Deposit Interest Rates Dynamics in Indonesia: A Quadratic Cost Function Approach with Twin Shock Variables

INSUKINDRO
Department of Economics, Faculty of Economics and Business
Universitas Gadjah Mada, Yogyakarta, Indonesia
insukindro@ugm.ac.id and insukindro@gmail.com

Article's history:

Received 21st January, 2020; *Received in revised form* 16th February, 2020; *Accepted* 6th March, 2020;
Published 30th March, 2020.

Suggested citation:

Insukindro. 2020. Deposit interest rates dynamics in Indonesia: A quadratic cost function approach with twin shock variables. *Journal of Applied Economic Sciences*, Volume XV, Spring, 1(67): 144-151. DOI: https://doi.org/10.14505/jaes.v15.1(67).13

Abstract:

The purpose of this study is to estimate the deposits interest rate dynamics using quadratic cost function approach with twin shock variable (economic and foreign exchange fluctuations). Using this approach, a backward- and a forward-looking model with twin shock variables may be derived. Based on non-nested test, the empirical studies reveal that the two models can not be discrimated or the results are inconclusive. With respect to the level of development of financial feature in Indonesia, the results may allow us to suggest that the future forcing variable and twin shock variables can be potentially key variable of the deposit interest rates dynamics in Indonesia. The findings may indicate that in the short- and long-term, the inflation rate, the twin shock variables (economic fluctuations and exchange rate shock) have a positive effect on the deposit interest rates in Indonesia.

Keywords: interest rate dynamics; inflation; economic and exchange rate fluctuations; quadratic cost function; a backward- and a forward-looking model with twin shock variables.

JEL Classification: E43; C51; C61; E32.

Introduction

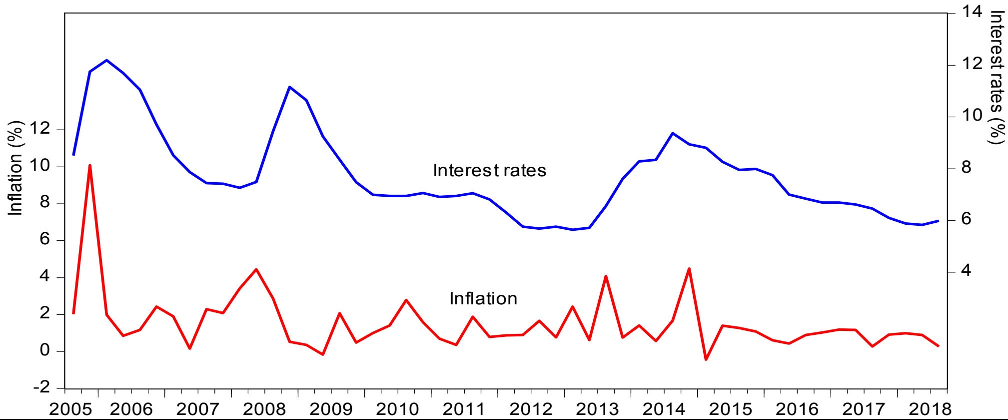
Key macroeconomic variables such as interest rates, inflation, government budget deficits and economic growth significantly affects a country's economic performance. The movement of these variables is always reported almost every day by mass media because they affect the lives of the people and are related to the health of the economy. Interest rates also affect individual decisions, such as whether they will consume or save their wealth in the form of other assets. Similarly, for companies, whether they will use their funds to buy new equipment or save their money in the bank. High deposit rates, for example, may indicate the scarcity of third party funds and the high cost of intermediation and may restrict potential borrowers to enter credit markets. This phenomenon may also indicate chaotic economic performance and may inhibit investment and slow economic growth and job creation. Therefore, interest rates should be observed and examined because this variable is also one of the important key factors in formulating and making macroeconomic policies (Wilson and Sheefani 2014, Kikote 2015).

The study on short-term and long-term behavior of interest rates or interest rates dynamics has always been an important and interesting issue both from the perspective of central bank and academics. From the perspective of the central bank, the study of dynamic interest rates can be a reference for formulating the rate policy reaction function, an illustration of determining past interest rates, and a background information in formulating and making decisions in the future. On the other hand, from the academic perspective, the model of dynamic interest rates determination or interest rate reaction function may include the main considerations or factors underlying the interest rate setting (Gerlach-Kristen 2003, Aas 2016, Bikker and Gerritsen 2018).

This study investigated deposit interest rates in Indonesia because since October 1988 the behavior of all interest rates was determined by the banking system in line with the implementation of financial reforms. This means that the deposit interest rates (hereinafter referred to interest rates) were determined by the force and condition of the money market. According to the Keynesians, in disequlibrium condition, interest rates have a direct relationship with prices or inflation (Harris 1985, 391). Studies conducted by Amaefula (2016) and Bikker and Gerritsen (2018) also support a positive relationship between deposit interest rates and inflation rates in respective countries observed, namely Nigeria and the Netherlands.

Graph 1 shows the behavior of interest rates and inflation in Indonesia during the period of 2005Q3 - 2018Q3. In general, the movement of interest rates and inflation is in the same direction, although fluctuation in interest rates are relatively lower than that in inflation. In 2006, the interest rates reached 12% per year, but declined to approximately 6% per year in 2012 and slightly increased in 2014 and returned to a rate of 6% in 2018. Quarterly inflation increased at the end of 2005 and reached its peak in 2006 at approximately 10% and decreased to a decreased to a relatively stable rate of approximately 1% in 2018.

Figure 1. Movement of Interest Rates (%) and Inflation (%) in Indonesia: 2005Q3-2018Q3

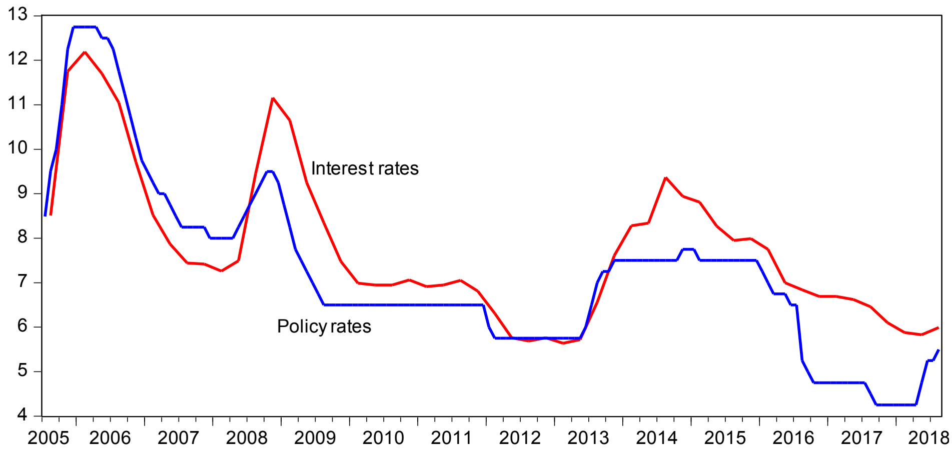


Source: Bank Indonesia, 2019

In addition, since the implementation of the monetary target of interest rate of Bank of Indonesia (BI rate) in mid-2005, the interest rate behavior tends to be in line with the BI rate. Graph 2 shows the interest rates does not significantly differ from the BI rate and their movement are also in line with the BI rate. In the third quarter of 2016, the BI Rate declined rather sharply because since August 2016 BI changed the reference interest rate from the BI rate into the BI 7-day Repo Rate. However, since the beginning of 2018, this interest rate has continued to increase to reach approximately 6% in mid-2018.

This study aims to estimate the interest rates dynamic model by using the disequilibrium approach in the money market. Disequlibrium may occur due to the difference between the desired interest rate and the actual interest rate. In this case, economic agents encounter two types of costs, namely disequilibrium costs and adjustment costs that make it possible to derive the model of interest rates dynamics either with or without shock variables and either from demand or supply side (for surveys of deriving dynamic models using this approach, see for example: Cuthbertson (1988, 1997), Domowitz and Elbadawi (1987), Price and Insukindro (1994).

Figure 2. Deposit interest rates and BI rate in Indonesia: 2005 Q3 - 2018 Q3



Source: Bank Indonesia, 2019

1. Methodology

1.1. Research framework

Based on the Keynes' liquidity preference theory, interest rates are determined in the money market. In equilibrium, interest rates are determined by the force of interaction between money demand and supply see Harris (1985, 306-307), Kikote (2015, 12). In order to obtain an illustration of this approach, the equilibrium in the money market is described below.

Suppose that the real money demand is expressed by equation (1) as follows.

$$md = ky + L(i) \tag{1}$$

where: md is demand for real money, *y* is real income, *P* is price level and *M* is money supply.

In the equlibrium $md = M/P$, or

$$ky + L(i) = \frac{M}{P} \tag{2}$$

so that:

$$L(i) = \frac{M}{P} - ky \tag{3}$$

thus, a equlibrium interest rate is obtained:

$$i = L^{-1}\left(\frac{M}{P} - ky\right) \tag{4}$$

From equation (3), it can be seen that $\frac{di}{dM} < 0$; $\frac{di}{dP} > 0$ and $\frac{di}{dy} > 0$.

Furthermore, Keynesians argue that if the money market is in disequlibrium due to the disequlibrium between money demand and supply, price increase (or inflation) will increase in interest rates (Harris 1985, 391). If the money supply is determined by the monetary authority, disequlibrium in the money market can occur because the desired money demand is not equal to the actual demand, so that economic agents may face disequilibrium costs and adjustment costs as well as dynamic interest rate behavior.

Empirical studies on positive relationship between the interest rates and inflation have been conducted in developing and developed countries. Amaefula (2016) in his study in Nigeria found a positive relationship between deposit interest rates and inflation rates in the long-term. Kurniawan and Prajanti (2017) in their study in Indonesia also found a positive effect of inflation on deposit rates. Similarly, Bikker and Gerritsen (2018) stated that inflation is one of the macro variables that has a positive effect on the deposit interest rates in the Netherland.

1.2. Derivation of dynamic interest rate model

An assumption used in this approach is that unanticipated behavior can be regarded as the difference between the desired interest rates and the actual interest rates, so that economic agents encounter the disequilibrium costs and need to make adjustments. This behavior can then be used to explain why economic agents face the temporary deviation between the desired and the actual. They must optimize all costs encountered in order to obtain a model of interest rates dynamics.

The model of interest rates dynamics in this study is derived by using a single period and multiple period quadratic cost function approach that make it possible to obtain the Autoregressive Distributed Lag (ARDL) or Error Correction Model (ECM) with shock variable and a forward-looking Partial Adjustment Model with shock variable.

The role of the shock variable is also of great concern to economists, especially economists from new macroeconomic school: New Neoclassical Synthesis. Their macroeconomic modeling discusses the effect of shock from aggregate demand and supply side on real interest rates and inflation (Hubbard *et al*. 2014, Ch 11). Insukindro (2018) also studied the role of twin shock on fiscal sustainability in Indonesia.

Furthermore, in order to derive the dynamic interest rate model using the cost function approach, suppose the desired interest rate can be formulated with the following simple model.

$$X_t^* = a + bIF_t + \epsilon_t \tag{5}$$

X_t^* is the desired interest rates and IF is the inflation rates.

1.3. Error Correction Model (ECM) with shock

In order to illustrate this model, suppose that the economy is in disequilibrium. In general, economic agents will find that the actual interest rates may diverge from the desired interest rates. This deviation may be caused by shock variable and slow adjustment process. The behavior of economic agents are assumed to be based on their decision with the single period quadratic cost function as stated by equation (6) below (see: Insukindro 1998, 2018):

$$C = c_1\left(\dot{X}_t - X_t^*\right)^2 + c_1\left(\dot{X}_t - \dot{X}_{t-1} - \beta\Delta Z_t\right)^2 \tag{6}$$

$$\dot{X}_t = X_t + S_t$$

where: C is the single period quadratic cost function of the interest rates.

The first part of equation (6) is disequilibrium costs and the second part is adjustment costs, as follows: X is the actual interest rate, $\dot{X}$ is the expected interest rate in the short term, $X^*$is the desired interest rate in the long term, Z_t is the vector of variables affecting the interest rate, S is shock variable. Economic agent minimizes C of the equation (6) with respect to X_t and reparametrizes the solution, then an error correction model (ECM) with shock variable will be obtained as follows.

$$\Delta X_t = \theta_1 \Delta IF_t - \theta_2 (X_{t-1} - \hat{a}_0 - \hat{a}_1 IF_{t-1}) + \theta_3 \Delta S_t + \theta_4 S_{t-1} \quad (7)$$

$$\Delta X_t = \theta_1 \Delta IF_t - \theta_2 \hat{e}_{t-1} + \theta_3 \Delta S_t + \theta_4 \Delta S_{t-1} \quad (8)$$

$0 < \theta_2 < 1$

In this study we use twin shock, therefore equation (8) can be modified as follows.

$$\Delta X_t = \alpha_1 \Delta IF_{t-1} + \alpha_2 u_{t-1} + \alpha_3 \Delta fe_t + \alpha_4 fe_{t-1} + \alpha_5 fe_{t-2} + \alpha_6 \Delta fk_t + \alpha_7 fk_{t-1} + e_t \quad (9)$$

The shock variable (S) cannot be observed so that a method is needed to proxy it, for example: AR, MA, deviation of linear/nonlinear trend & filter method (H-P and Kalman).

1.4. Forward-Looking Model (FML) with shock variables

In this model, individual's behavior in general is considered to be based on an infinite discounted sum of his expected value of cost function. It is argued that the economic agent's multiperiod quadratic cost function can be written as follows, see: Cuthbertson (1988, 1997), Price and Insukindro (1994) Insukindro and Sahadewo (2010):

$$C_t = E \sum_{i=0}^{\infty} D^i [a_1 (X_{t+i} - X^*_{t+i})^2 + a_2 \{(1-L) X_{t+i}\}^2] \quad (10)$$

where: E is the expectations operator based all information available at time t-1, *D* is the discount factor, L is lag operator and X_{t+i} and X^*_{t+i} are the actual and optimal or desired interest rate.

The first component of equation (10) is the equilibrium cost whereas the second one represents the adjustment cost The parameter a_1 and a_2 are the weight which economic agent places on the disequilibriun cost and the adjustment cost.

Minimizing equation (10) with respect to X_t and then use the Sargent's method for forward operators (Sargent 1987, chapter IX) to construct the forward-looking specification as follows.

$$X_t = r_1 L X_t + (1-r_1)(1-r_1 D) \sum_{s=0}^{\infty} (r_1 D)^s E X^*_{t+s} \quad (11)$$

The shock variable (S_t) can be introduced in the component of adjustment cost of equation (10) as follows (Cuthbertson 1988):

$$C_t = E \sum_{i=0}^{\infty} D^i [a_1 (X_{t+i} - X^*_{t+i})^2 + a_2 \{(1-L) X_{t+i} - S_{t+i}\}^2] \quad (12)$$

The optimal solution of equation (12) is:

$$X_t = r_1 L X_t + (1-r_1)(1-r_1 D) \sum_{s=0}^{\infty} (r_1 D)^s E X^*_{t+s} + r_1 S_t - (1-r_1) \sum_{s=0}^{\infty} (r_1 D)^s E S^*_{t+s} \quad (13)$$

Cuthbertson (1988) states that it might be assumed that $ES^*_{t+s} = 0$ if $s \geq 1$, so we can obtain the following equation:

$$X_t = r_1 L X_t + (1-r_1)(1-r_1 D) \sum_{s=0}^{\infty} (r_1 D)^s E X^*_{t+s} + r_1 S_t \quad (14)$$

As mentioned above, in this study we use twin shock, so equation (14) can be modified as follows:

$$X_t = r_1 L X_t + (1-r_1)(1-r_1 D) \sum_{s=0}^{\infty} (r_1 D)^s E X^*_{t+s} + r_2\, fe_t + r_3 fe_{t-1} + r_4 fk_t + r_5 fk_{t-1} + \varepsilon_t \quad (15)$$

2. Data analysis

2.1. Data

This study uses the following variables: deposit interest rates, inflation rates, economic fluctuations and exchange rate fluctuations. The definition of the variables and data sources are shown in Table 1. The data to be used in this study are quarterly time series data from the third quarter of 2005 to the second quarter of 2018.

Table 1. Variable definitions and data sources

Variable	Symbol	Unit	Description	Source
Deposit interest rates	X	Percent	Quarterly end-of-period deposit interest rates of commercial banks.	Bank of Indonesia
Inflation	IF	Percent	Quarterly inflation. The percentage change in the CPI (consumer price index) for a quarterly period compared to the past quarterly period.	The Indonesian Central Bureau of Statistics (BPS)
Real Output (real GDP)	y	Billion Rupiah	Real GDP with 2010 base year	The Indonesian Central Bureau of Statistics (BPS)
Exchange rate of US $/Rp	K	Rupiah	The exchange rate of US $/Rp/ USD at the end of quarterly period.	Pacific Exchange Rate Services.
Potential output	y^*	Billion Rupiah	Obtained by using HP Filters	
Expected exchange rates	K^*	Rupiah	Obtained by using HP Filters	
Economic fluctuations	fe	Percent	$fe_t = \frac{y_t - y_t^*}{y_t^*} \times 100\%$	
Exchange rate fluctuations	fk	Percent	$fk_t = \frac{K_t - K_t^*}{K_t^*} \times 100\%$	

2.2. Stationarity

This study uses time series variables, so that it is necessary to perform stationarity tests. If the variable observed is not stationary or integrated of order non-zero (I ≠ 0) or integrated of order one or I(1), for example, the next step can use cointegration techniques to estimate the long run relationship between observed variables; on the contrary, if the variable used is stationary or I(0), the standard economic estimation can be used (Nelson and Ploser 1982, Engle and Granger 1987, Clemente *et al.* 2017).

Table 2. Stationarity test

Unit Root Tests for stationary at level						
Variables	DF		ADF		KPSS (intercept)	KPSS (Intercept. & Trend)
	t-stat.	Prob.	t-stat.	Prob.	LM-Stat.	LM-Stat.
Interest rates (X)	-4.4458[a]	0.0008	-4.4612[a]	0.0042	0.4793[b]	0.1111
Inflation (IF)	-6.3294[a]	0.0000	-7.1155[a]	0.0000	0.5708[b]	0.1121

Note: [a] significant at 1% level. [b] significant at 5% level.

Table 2 reports the results of the unit root test based on the DF, ADF (Augmented Dickey-Fuller) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin) tests which state that the interest rate (X) and inflation rate (IF) variables are stationary or I(0). Therefore, the cointegration test could not be performed and further estimation could use the standard regression analysis method.

2.3. Granger Causality test

The causality test is employed to identify the presence and direction of causality between the interest rates and inflation rate. Since the variables used are I(0), the Granger causality test will be applied in this study. Table 2 shows the Granger causality test between interest rates and inflation rates and reveals that Granger causality occurred in one direction from inflation to interest rates and not vice versa. It seems that this result also supports the Keynesian approach as described above.

Table 3. Granger Causality test

Null Hypothesis:	F-Statistic	Prob.
Inflation does not Granger Cause Interest rates	7.3676[a]	0.0002
Interest rates does not Granger Cause Inflation	1.4348	0.2402

Notes: lag length 4, Reject null hyphotesis at a) α=1%; b) α=5%; c) α=10%.

2.4. Basic Long Run Model of Interest Rate

Based on the literature review and stationary tests, we may develop a basic model interest rate and estimate using standard regression because all variables used in this studi are I(0) or stasionary. The best result of estimation is reported in Table 4. This Table shows the long run specification of interest rate is well defined and has a sensible magnitude and is correctly signed. The residual of this basic model is stasionary or I(0). Furthermore, the residual u_t and fitted values of X_t will be used to estimate our ECM with shock variabel in equation (9) and forward looking model with variabel in equation (15).

Table 4. OLS estimate of Basic Model of iInterest rate

$X_t = a_1 + \alpha_2 IF_{t-1} + u_t$		
Variables	Coefficient	t-stat.
$Constant$	7.0751[a]	23.1962
IF_{t-1}	0.4333[a]	3.1793
R-squared	0.1682	
F-statistic	10.1081	
Prob(F-statistic)	0.0025	
Stationarity test for residual (DF-test statistic)	-3.2642[a]	
Theil Inequality Coefficient	0.0978	

Note: [a] significant at 1% level.

2.5. Error Correction Model (ECM) and Forward-Looking Model (FLM) with Twin Shock

In this study, ECM and FLM with twin shock as mentioned in eq. (9) and (15) will be used to estimate the effect of twin shock on interest rate dynamics in Indonesia. The hypothesis testings for eq. (9) and (15) are as follows:

Tabel 5. Hypothesis testing for equation (9)

Ho: $\alpha_3 = 0$	Ho: $\alpha_4 = 0$	Ho: $\alpha_5 = 0$	Ho: $\alpha_6 = 0$	Ho: $\alpha_7 = 0$
Ha: $\alpha_3 \neq 0$	Ha: $\alpha_4 \neq 0$	Ha: $\alpha_5 \neq 0$	Ha: $\alpha_6 \neq 0$	Ha: $\alpha_7 \neq 0$

If only α_3, and α_6 are significantly different from zero, it means that the twin shock occurred in the short run, whereas if α_4 (or α_5) and α_7 are significantly different from zero, the twin shock variables are continously for the long run (see also: Insukindro 2018). Hypothesis testings for equation (15) are similar to test for equation (9) in which we just substitute λ_i into α_i, see also equation (15) in Table 6.

2.6. Error Correction Model (ECM) with Twin Shock

The best results of the ECM with twin shock is well defined as reported in Table 6. Based on the DF statistic, it shows that the residual of the model is stasionary. This result may provide evidence of the existence of homoscedasticity and the absence of serial correlation. The error correction term coefficient reveals evidence of the existence of long run relationship between the interest rate and inflation rate in Indonesia, and the adjustment coefficient is 0.2307. In the short- and long-term, the twin shock variabels namely the economic and exchange rate fluctuation have significantly positive effect on the interest rate.

Table 6. OLS Estimate of ECM with Twin Shock

$\Delta X_t = \alpha_1 \Delta IF_{t-1} + \alpha_2 u_{t-1} + \alpha_3 \Delta fe_t + \alpha_4 fe_{t-1} + \alpha_5 fe_{t-2} + \alpha_6 \Delta fK_t + \alpha_7 fK_{t-1} + e_t$ (9)		
Variables	Coefficient	t-stat.
ΔIF_{t-1}	0.0671[c]	1.9125
u_{t-1}	-0.2307[a]	-4.0852
fe_t	0.1638[b]	2.4127
fe_{t-1}	0.2414[a]	2.7177
fe_{t-2}	0.1229[c]	1.8719
fK_t	0.0445[a]	2.7965
fK_{t-1}	0.0338[b]	2.5749
R-squared	0.4747	
Stationarity test for residuals (DF-test statistic)	-4.5021	
Theil Inequality Coefficient	0.0819	

Note: [a] significant at 1% level. [b] significant at 5% level. [c] significant at 10% level.

2.7. Forward Looking Model (FLM) with Twin Shock

The empirical result of the ristriction FLM (D=0.99) with twin shock is presented in Table 7. The result is relatively well defined and the residual is also stasionary. The J-statistic reveals evidence of the existence of overidentifaction condition. The value of λ_2 is 0.2733. As expected that the speed of adjustment is faster than the result obtained in the ECM with twin shock discussed above. However, the effects of twin shock on our interest rate dynamics can not be supported in this study. The results show that only fluctuation of exhange rate has a positive effect on interest rate dynamics in Indonesia in the short run.

Tabel 7. GMM Estimate of FLM with Twin Shock

$X_t = \lambda_1 + \lambda_2 X_{t-1} + (1-\lambda_2)(1-D\lambda_2)\sum_{i=1}^{\infty}(\lambda_2 D)^i X_{t+i}^* + \lambda_3 fe_t + \lambda_4 fe_{t-1} + \lambda_5 fK_t + \lambda_6 fK_{t-1} + \varepsilon_t$ (15)		
	Coefficient	t-stat.
λ_1	1.6062[c]	1.8395
λ_2	0.7267[a]	4.4315
λ_3	0.1954	1.2922
λ_4	0.0285	0.2353
λ_5	0.1756[a]	3.0876
λ_6	-0.0888[c]	-1.8464
Instrument rank	7	
J-statistic	1.950	
Prob(J-statistic)	0.1626	
Instrument specification:	$X_{t-2}; X_{t-3}; X_{t-4}; IF_{t-2}; IF_{t-3}; IF_{t-4}$	
Stationarity test for residuals (DF-test statistic)	-6.4437[a]	
Theil Inequality Coefficient	0.1076	
Note: [a] significant at 1% level. [b] significant at 5% level. [c] significant at 10% level.		

2.8. Non-Nested test

Having discussed ECM with twin shock and FLM with twin shock, our discussion is now concentrated on non-nested test to make comparison among regression models with different variables and functional forms. In such cases, we are often confronted with the problem of making choice among alternative models.

Based on the *J* test proposed by Davidson and MacKinnon (1981), the results of non-nested tests are reported in Table 8. The findings show that the estimated *t*-values are not significantly difference from zero, therefore we can not discrimate between the back-ward and forward-looking models. With respect of the level of development of financial feature in Indonesia and the ambiguity of the non-nested tests, the findings may allow us to argue that the future forcing variables can be potentially important components but we should not wish to suggest that the FLM is the "true model" for our deposits interest. Based on empirical results, it may be concluded that the ECM with twin shock can be the "best model" for interest rate dynamics in Indonesia

Table 8. Non-Nested test

H_0	H_1	t-stat.	Prob.
Forward + Shock	ECM + Shock	1.1915	0.2403
ECM + Shock	Forward + Shock	-0.8627	0.3932

Conclusion and Recommendation

The aim of this study is to estimate the interest rate dynamics in Indonesia using the quadratic cost function approach with twin shock variables. Using this approach, we may derive and estimate ECM as well as FLM with twin shock. Based on the non-nested test, it can be concluded that the ECM with twin shock may be the best model in explaining the effect of twin shock on the interest rate dynamics in Indonesia.

Based on the best model ECM with twin shock, it is concluded that in the long run the inflation rate has significantly positive relationship with the interest rate. Furthermore, the twin shock variables indicate that in the short- and long-term, economic fluctuations and exhange rate shock have a positive effect on the interest rate in question. Therefore, unanticipated increase of output and of exchange rates will increase interest rates. The positive effect of the output shock reveals that an increase in economic activity driven by aggregate demand will increase interest rates. In the other hand, if the economic fluctuations are driven by an increase in aggregate supply or potential output, it will lead to a decline in interest rates. Unanticipated rupiah depreciation or US $ appreciation, for example, can lead to an increase in interest rates. Therefore, efforts should be made to increase output or reduce aggregate demand and prevent an increase in exchange rate fluctuations because they can reduce interest

Acknowledgements

The author takes this opportunity to the Faculty of Economics and Business, Universitas Gadjah Mada, Yogyakarta, Indonesia for financial support to carry out this research.

References

[1] Aas, A.F. 2016. *Estimationg reaction functions for norges bank's key policy rate*. Master's thesis. Master of Philosophy in Economics. Department of Economics, University of Oslo. Unpublished.

[2] Amaefula, C.G. 2016. Long-run relationship between interest rate and inflation, evidence from Nigeria, *IOSR Journal of Economics and Finance,* 7(3): 24-28. DOI: https://doi.org/10.2307/2077969

[3] Bikker, J.A., Gerritsen, D.F. 2018. Determinants of interest rate on time deposits and savings accounts: Macro factors, bank risk, and account features. *International Review of Finance*, 18(2): 169-216. DOI: https://doi.org/10.1111/Irfo.12143. 10.1111/Irfo.12143

[4] Clemente, J., Gadea, M.D., Montanes, A., Reyes, M. 2017. Structural breaks, inflation and interest rates: Evidence from the G7 Countries. *Econometrics*, 5(11): 1-17.

[5] Cuthbertson, K. 1988. The demand for M1: A forward looking buffer stock model. *Oxford Economic Papers,* 40: 110-131.

[6] Cuthbertson, K. 1997. Microfoundations and the demand for money. *Economic Journal,* 107: 1186-1201. DOI: https://doi.org/10.1111/j.1468-0297.1997.tb00018.x.

[7] Davidson, R., and MacKinnon, J.G., 1981. Several tests for model specification in the presence of alternative hypothesis. *Econometrica*, 49: 781-793. DOI: https://doi.org/10.13140/RG.2.1.1247.6322

[8] Domowitz, I., and Elbadawi, L. 1987. An error-correction approach to money demand: The case of the Sudan. *Journal of Development Economics*, 26: 257-275. DOI: https://doi.org/10.1016/0304-3878(87)90029-0

[9] Engle, R.J., and Granger, C.W.J. 1987. Co-integration and error correction: Representation, estimation and testing. *Econometrica*, 55: 69-78. DOI: https://doi.org/10.2307/1913236

[10] Gerlach-Kristen, P. 2003. Interest rate reaction functions and the Taylor Rule in the Euro Area. *Working Paper*, No. 258. European Central Bank. September.

[11] Harris, L. 1985. *Monetary Theory*. Singapore: McGraw-Hill, Inc. ISBN: 978-0070663480, 481 pp.

[12] Hubbard, R.G., O'Brien, A.P., and Rafferty, M. 2014. *Macroeconomics*. Harlow, Essex: Pearson Education, Inc. ISBN: 978-0132992794, 672 pp.

[13] Insukindro, and Sahadewo, G.A. 2010. Inflation dynamics in Indonesia: Equilibrium correction and forward-looking Phillips curve approaches. *Gadjah Mada International Journal of Business,* 12: 117-133. DOI: https://doi.org/10.22146/gamaijb.5515

[14] Insukindro. 1998. Pendekatan stok Penyangga Permintaan Uang: Tinjauan teoritik dan sebuah studi empirik di Indonesia (Buffer stock approach to money demand: Theoretical review and an empirical study in Indonesia), *Economics and Finance in Indonesia,* Volume XLVI, 4: 451-471.

[15] Insukindro. 2018. The effect of twin shock on fiscal sustainability in Indonesia. *Economics and Sociology,* 11(1): 75-84. DOI: https://doi.org/10.14254/2071-789X. 2018/11-1/5.

[16] Kikote, B. 2015. *The dynamic determinants of interest rate in Tanzania: A focus on inflation, money supply and exchange rates*. Dissertation. M.Sc in Accounting and Finance, Mzumbe University, Unpublished.

[17] Kurniawan, T., and Prajanti, S.D.W. 2017. Determinants factors of interest rates on three-month deposits of Bank Pesero. *Journal of Economics and Policy,* 10(1): 90-102. DOI: https://doi.org/10.15294/jejak.v10i1.9129

[18] Nelson, C.R., and Plosser, C.I. 1982. Trends and random walks in macroeconomicstime series. *Journal of Monetary Economics,* 10: 139-162. DOI: https://doi.org/10.1016/0304-3932(82)90012-5

[19] Price, S., and Insukindro. 1994. The demand for Indonesian Narrow Money: Long-run equilibrium, error correction and forward-looking behaviour. *Journal of International Trade and Economic Development*, 3: 147-163. DOI: https://doi.org/10.1080/09638199400000009

[20] Sargent, T.J. 1987. *Macroeconomic Theory*. Orlando: Academic Press, Inc. ISBN: 978-0126197518, 536 pp.

[21] Wilson, L., and Sheefeni, J.P.S. 2014. The relationship between interest rate and exchange rate in Namibia. *Journal of Emerging Issues in Economics, Finance and Banking,* 3(1): 947-961.