to 1997:2. Source of data is CEIC, Bank Indonesia, Jakarta.

As shown in Table 2, only 5.67 percent of the unconditional variance of the change in the log of output is attributed to monetary shocks, with the majority of this variance, 92.3 percent, being attributed to supply shocks. While, the demand shocks only contributes 2.01 percent. A similar result is also obtained by using the Indonesia versus Japan data, as shown in the second part of Table 2. The supply shocks play a major role, attributed to more than 80 percent of the unconditional variance of the change in the log of output. While the demand and monetary shocks are accounted for 3.9 percent and 7.8 percent, respectively.

In both cases, the convergences are quite rapid, within 13 to 16 quarters, as illustrated in Figure 1 and 2. Hence, by using the data before the Asian financial crisis, it is shown that real shocks, which consists of the supply and demand shocks, are dominant in explaining the unconditional variance of the change in the log of output.

Figure 1. Variance Decomposition of Output (Dy_t)
 (Data: 1983:1 - 1997:2, Indonesia vs US)

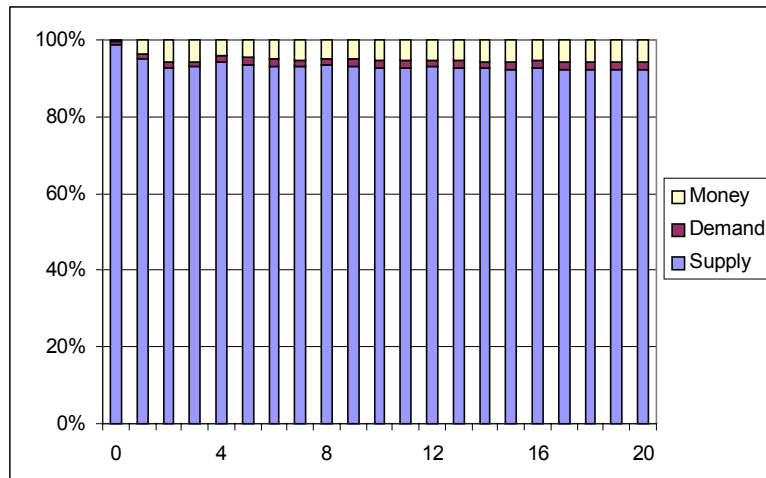
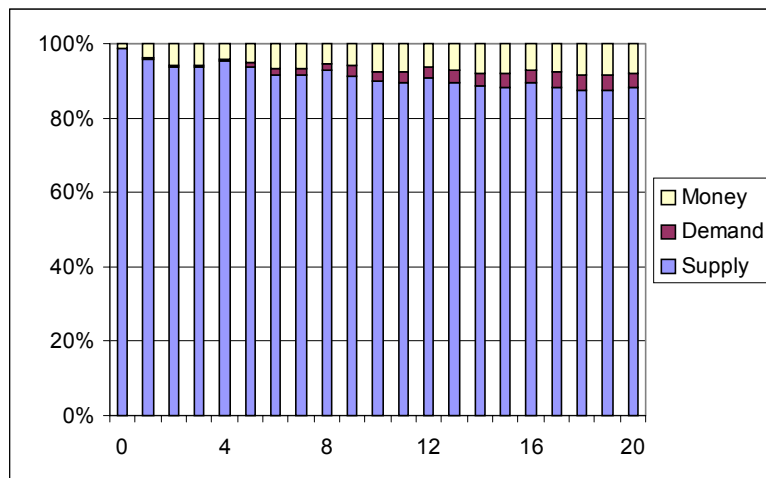


Figure 2. Variance Decomposition of Output (Dy_t)
 (Data: 1983:1 - 1997:2, Indonesia vs Japan)



B. Data 1983:1 to 2000:2

Table 3 presents the result of variance decomposition using all available data. In the first part, using the Indonesia-US data, it is shown that 58.2 percent of the unconditional variance of the change in relative output is attributed to demand shocks, 28.7 percent is attributed to supply shocks, and 14.0 percent is attributed to monetary shocks. Therefore, this structural VAR estimates imply that monetary shocks explain very little of the variance in relative output. It is also found that monetary shocks are relatively smaller compared to the demand and supply shocks in explaining the variance of relative output.

Table 3.
Variance Decomposition of Output (Δy_t)

Horizon	Indonesia vs United States				Indonesia vs Japan			
	Forecast standard error	proportion of forecast error variance due to			Forecast standard error	proportion of forecast error variance due to		
		Supply	Demand	Money		Supply	Demand	Money
0	0.01738	53.20%	46.80%	0.00%	0.02079	43.90%	24.80%	31.40%
1	0.02000	48.10%	50.40%	1.50%	0.02667	27.20%	15.20%	57.50%
2	0.02471	40.80%	48.00%	11.20%	0.02898	23.90%	27.20%	48.90%
3	0.02669	41.50%	45.00%	13.50%	0.02922	23.80%	27.80%	48.40%
4	0.03024	34.20%	55.20%	10.60%	0.03541	21.10%	21.20%	57.80%
5	0.03042	33.80%	54.60%	11.60%	0.03728	19.20%	19.10%	61.70%
7	0.03122	32.54%	54.34%	13.12%	0.03805	18.80%	21.42%	59.79%
10	0.03310	29.90%	56.50%	13.60%	0.04434	15.70%	20.40%	63.90%
12	0.03400	28.99%	57.58%	13.43%	0.04714	15.15%	18.82%	66.03%
15	0.03429	28.60%	57.40%	14.00%	0.04892	14.30%	19.30%	66.40%
20	0.03492	27.80%	58.20%	14.00%	0.05386	13.20%	18.20%	68.60%

Notes:

The result is estimated from econometric software RATS 4.3 using program of VAR.src version 4 written by N. Morin (1998). The sample is quarterly data from 1983:1 to 2002:2. Source of data is CEIC, Bank Indonesia, Jakarta.

Contrast to the Indonesia-US result, it is found, by using Indonesia versus Japan data, that monetary shocks are relatively dominant, compared to supply and demand shocks. As can be seen from the second part of Table 3, it is shown that 18.2 percent of the unconditional variance of the change in relative output is attributed to demand shocks, 13.2 percent is attributed to supply shocks, and 68.6 percent is attributed to monetary shocks. The convergence is quite rapid, as illustrated in Figure 4, within 13 to 16 quarters. Hence, more than 50 percent of the 20 quarter variance in forecasting the ratio of log domestic to foreign output is attributed to the shock in the system that has no long run effect on national output levels or the level of the real exchange rate.

In short, this empirical study, using all available data, found contrasting results. Real shocks are accounted for more than 50% in explaining the variance of relative output, if we

use Indonesia versus US data, whereas monetary shocks are found to be dominant, if we use Indonesia versus Japan data.

Comparing the result of two different periods of Indonesia versus US data, as illustrated in Figure 1 and 3, it is shown that real shocks play a major role in explaining the variance of relative output. However, there is a significant difference. Before mid 1997, the dominance of real shocks are mainly attributed due to supply shocks. However, using all available data, the dominant of real shocks are attributed due to demand shocks as well as supply shocks.

Figure 3. Variance Decomposition of Output (Dy_t)
(Data: 1983:1 - 2000:2, Indonesia vs US)

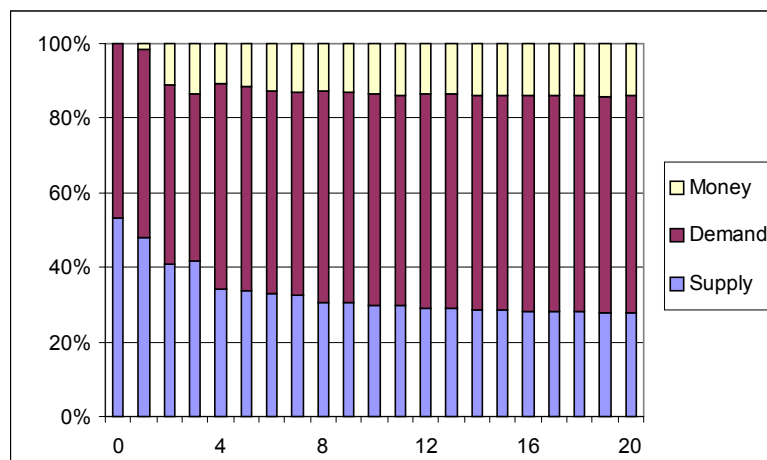
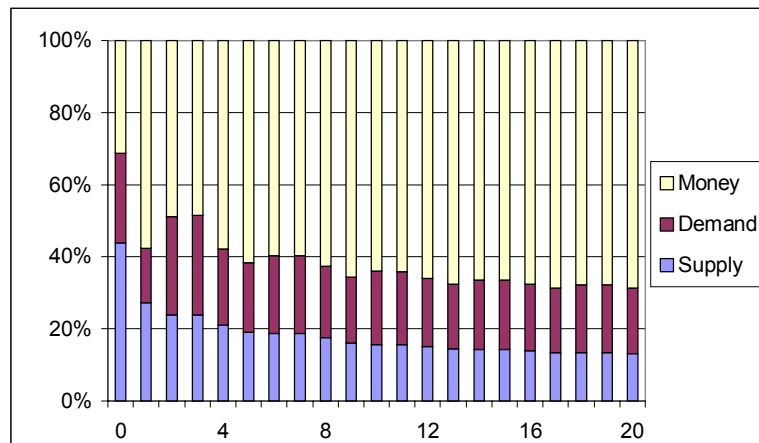


Figure 4. Variance Decomposition of Output (Dy_t)
(Data: 1983:1 - 2000:2, Indonesia vs Japan)



6. RESULTS AND CONCLUSION

There are two important findings. Firstly, using the data before the Asian financial crisis, it is found that real shocks are dominant. Therefore, referring to the Poole model, money supply targeting is better approached in minimizing the loss function. This result is also supported by the evidence in which monetary aggregate was used as an intermediate target by most central banks in 1980s. This procedure, namely the two step monetary policy procedures, was particularly adopted to stop high inflation in the 1970s and the early of 1980s and the strategy succeeded in ending the high inflation.

The central banks adopt this strategy because it is more practical to achieve a goal by aiming at an intermediate target rather than by aiming at the goal directly. By using an intermediate target, central banks can judge more quickly whether monetary policy is on the right track rather than waiting until they observe the ultimate goal of the policy.

Secondly, using all available data, up to the second quarter of 2000, we found that there is a conflicting result. Using Indonesia versus US data, we found that real shocks are dominant, however, using Indonesia versus Japan data, we found monetary shocks play the dominant role. Therefore, we could not find enough evidence to conclude which monetary policy instrument that minimizes the loss function.

There is a strong argument to use interest rates as a policy instrument, particularly since Bank Indonesia sets inflation targets as its ultimate goal for monetary policy. When there is a rapid development of a financial sector, the relationship between the monetary aggregate and the inflation rate tends to be weakened, which in turn reduces the effectiveness of the monetary aggregate as an intermediate target for monetary policy.

In determining the optimal monetary policy instrument, it is also important to consider the framework of monetary policy with inflation as the ultimate target, namely the inflation targeting. This framework gives rise to the importance of inflationary expectations and the credibility of monetary authority. It means that monetary policy framework for controlling inflation has to be recognized and understood by market agents. This framework also suggests that monetary policy can not be set on a reactive basis. Therefore, the choice of monetary policy instruments need to be forward looking, which considers lags in monetary policy and the medium or long term inflation projecting.

To improve and refine these findings, there are several steps that need to be addressed. Firstly, we could expand and broaden the data by using more countries, instead of only two countries. These countries can be selected based on their contributions in exports and imports with Indonesia. Secondly, we could use real effective exchange rates to replace real exchange rates, since the movement of REER has a better and closer relationship to the movement of

exports and imports, compared to real exchange rates. The REER has also included the weight of trade partnership into its calculation. Thirdly, the analysis of impulse response functions is also an interesting area to be investigated, in order to seek the behavior of all variables in the long run. Fourthly, the application of vector auto-regression can also be used for forecasting, so it is recommended to forecast the short run behavior for all variables in the model.

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