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Monetary Reaction Function in Indonesia During Inflation Targeting Period

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Abstract

This study analyzes the monetary reaction function in Indonesia with shocks and the fear of floating phenomenon in the inflation targeting period using a new neoclassical synthesis approach. The unit root test result explains that all variables are stationary or "I(0)", and in the long run, interest rates respond positively to future inflationary (counter-cyclical). Using a predictive performance model, the short-run FLM was chosen to explain the effect of triple shocks on interest rates in Indonesia. In the short run, only fluctuations in world oil prices significantly affect interest rates (counter-cyclical policy). Furthermore, this research has not been able to prove the existence of the fear of the floating phenomenon in Indonesia.

Keywords: *Monetary Policy; Inflation Targeting; Economic Fluctuations; Exchange Rate Fluctuations; Oil Price Fluctuations*
JEL Classification: E130; E310; E320; E520

INTRODUCTION

The monetary reaction function explains the positive relationship between real interest and inflation rates. It shows how the central bank adjusts its target for the real interest rate in response to changes in the inflation rate. The central bank increases the real interest rate as the inflation rate increases and decreases the real interest rate as the inflation rate decreases (Hubbard, 2014).

Monetary policy is fundamental in closed and open economies because the central bank uses it to set interest rates in response to changing economic conditions. The central bank carries out monetary policy to maintain price stability (low inflation and exchange rates stability). The monetary policy affects the real sector through aggregate demand because changing the real interest rate affects consumption, investment, and net exports through the exchange rate.

According to Frankel (1979), and Golit et al. (2019), there are two approaches explain the relationship between the exchange and interest rates. The first approach might be called the Chicago theory, which assumes that prices are perfectly flexible. This approach shows that the relationship between the exchange rate and the nominal interest differential is positive. The rising inflation rate and depreciation of the domestic currency make the domestic interest rate rises relative to the foreign interest rate.

The second approach might be called the Keynesian theory, which assumes that prices are sticky in the short run. The higher domestic interest rate (tightness of monetary policy) than the foreign interest rate attracts a capital inflow, which causes the domestic currency to appreciate. So there is a negative relationship between the exchange rate and the nominal interest differential.

Another debate took place between the New Classical with the Real Business Cycle and the New Keynesian regarding the role of monetary policy on actual economic activity. Using the flexible price model, the New Classical economics and the Real Business Cycle argue that monetary policy does not affect real economic activity. At the same time, the New Keynesian uses the rigid price model, which explains that monetary policy is the center of the evolution of real economic activity (Goodfriend & King, 1997).

The effect of the exchange rate on inflation and output is fast and robust (Rahutami, 2004, Jašová, Moessner, & Takats, 2016, and Carriere-Swallow et al., 2021). Exchange rates directly affect inflation through the prices of final, semi-finished, or imported raw products (Helmy et al., 2019). The effect of the exchange rate on inflation (changes in the price of imported goods) is faster and more robust than its effect on aggregate demand. This condition occurred in Indonesia after the 1997/98 Asian crisis and when Indonesia used a flexible exchange rate system (see Siswanto et al., 2002 in Warjiyo & Juhro, 2016).

Bank Indonesia (BI) started implementing the Inflation Targeting Framework (ITF) in Indonesia on July 1, 2005. It used the interest rate as an operational target (price policy) to achieve the inflation target. Implementing the ITF implies that monetary policy is a forward-looking policy and the behavior of forming inflation expectations by economic agents shifts to forward-looking behavior.

According to Warjiyo & Juhro (2016), administrative prices and volatility of supply shocks influence inflation in Indonesia. During ITF, the inflation target was challenging to achieve, especially in 2005, 2008, 2013, and 2014 when the government reduced fuel subsidies, and in 2010, when there was an increase in world commodity prices and weather disturbances that affected agricultural products.

Empirical studies of monetary policy in Indonesia using the forward-looking new Keynesian framework were conducted by Juhro & Mochtar (2015). Lubik dan Schorfheide (2007) used the forward-looking equilibrium model in the goods market (IS) and the Phillips curve (PC) in estimating the central bank's reaction function to exchange rate movements.

Kempa (2016), Mohanty & Klau (2004), and Best & Kapinos (2016) used the forward-looking Taylor rule model. Taylor (1993) developed this approach, which explains how interest rates respond to inflation and output deviations from their targets. Monetary policy becomes optimal and effective when using the Taylor rule in the ITF period (Taylor, 2001). It includes reduced output volatility despite an increase in inflation volatility in the short run. So the Taylor rule is widely used as the central bank's reaction function to explain and evaluate monetary policy in the inflation-targeting period.

Empirical studies also show the importance of price policy in responding to exchange rate changes. Best & Kapinos (2016), Kempa (2016), Lubik & Schorfheide (2007), Mohanty & Klau (2004), and Taylor (2001) explain that interest rate is the central bank's reaction function to the exchange rate changes. Furthermore, Taylor (2001) shows that when we use inflation and output from forecast results, the impact on interest rates will be more significant when exchange rate appreciation.

Arintoko & Insukindro (2017), and Juhro & Mochtar (2009) show that Bank Indonesia responds by adjusting interest rates when exchange rates change. Mayandy (2019), and Mohanty & Klau (2004) found that the interest rate response is more robust to exchange rate when compared to inflation and output gap. Different results obtained by Leitemo & Söderström (2005) showed that the additional benefit of including the exchange rate in the central bank's reaction function is small. However, on the other side, Lubik & Schorfheide (2007) show no strong evidence that the central bank changes interest rates systematically when the exchange rate depreciation.

The New Keynesian approach—focusing on the demand side—is widely used in previous empirical studies because monetary policy significantly impacts real economic activity. However, inflation in Indonesia more influences by the supply side, such as oil price fluctuation. Therefore, this study adds assumptions from other economic approaches that also consider shocks from the supply side, such as the new classical and the real business cycle approach.

Therefore this study uses a new neoclassical synthesis approach which is a convergence between the New Classical approach jointly with the Real Business Cycle and the New Keynesian (see Goodfriend & King, 1997). This approach also explains how important monetary policy is in influencing real economic activity, including the important role of central bank credibility in explaining the impact of monetary policy.

During the inflation targeting period, research on monetary policy in Indonesia still needs further analysis. Warjiyo and Juhro (2016) explained that it was difficult for BI to achieve the inflation target because of the demand and supply side shocks, such as exchange rate fluctuation and world oil price fluctuation. As a small and open economy, the Indonesian economy is vulnerable to exchange rate fluctuations. Exchange rate instability puts pressure on inflation, so exchange rate instability can become an obstacle to implementing inflation targeting in monetary policy (Rahutami, 2004).

This study analyzes the monetary reaction function in Indonesia during the inflation targeting period, including the impact of economic fluctuations, fluctuations in exchange rates, fluctuations in oil prices on interest rates, and the phenomenon of fear of floating in Indonesia. Furthermore, this study also compares whether the monetary reaction function in Indonesia is a backward or forward-looking policy.

We hope this research can enrich the monetary economics literature, particularly regarding the effect of demand and supply side shocks on the monetary reaction function in Indonesia. This research can also be a consideration for policymakers, particularly Bank Indonesia, in stabilizing the economy by considering these three shocks.

METHOD AND MODELING

This research focuses on Indonesia's monetary policy reaction function during the ITF period and uses time series data from 2005Q3 to 2019Q4. This research does not include the Covid-19 pandemic period (2020-2022) because Indonesia is in a crisis period, and Indonesia's economic condition is unstable. The study uses the following variables: commercial bank deposit interest rates, inflation rates, output, fluctuations in the Rupiah exchange rate, and fluctuations in world oil prices. Table 1 below shows the definition of variables and data sources.

The initial step is to pre-test the unit root test of Augmented Dickey-Fuller (ADF), Phillips-Peron (PP), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS). The long-run model with the Dynamic Ordinary Least Squares (DOLS) method use when all variables are stationary or I(0). However, if all variables are not stationary or integrated not at zero degrees ($I \neq 0$) or I(1), then the next step is to perform a cointegration test to analyze the long-run relationship between the variables studied (Clemente et al., 2017; Engle & Granger, 1987; and Insukindro, 2020).

The monetary reaction function in this study uses a dynamic model. It assumes that disequilibrium conditions often occur through the difference between the desired and actual interest rates. It happens because of uncertainty and shock, and the economic agents face disequilibrium costs, so adjustments are needed by optimizing all these costs.

The dynamic model of the monetary reaction function in Indonesia is derived using a single-period and multiple periods quadratic cost function approach. It is possible to obtain the Forward-Looking Partial Adjustment Model (FLM) with a shock variable and the Error Correction Model (ECM) with a shock variable (Insukindro, 2020). After estimating the ECM and FLM with the shock variable, an informal predictive performance model is used to obtain a suitable model for explaining Indonesia's monetary reaction function.

Table 1. Definition of Variables and Data Sources

Variables	Notation	Unit	Description	Data Source
Nominal interest rate	i	Percent	Indonesian commercial bank deposit interest rates	Bank Indonesia (BI) 2022
Inflation rate	π	Percent	Changes in CPI (2012=100) Indonesia	
Natural inflation	π^*	Percent	Long-run Indonesian CPI inflation (2012=100) estimated by using Hodrick-Prescott~HP filter	
Real exchange rate	rer	Rupiah/ Dollar	The nominal rupiah exchange rate ratio has been adjusted to the ratio of the Indonesian and American price indexes (2012=100) to Indonesia's potential real GDP estimated using the HP filter.	
Real exchange rate fluctuations	frer	Percent	$frer_t = \frac{rer_t - rer_t^*}{rer_t^*} x100\%$	
Real interest rate	r	Percent	Nominal commercial bank deposit interest rate minus Indonesian CPI inflation (logarithm).	
Real GDP	Y	Billion rupiah	Gross Domestic Product (GDP) at current prices of Indonesia (expenditures) as a ratio to CPI (2012=100)	
Natural Real GDP	Y^*	Billion rupiah	Indonesia's long-run real GDP estimated using the HP filter	
Economic Fluctuations	fe	Percent	$fe_t = \frac{Y_t - Y_t^*}{Y_t^*} x100\%$	
World oil price	op	Dollar	Crude oil price (WTI NSA)	FRED St. Louis FED 2022
Natural world oil price	op^*	Dollar	Long-run Crude oil price (WTI NSA) estimated using HP filter	
World oil price fluctuations	fop	Percent	$fop_t = \frac{op_t - op_t^*}{op_t^*} x100\%$	

Modeling

The monetary reaction function explains the positive response of the central bank in setting the benchmark interest rate when the inflation rate is different from the inflation target. It means that when the inflation rate is higher (less) than the inflation target, the central bank will increase (decrease) interest rates to reduce (increase) aggregate expenditure and real GDP, which in turn will reduce (raise) the inflation rate (Hubbard et al., 2014).

The monetary reaction function describes the relationship between real interest rates (r_t) and the inflation rate (inf_t).

$$r_t = b_0 + b_1 inf_t + e_t^{mp} \quad (1)$$

The interest rate policy in this study uses the real interest rate on deposits in commercial banks (r_t). Parameter b_0 is a constant, and the parameter $b_2 > 0$ is the weight of Bank Indonesia's reaction in adjusting interest rates when there is a change in the inflation rate.

Error Correction Model (ECM) with Shocks

Using a dynamic model, analyze the role of demand-side shock variables (exchange rate fluctuations) and supply-side shocks (world oil price fluctuations) on the monetary reaction function. Derivation of the dynamic model of the Indonesian monetary reaction function using a quadratic cost function approach makes it possible to obtain an Error Correction Model (ECM) with shocks (see. Insukindro, 2018).

The ECM model is derived by assuming the economy is in disequilibrium, and economic agents find that the actual interest rate differs from the natural interest rate. This difference is generally caused by the shock variable and the slow adjustment process. It is also assumed that the behavior of these economic agents is based on their decisions through a single-period quadratic cost function C as follows (see Insukindro, 2018, 2020).

$$C = c_1(\dot{r}_t - r_t^*)^2 + c_1(\dot{r}_t - \dot{r}_{t-1} - \beta\Delta Z_t)^2 \quad (2)$$
$$\dot{r}_t = r_t + S_t$$

The first part of equation 2 describes equilibrium costs, and the second describes adjustment costs. The component of the model is the actual interest rate (rt), expected interest rates in the short-run (rt), the long-run interest rate (rt*), the vector of variables that affect interest rates (Zt), and the shock variable (St). An error correction model with shock variables is obtained when economic agents can minimize C to interest rates and re-parameterize.

$$\Delta r_t = \delta_1 \Delta inf_{t+1} - \delta_3\left(r_{t-1} - \hat{\theta}_0 - \hat{\theta}_1 inf_{t-1}\right) + \delta_4 \Delta S_t + \delta_5 \Delta S_{t-1} \quad (3)$$
$$\Delta r_t = \delta_1 \Delta inf_{t+1} - \delta_3 \widehat{ect}_{t-1} + \delta_4 \Delta S_t + \delta_5 \Delta S_{t-1} \quad (4)$$
$$0 < \delta_3 < 1$$

This study uses economic fluctuations, exchange rate, and world oil price fluctuations and includes an element of backward-looking so that equation 4 is adjusted to be as follows.

$$\Delta r_t = \eta_1 \Delta inf_{t+1} - \eta_2 \widehat{ect}_{t-1} + \eta_3 \Delta fe_t + \eta_4 fe_{t-1} + \eta_5 \Delta frer_t + \eta_6 frer_{t-1} + \eta_7 \Delta fop_t + \eta_8 fop_{t-1} \quad (5)$$

Equation 5 is an error correction model of the dynamic model of Indonesia's monetary reaction function with shock variables. Parameters η3, η5, and η7 describe the shock in the short run, while parameters η4, η6, and η8 is the shock that continues for the long run (Insukindro, 2020).

Forward-Looking Model with Shocks

The inflation targeting policy with the interest rate as an operational target is a forward-looking policy. Using a forward-looking model is in line with the modern macroeconomic framework and enables the central bank to manage inflation well so that the policies implemented are credible (Zhang & Dang, 2018).

The forward-looking model in this study used the quadratic cost adjustment function of multiple periods as described by Cuthbertson (1988). In the quadratic cost adjustment function (Cuthbertson, 1988), the multiple periods of each (CF_t) reduced form function can be written as follows (see Cuthbertson, 1988; Insukindro, 2020; and Insukindro & Sahadewo, 2010).

$$CF_t = E \sum_{i=0}^{\infty} D^i [\psi_1 (r_{t+i} - r^*_{t+i})^2 + \psi_2 \{(1-L) r_{t+i}\}^2] \quad (6)$$

Equation 6 explains that E is an expectation based on the information available in the period $t-1$; D is the discount factor; L is the lag operator, and r_{t+i}, r^*_{t+i}, is the actual and long-run interest rates, respectively. The first component, in Equation 2 describes the balance cost, while the second describes the adjustment cost. Parameters $\psi_1$and ψ_2 are the weight of the balancing and adjustment costs.

By minimizing equation 6 to r_t, the following is obtained:

$$2\psi_1 (r_t - r^*_t) + 2\psi_2 (r_t - r_{t-1}) - 2\psi_2 D (r_{t+1} - r_t) = 0 \quad (7)$$

Equation 7 can be simplified to be as follows:

$$\left(1 - \frac{(1+D+\psi)L}{D} + \frac{L^2}{D}\right) fe_t = \frac{-\psi_5}{D} r^*_{t-1} \text{ ; or } B(L) r_t = \left(\frac{-\psi_3}{D}\right) r^*_{t-1} \quad (8)$$

L describes the operator shifting inaction over information; $\psi_3 = \psi_1 / \psi_2$. Cuthbertson (1988) explains that the root B(L) is as follows.

$$\lambda_1 \lambda_2 = \left(\frac{1}{D}\right); \lambda_1 + \lambda_2 = (1 + D + \psi_3)/D \quad (9)$$

$$(1-\lambda_1) + (1-\lambda_2) = (1-\lambda_1)[1 - (\lambda_1 D)^{-1}] = -\psi_3 / D \quad (10)$$

Transversality condition occurs if the sequence of r_t and r_t^* is each exponentially ranked less than D^{-1}. Assuming $\lambda_1 < 1$ and $\lambda_2 > 1$, then using the Sargent method to construct a forward-looking operator after factorization (BL), the following forward-looking model is obtained:

$$r_t = \lambda_1 Lr_t + (1-\lambda_1)(1-\lambda_1 D)\sum_{s=0}^{\infty}(\lambda_1 D)^s (Er_{t+s}^*) \quad (11)$$

Er_{t+s}^* is the value of long-run interest rate expectations. The variable shock can be integrated into Equation 6 following Cuthbertson (1988) as follows:

$$CF_t = E\sum_{i=0}^{\infty} D^i[\psi_1(r_{t+i} - r_{t+i}^*)^2 + \psi_2\{(1-L)r_{t+i} - S_{t+i}\}^2] \quad (12)$$

The optimal solution of Equation 12 is as follows:

$$r_t = \lambda_1 + \lambda_2 Lr_t + (1-\lambda_1)(1-\lambda_1 D)\sum_{s=0}^{\infty}(\lambda_1 D)^s Er_{t+s}^* + \lambda_3 S_t - (1-\lambda_1)\sum_{s=0}^{\infty}(\lambda_1 D)^s ES_{t+s}^* \quad (13)$$

Cuthbertson (1988) explains that if it can be assumed that $ES_{t+s}^* = 0$ if $s \geq 1$, then the following equation will be obtained:

$$r_t = \lambda_1 + \lambda_2 Lr_t + (1-\lambda_1)(1-\lambda_1 D)\sum_{s=0}^{\infty}(\lambda_1 D)^s Er_{t+s}^* + \lambda_3 S_t \quad (14)$$

The following is obtained by modifying Equation 14, which includes three shock variables: economic fluctuations, real exchange rate fluctuations, and world oil price fluctuations (see Insukindro, 2018, 2020).

$$r_t = \lambda_1 + \lambda_2 Lr_t + (1-\lambda_1)(1-\lambda_1 D)\sum_{s=0}^{\infty}(\lambda_1 D)^s Er_{t+s}^* + \lambda_3 fe_t + \lambda_4 fe_{t-1} + \lambda_5 frer_t + \lambda_6 frer_{t-1} + \lambda_7 fop_t + \lambda_8 fop_{t-1} + e_t \quad (15)$$

The parameter λ_i (i=3,…, 8) describes the triple shock variables in the short run.

RESULTS AND DISCUSSION

Descriptive statistics for all the variables in this study are in table 2. During this study period, Indonesia's mean interest and inflation rates were 6.97 percent and 0.41 percent, respectively. The positive value of the economic fluctuation variable explains that during this study period, the economy was in a state of expansion, while the negative value defines the economic recession. The positive (negative) value of exchange rate fluctuations explains the depreciation (appreciation) of the exchange rate. In contrast, the positive (negative) value of world oil price fluctuations explains the increase (decrease) in world oil prices.

During the study period (58 observations), interest rates had a median value of 6.52 percent, while the highest and lowest interest rates were 12.02 percent and 4.57 percent, respectively, occurring in the 2005 4th quarter and 2013 2nd quarter. The highest and lowest inflation rates were respectively 2.46 percent and -0.97 percent and appeared in 2014 4th quarter and 2008 2nd quarter, respectively.

Table 2. Statistic Descriptive

	r	inf	fe	frer	fop
Mean	6.97	0.41	0.28	-0.19	0.10
Median	6.52	0.40	0.24	-1.44	-1.40
Maximum	12.02	2.46	9.79	26.89	68.78
Minimum	4.57	-0.97	-5.77	-12.14	-49.33
Std. Dev.	1.6475	0.5028	3.2869	7.5085	21.9807
Skewness	1.2668	0.8488	0.3010	1.1806	0.2925
Kurtosis	4.4452	6.7249	2.8832	5.7371	3.5899
Jarque-Bera	20.5612	40.4941	0.9091	31.5788	1.6678
Probability	0.000034	0.0000	0.6347	0.0000	0.4343
Observations	58	58	58	58	58

The standard deviation value of the interest rate is smaller than the inflation rate; this explains that the interest rate variable has a more diverse value than the inflation rate during the study period. In this condition, the value of the interest rate variable is increasingly inaccurate with the average value, while the inflation rate is increasingly accurate with the average. Not all variables in this study are normally distributed based on Jarque-Bera statistics. Interest rates, inflation rates, and exchange rate fluctuations variables are not normally distributed. This condition is also related to each variable's skewness and kurtosis values.

Unit Root Test

The unit root test uses ADF, PP, and KPSS; the results are in table 3. These results explain that the interest rate and inflation rate variables are stationary or I(0), so there is no need for a cointegration test. The next step is to estimate the long-term regression model.

Table 3. Unit Root Test

Variables	Unit Root Test for Stationarity at Level or I(0)					
	ADF		PP		KPSS	
	Stat-t	Prob.	Stat-t	Prob.	Intercept	Intercept & Trend
r	-4.6880***	0.0003	-2.6559*	0.0881	0.5069**	0.1297*
inf(1)	-10.7056***	0.0000	-11.5588***	0.0000	0.5000**	0.5000***
fe	-2.2179**	0.0269	-4.9712***	0.0001	NA	NA
frer	-3.5033**	0.0114	-2.8996*	0.0516	NA	NA
fop	-4.2293***	0.0014	-3.5110**	0.0111	NA	NA

Notes:
(*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.
(.) P-values
*MacKinnon (1996) one-sided p-values.
Lag Length based on SIC
Probability based on Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Regression Model Estimation

The best estimation results from the long-run regression model are shown in table 4. In the long run, Indonesia has a positive relationship between interest rates and future inflation. BI will raise (lower) interest rates when future inflation increases (decreases). BI's response to changes in the future inflation rate explains that BI is implementing a counter-cyclical policy.

The next step is to analyze the effect of triple shock variables (economic fluctuations, fluctuations in the real Rupiah exchange rate, and fluctuations in world oil prices) on changes in deposit interest rates at commercial banks using the error correction model (equation 5) and the forward-looking model (equation 15).

The best estimation results of the ECM are shown in Table 5. The residual of the ECM model is stationary or I(0) using the ADF unit root test. These results explain that the ECM model does not contain heteroscedasticity and serial correlation. The significant ECT describes the long-run relationship between the interest rate and future inflation. The ECT also shows that the speed of adjustment to the long-run condition between two variables is relatively slow (ECT=0.1640).

Table 4. Estimation Results of the Long-Run Model (DOLS)

$$\mathbf{r_t = b_0 + b_1 inf_{t+1} + e_t^{mp}}$$

Variables	Coefficient	t-Stat
b_0	1.9078	15.4848
b_1	0.0134	0.0484
R^2	0.1492	
Residual Stationary Test (ADF)	-3.4511**	

Notes. (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%
Source: processed data, 2022

Table 5. ECM-EG Estimation Results with Shocks

$$\mathbf{\Delta r_t = \eta_1 \Delta inf_{t+1} + \eta_2 \widehat{ect}_{t-1} + \eta_3 \Delta fe_t + \eta_4 fe_{t-1} + \eta_5 fe_{t-2} + \eta_6 \Delta frer_t + \eta_7 frer_{t-1} + \eta_8 \Delta fop_t + \eta_9 fop_{t-1}}$$

Variables	Coefficient	t-Stat
C	-0.0112	-0.8494
η_1	0.1022***	5.7525
η_2	-0.1640*	-1.8894
η_3	-0.0010	-0.1562
η_4	-0.0111*	-1.6840
η_5	0.0104*	1.9416
η_6	0.0112***	3.5781
η_7	0.0036	1.4067
η_8	0.0009	0.8861
η_9	0.0018**	2.3026
R^2	0.6042	
Adjusted R-squared	0.5267	
F-Stat	7.8008	
Prob. (Statistic – F)	0.0000	
Residual Stationary Test (ADF)	-7.0368***	

Notes. (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%
Source: processed data, 2022

In the short run, exchange rate fluctuations positively affect changes in interest rates. Nevertheless, in the long run, economic fluctuations and world oil price fluctuations significantly positively affect changes in interest rates. Positive economic fluctuations (expansion), exchange rate fluctuations (appreciation), and world oil prices (rising) will be responded to by BI by raising interest rates.

Indonesian monetary reaction function in the inflation targeting framework period is very responsive to changes in future inflation. This condition can be shown by the coefficient of future inflation being more significant than the coefficient of exchange rate fluctuations. This result confirms that the fear of the floating phenomenon in the Indonesian monetary reaction function is not proven.

The next step is estimating the FLM. The results of the FLM estimation using the restriction D=0.99 and the triple shock variables are shown in Table 5. Statistics J explains that there is an overidentification condition. Parameter value λ_2=0.4813 explains that the speed of adjustment in FLM is faster than in ECM (0.1640) see Table 6.

In the short run, world oil price fluctuations have a significant effect, while economic and exchange rate fluctuations have an insignificant impact on changes in interest rates. World oil price fluctuations have a negative effect, while the previous world oil price fluctuations positively affect changes in interest rates (counter-cyclical). This condition explains that if there is a positive fluctuation in world oil prices (increase) in the previous period, BI will respond by lowering the benchmark interest rate and decreasing deposit interest rates.

Table 6. Forward-Looking Model Estimation Results with Shocks

$$r_t = \lambda_1 + \lambda_2 Lr_t + (1-\lambda_1)(1-\lambda_1 D)\sum_{s=0}^{\infty}(\lambda_1 D)^s Er^*_{t+s} + \lambda_3 fe_t + \lambda_4 fe_{t-1} + \lambda_5 frer_t + \lambda_6 frer_{t-1} + \lambda_7 fop_t + \lambda_8 fop_{t-1} + e_t$$

Variables	Coefficient	t-Stat
λ_1	0.9913***	6.5885
λ_2	0.4752***	6.3335
λ_3	0.0034	0.4477
λ_4	-0.0228	-1.4781
λ_5	-0.0003	-0.0564
λ_6	0.0021	0.5238
λ_7	-0.0059**	-2.3965
λ_8	0.0070***	3.3413
J-Statistic	9.2588	
Prob (J-Statistic)	0.0992	
R^2	0.3529	
Adjusted R-squared	0.2522	
Instrument rank	13	
Instrument: r(-2) r(-3) r(-4) fe(-2) fe(-3) fe(-4) frer(-2) frer(-3) frer(-4) fop(-2) fop(-3) fop(-4) C		

Notes. (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%
Source: processed data, 2022

To choose the most appropriate model for explaining the monetary reaction function in Indonesia using model predictive performance by observing the bias, variance, and covariance proportion suggested by Pindyck & Rubinfeld (1998). The best model has the criteria for the value of bias and variance proportion close to zero, the covariance proportion close to one, and the smallest mean absolute error and mean absolute percentage error. Furthermore, if the bias proportion value is more than 0.2, there is a systematic error in the model specification.

Table 7. Predictive Performance Model

Criterion	FLM	ECM
Mean Absolute Error	0.1436	0.6451
Mean Absolute Percentage Error	7.3018	9.7242
Bias Proportion	0.0168	0.0519
Variance Proportion	0.1241	0.0510
Covariance Proportion	0.8591	0.8971

Source: processed data, 2022

The predictive performance of the FLM model specification is slightly better than the ECM model specification. The FLM specification fulfills three of the five predictive performance criteria as the model with the best specifications: the criteria for the mean absolute error, mean absolute percentage error, and a smaller bias proportion compared to the ECM specification.

The Indonesian monetary reaction function is the forward-looking policy based on the predictive performance model (see table 7), consistent with the inflation targeting framework implemented by Bank Indonesia. In addition, the results of this study also confirm the thought of the New Neoclassical Synthesis that monetary policy has an essential role in influencing economic activity.

CONCLUSION

This empirical research analyzes the monetary reaction function in Indonesia with triple shocks using the New Neoclassical Synthesis approach. This study also analyzes the presence of the fear of floating phenomenon in Indonesia. The monetary reaction function in Indonesia is estimated using ECM and FLM. Using the predictive performance model, the FLM is slightly better than the ECM.

In the long run, BI positively reacts when there is a change in future inflation, which means that Bi is using a counter-cyclical policy. In the short run, BI's response will be significant when there are fluctuations in world oil prices. BI will lower the policy rate, which will result in lowering deposit interest rates when there are positive fluctuations in world oil prices.

Overall, the results of this study confirm that BI is implementing an inflation-targeting framework (forward-looking policy). Furthermore, this study has not been able to explain the significant effect of economic and exchange rate fluctuations on deposit interest rates, including the fear of the floating phenomenon.

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