Chin-Hong Puah
PhD (Economics), Associate Professor,
Faculty of Economics and Business,
University of Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia
chpuah@unimas.my
ORCID ID:
http://orcid.org/0000-0003-0187-7413

Venus Khim-Sen Liew
PhD (Economics), Associate Professor,
Faculty of Economics and Business,
University of Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia
ksliew@unimas.my
ORCID ID:
http://orcid.org/0000-0002-2305-1404

Maggie May-Jean Tang
PhD Candidate (Economics),
Faculty of Economics and Business,
University of Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia
maggietang86@hotmail.com
ORCID ID:
http://orcid.org/0000-0002-3279-2538

The pass-through effect
of interest rate and asymmetric adjustment in Indonesia

Abstract. Using the data set for the sample period of January 1999 to December 2016, this paper aims to analyse the interest rate pass-through effect and the asymmetric behaviour of retail rates in Indonesia's economy. By employing asymmetric threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) models, the deposit and lending rates were found to have an incomplete pass-through effect in response to the changes in the money market rates. Based on the empirical results, an asymmetric behaviour was discovered in the adjustment of the deposit and lending rates. The asymmetric error correction models further reflected that the deposit rate has a faster speed in the downward direction while the lending rate adjusts more rapidly in the upward direction.
Keywords: Interest Rate Pass-through; Credit: Deposit; Asymmetric Threshold Autoregressive Model (TAR); Momentum Threshold Autoregressive Model (MTAR); Indonesia
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Пуах Ч.-Х.
кандидат економічних наук, доцент, факультет економіки і бізнесу, Університет Малайзія Саравак, Саравак, Малайзія
Лю В. Х.-С.
кандидат економічних наук, доцент, факультет економіки і бізнесу, Університет Малайзія Саравак, Саравак, Малайзія
Танг М. М.-Ж.
кандидат економічних наук, доцент, факультет економіки і бізнесу, Університет Малайзія Саравак, Саравак, Малайзія
Ефект переносу процентної ставки й асиметричне регулювання в Індонезії
Анотація. Метою статті є аналіз ефекту переносу процентної ставки й асиметричного регулювання в економіці Індонезії згідно даних вибірки з січня 1999 року по грудень 2016 року. Шляхом використання асиметричної (TAR) та імпульсної (MTAR) порогової авторегресійної моделі було визначено, що відносно депозитних і кредитних ставок спостерігається неповний ефект переносу у відповідь на зміну ставок на кредитному ринку. На підставі даних, отриманих емпіричним шляхом, було зроблено висновок про асиметричність коригування ставок за депозитами й кредитами. За допомогою моделей коригування помилок асиметрії було визначено, що амплітуда коливань ставок за депозитами швидше зростає в напрямку вниз, тоді як амплітуда коливань ставок за кредитами швидше зростає в напрямку вгору.
Ключові слова: перенесення процентної ставки; кредит; депозит; асиметрична порогова авторегресійна модель; імпульсна порогова авторегресійна модель; Індонезія.

Пуах Ч.-Х.
кандидат экономических наук, доцент, факультет экономики и бизнеса, Университет Малайзия Саравак, Саравак, Малайзия
Лью В. Х.-С.
кандидат экономических наук, доцент, факультет экономики и бизнеса, Университет Малайзия Саравак, Саравак, Малайзия
Танг М. М.-Ж.
кандидат экономических наук, доцент, факультет экономики и бизнеса, Университет Малайзия Саравак, Саравак, Малайзия
Эффект переноса процентной ставки и ассиметричное регулирование в Индонезии
Аннотация. Целью статьи является анализ эффекта переноса процентной ставки и ассиметричное регулирование в экономике Индонезии с января 1999 г. по декабрь 2016 г. Путем использования ассиметричной (TAR) и импульсной (MTAR) пороговой авторегрессионной модели было определено, что относительно депозитных и кредитных ставок наблюдается неполный эффект переноса в ответ на изменение ставок на кредитном рынке. На основании эмпирических данных был сделан вывод об ассиметричности корректировки ставок по депозитам и кредитам. Посредством моделей корректировки ошибок ассиметрии было определено, что амплитуда колебаний ставок по депозитам быстрее возрастает в направлении вниз, в то время как амплитуда колебаний ставок по кредитам быстрее возрастает в направлении вверх.
Ключевые слова: перенос процентной ставки; кредит; депозит; ассиметричная пороговая авторегрессионная модель; импульсная пороговая авторегрессионная модель; Индонезия.

1. Introduction

Since the 1980s, Indonesia has been viewed as one of the newly industrialised economies in Southeast Asia that has experienced remarkable economic growth. The impressive speed of growth in Indonesia was brought on by the financial liberalisation reforms in 1983 which stabilised the macroeconomic conditions and increased non-oil exports significantly. Indonesia was said to be following the trail of the Asian Tigers during the 1980s and 1990s. However, in mid-1997, Indonesia was critically affected by the 1997 Asian Financial Crisis which threw the country into economic turbulence and political turmoil. The booming economy was halted by the serious depreciation of the Rupiah against the US dollar and other currencies. During the reformation period, the Indonesian economy slowly recovered with the improved political conditions.

In May 1999, the Central Bank of Indonesia (hereafter - BI) decided to adopt inflation targeting and implemented a new central bank law called Act No. 23 of 1999. Pursuant to this law, the BI had the full independent authority to carry out its duties and was obligated to manage the schedule of loans and cooperation with the IMF, which ended in the year 2004. A new inflation targeting framework using the policy rate was adopted in July 2005 to replace the previous inflation targeting which used base money as the operational target. Under the framework of the new policy, the economic situation was evaluated before applying any changes in the policy rate in order to keep the inflation rate on track with the established inflation target. During the 2010-2011 period, Indonesia was suffering as global commodity prices soared which had worsened the inflationary pressure in the country. At the time, the policy rate was the major instrument used by the BI to tame inflation.

Although the Indonesian economy has great growth potential, the country is still sensitive to the threat of economic crises. The downturn of the global macroeconomic condition in 2015-2016 had put the Indonesian economy and its banking industry into a challenging position. Indonesia was adversely affected by the depressed and weak growth of the global economy which consolidated with low commodity prices. The condition turned serious with the high uncertainty in financial markets brought by the increasing of the federal fund rate and the political transition in the major world economy. In spite of the sluggish growth and uncertainty, the Indonesian economy was resilient. In order to strengthen the stability of the financial system and the momentum of economic recovery, the BI had revised its monetary policy by gradually reducing the interest rate by 150 Basis points (1.5%) in 2016. By the end of 2016, the economic growth of Indonesia had returned to the upward trend.

Reliable and effective monetary policies play an important role in the Indonesian economy in terms of achieving sustainable growth. In retrospect, to the history of Indonesian monetary policy, the interest rate channel has been thought of as the most important channel among its various monetary transmission mechanisms. The effectiveness of the policy rate in influencing the economy has become a major area of interest for policymakers. In recent years, questions regarding the symmetric effect of interest rates have also been raised by many policymakers as macroeconomic cycles are thought to have an asymmetric behaviour. Thus, knowing the asymmetric behaviour of interest rates becomes crucial for policymakers in analysing the effectiveness and impact of the interest rate channel toward the economy.

This study was carried out to examine the effectiveness of the interest rate channel in Indonesia by analysing the pass-through effect of the money market rate toward the deposit and lending rates. Based on the consideration that the BI offered retail interest rates in foreign currency, a global interest rate proxy, the U.S. federal fund rate, is included in the analyses. Moreover, the asymmetric effect of the Indonesian interest rates will be investigated as well.

2. Literature Review

Monetary policy is a fundamental property of a country in altering and influencing economic performance. Investigating the effectiveness of monetary policy is still a continuing concern to economists with a large volume of studies carried out over the past few decades (for example, Leong et al., 2010; Puah and Jayaraman, 2007; Tang et al., 2013). Recent trends in the study of monetary policy have led to a proliferation of research that analyses the monetary transmission mechanism (for example, Cetorelli and Goldberg, 2012; Gunji and Yuan, 2010; Puah et al., 2008; Puah et al., 2015).

The interest rate channel is one of the most famous and important transmission channels. For an interest rate channel to be successful and effective, a complete interest rate pass-through between the policy rate and the retail rates is needed as it enables the policy rate to influentially affect market activities. The interest rate pass-through effect is the response of banking retail interest rates to changes in the policy rate or the money market rate where the degree of change and adjustment speed is taken into account. Several attempts have been made to investigate the pass-through effect of interest rates; however, the results are rather mixed.

For instance, Sellon and Gordon (2002) carried out a study in the U.S. to investigate the pass-through effect on mortgage rates and retail interest rates in response to changes in monetary policy. They found that the effect of monetary alteration was not completely passed through to the retail interest rates. In contrast with these findings, Cook (2008) and Wang and Lee (2009) showed that a complete pass-through effect was found between the policy rate and retail rates in the U.S. Nevertheless, most of the studies revealed that a complete pass-through effect is rarely achieved in reality due to the occurrence of rigidity and stickiness in the interest rate adjustment process. For example, Egert et al. (2007) reported that the interest rate pass-through in five Central and Eastern European countries (CEE-5) was incomplete and decreasing overtime. In addition, Wang and Thi (2010), Holmes et al. (2015) and Tang et al. (2015) also indicated that the pass-through process of deposit and lending rates are both incomplete and sluggish.

A number of researchers found that interest rate pass-through may react differently with different maturities. In the study of Weth (2002), a complete pass-through effect was identified in the long-run for Germany. However, the effect remains sluggish for short-term interest rates. In the same vein, Betancourt et al. (2008) discovered that the degree of the interest rate pass-through for deposit rates was incomplete to the change of policy rate in the short run while in the long run, the interest rate pass-through was found to be complete. Havranek et al. (2016) indicated that before financial crisis, the pass-through effect was nearly perfect in the long run, but it turned weak after the crisis. This finding is in contrast with Borstel et al. (2016) where they find no difference in the interest rate pass-through of lending rates with the financial crisis.

Apart from the maturity aspect, different types of retail interest rates are found to have different reactions in the pass-through process. Bruna (2008) claimed that changes in the market interest rate tended to have a different impact on the adjustment of lending and deposit rates regardless of the term. In tandem with this, Tai et al. (2012) illustrated that the deposit rate was found to have a slightly higher pass-through effect compared to the lending rate in Asia. This view was contrasted with Kelilume (2014) who discovered that saving the deposit rate has the lowest pass-through effect in Nigeria. On the other hand, Stanislawska (2015) found evidence that the lending rate in Poland has the highest interest rate pass-through compared to other retail interest rates.

In recent years, researchers have shown increasing interest in the study of the asymmetric behaviour in interest rate adjustment. Kleimeier and Sander (2006), Chong (2010), and Wang and Thi (2010) drew similar conclusion where the adjustment of retail rates exhibited asymmetric behaviour. In supporting the findings of Wang and Thi (2010), Chong (2010) and Holmes et al. (2015) documented that deposit rates adjusted more rapidly to downward change of interbank bank rates than upward. However, a later work by Liu et al. (2008)

and Yuksell and Ozcan (2013) demonstrated that the interest rate is symmetrical in adjustment. Liu et al. (2008) pointed out that there is no significant asymmetric behaviour found in the interest rate pass-through. This view is in line with the conclusion made by Yuksell and Ozcan (2013) who showed supportive evidence on symmetric adjustment.

Numerous studies have been conducted to investigate and compare the asymmetrical interest rate pass-through across countries and mixed results were obtained. For instance, Wang and Lee (2009), Panagopoulosa et al. (2010) and Karagiannis et al. (2011) illustrated that the findings of asymmetric adjustment are rather mixed in terms of countries. They believed that the level of bank competition, development and liberalisation are the reasons that cause asymmetric adjustment in the pass-through process. However, Apergis and Cooray (2015) drew the opposite conclusion that change in financial structure across countries played only a minor role in determining asymmetric adjustment. Ahmad et al. (2013) pointed out that asymmetric behaviour existed in the adjustment of deposit, lending and mortgage rates while there is no evidence of asymmetric adjustment in the time rate.

3. Description of Data and Methodology

In order to investigate the pass-through effect of the policy rate to bank retail interest rates in Indonesia, monthly time series data sets consisting of deposit rate (DR), lending rate (LR), money market rate (MMR) and the U.S. federal fund rate (FED) are used. All the data were obtained from the database of CEIC, International Financial Statistics, as well as relevant statistical publications by the Central Bank of Indonesia. The data span a sampling period between 1999: M1 to 2016: M12.

Figure 1 depicts the trend in the monthly deposit rate, lending rate, money market rate, as well as the U.S. federal funds rate employed in this study. From the graph, it appears that all variables exhibit nonlinear movement. In addition, they seem to be cointegrated as they are moving in tandem over the sample period of study. Moreover, for the most part, the time deposit rate is slightly higher than the money market rate, while there is a spread between the lending rate and the money market rate.

Usually, cointegration tests are used to detect co-movement between the variables. One such commonly adopted test is the residual-based test for cointegration advocated by Engle and Granger (1987). The above test was used in estimating the long-run relationship among R_t, MMR_t and FED_t. This approach involved two stages. In the first stage, we regressed R_t on MMR_t and FED_t with a constant as follows and obtained the residuals:

$$R_t = d_0 + d_1 MMR_t + d_2 FED_t + \mu_t,$$ (1)

where $R_t = DR_t$ or LR_t, and the residual term is denoted by μ_t. If the variables are cointegrated, μ_t will be stationary. Hence, the second stage examines the stationarity of the estimated residuals ($\hat{\mu}$) using the principle of the Dickey-Fuller (DF) test:

$$\Delta \hat{\mu}_t = \rho \hat{\mu}_{t-1} + \varepsilon_t,$$ (2)

where Δ is the first-difference operator and ε_t is the white-noise disturbance. If ρ, the coefficient of the lagged-one residuals term, $\hat{\mu}_{t-1}$ is bounded within -2 and 0 ($-2 < \rho < 0$), the null hypothesis of no cointegration can be rejected. That means, variables R_t, MMR_t and FED_t are cointegrated. Otherwise, there is no evidence of cointegration.

However, the standard model of cointegration tests assumes a linear relationship and a symmetric adjustment in cointegrated variables. This might lead to a misspecification if, in actual fact, the variables exhibit an asymmetric relationship. In this respect, Enders and Siklos (2001) introduced the threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) models to estimate the asymmetrical co-integrating relationship. According to Enders and Siklos (2001), to test for the existence of asymmetric cointegration, Equation (2) can be re-written as:

$$\Delta \hat{\mu}_t = I_t \rho_1 \hat{\mu}_{t-1} + (1 - I_t) \rho_2 \hat{\mu}_{t-1} + \varepsilon_t$$ (3)

where I_t is the indicator variable:

$$I_t = \begin{cases} 1 \ if \ \hat{\mu}_{t-1} \geq \tau \\ 0 \ if \ \hat{\mu}_{t-1} < \tau \end{cases}$$ (4)

Based on Equation (4), ρ_1 will be the adjustment value if $\hat{\mu}_{t-1}$ is greater or equal to the threshold value τ, while ρ_2 is the adjustment value when $\hat{\mu}_{t-1}$ is less than the threshold value. When serial correlation occurs in the adjustment process, Equation (3) can be corrected by means of the Augmented Dickey-Fuller principle:

$$\Delta \hat{\mu}_t = I_t \rho_1 \hat{\mu}_{t-1} + (1 - I_t) \rho_2 \hat{\mu}_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta \hat{\mu}_{t-i} + \varepsilon_t,$$ (5)

Enders and Siklos (2001) further suggested replacing $\hat{\mu}_{t-1}$ with $\Delta \hat{\mu}_{t-1}$ which represents the momentum of the interest rate adjustment. The resulting MTAR model is generated below:

$$\Delta \hat{\mu}_t = M_t \rho_1 \hat{\mu}_{t-1} + (1 - M_t) \rho_2 \hat{\mu}_{t-1} + + \sum_{i=1}^{p} Y_i \Delta \hat{\mu}_{t-i} + \varepsilon_t$$ (6)
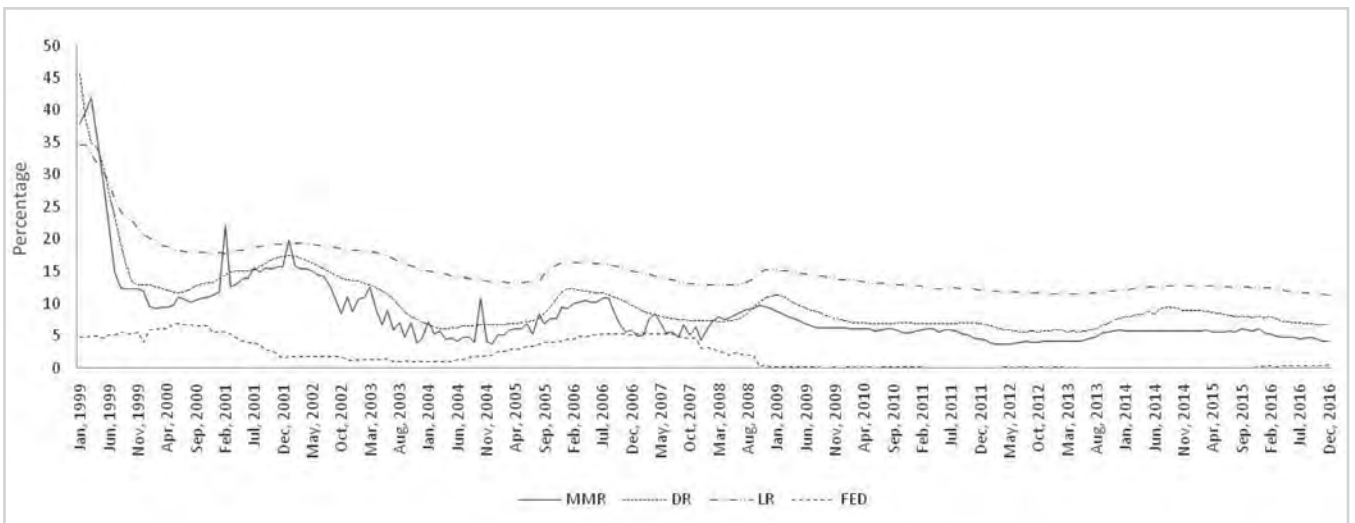
The indicator variables in Equation (6) are:

Fig. 1: **Graph of monthly deposit rate, lending rate, money market rate and U.S. Federal funds rate (percent)**
Source: Census and Economic Information Center (CEIC)

$$M_t = \begin{cases} 1 \ if \ \Delta \hat{\mu}_{t-1} \geq \tau \\ 0 \ if \ \Delta \hat{\mu}_{t-1} < \tau \end{cases} \qquad (7)$$

Based on the indicator rules in Equation (7), when $\Delta \hat{\mu}_{t-1}$ is greater or equal to the threshold value, ρ_1 will be the adjustment value in the MTAR model, while $\Delta \hat{\mu}_{t-1}$ is smaller than the threshold value, ρ_2 is the adjustment value in the MTAR model.

In addition, the Chan (1993) method is adopted in this study with the aim to determine the threshold value and minimum value of the squared terms of residual errors for the TAR and MTAR models. On the other hand, the Akaike Information Criterion (AIC) is used for the optimal lag length (ρ) for the TAR and MTAR models[1].

In the presence of asymmetrical adjustment, Enders and Siklos (2001) further proposed that the estimation of asymmetric error correction models are estimated to capture the short-run and long-run dynamic between the variables of interest. In our case, the models are specified as:

$$\Delta R_t = \theta_0 + \sum_{i=1}^{n} \theta_{1i} \Delta R_{t-i} + \sum_{i=1}^{q} \theta_{2i} \Delta MMR_{t-i} + \sum_{i=1}^{w} \theta_{3i} \Delta FED_{t-i} + Z^+ + Z^- + v_t, \qquad (8)$$

$$\Delta MMR = \phi_0 + \sum_{i=1}^{n} \phi_{1i} \Delta R_{t-i} + \sum_{i=1}^{q} \phi_{2i} \Delta MMR_{t-i} + \sum_{i=1}^{w} \phi_{3i} \Delta FED_{t-i} + Z^+ + Z^- + \varepsilon_t, \qquad (9)$$

$$\Delta FED = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i} \Delta R_{t-i} + \sum_{i=1}^{q} \lambda_{2i} \Delta MMR_{t-i} + \sum_{i=1}^{w} \lambda_{3i} \Delta FED_{t-i} + Z^+ + Z^- + \xi_t, \qquad (10)$$

where $R_t = DR_t$ or LR_t. The formulation of error correction terms are different for the TAR and MTAR specifications. Referring to Equations (3) and (4), the TAR specification of the error correction terms is defined as below:

$$Z^+ = \rho_1 I_t \hat{\mu}_{t-1}, \qquad (11)$$

and

$$Z^- = \rho_2 (1 - I_t) \hat{\mu}_{t-1}. \qquad (12)$$

While referring to Equations (6) and (7), the MTAR specification of the error correction terms is given as:

$$Z^+ = \rho_1 M_t \hat{\mu}_{t-1}; \qquad (13)$$

and

$$Z^- = \rho_2 (1 - M_t) \hat{\mu}_{t-1}. \qquad (14)$$

4. Empirical Findings

As time series data are used in this study, a prior determination of the stationarity properties of the variables is needed in order to proceed to the cointegration test. The Augmented Dickey-Fuller (ADF, Dickey and Fuller, 1981) unit root test and the Kwiatkowski et al. (KPSS, 1992) stationary test are adopted to determine the stationary processes of the time series data employed in this study. From the results[2], we can conclude that at 5% significance level the policy rate and retail interest rates are all integrated in the order of 1 as all the variables are non-stationary in level form but they become stationary after first-differencing.

The long-run parameter estimations of the deposit rate and the lending rate models toward the money market rate and the U.S. federal funds rate in Indonesia are revealed in Table 1.

[1]It is recommended to use AIC and Schwartz Information Criterion (SIC) for lag selection. Liew (2004) showed that the success rate of AIC is consistently higher than SIC in picking up the correct autogressive lag length when sample size ranges from 30 to 240. In this study, we have 216 observations.

[2]To conserve space, the unit root tests results are not reported here. However, the results can be obtained from the authors upon request.

Tab. 1: **The Long-Term Parameter Estimation**

Parameter	d_0	d_1	d_2
DR model	2.405***	0.902***	0.090
LR model	9.543***	0.586***	0.365**

Notes: Asterisks (***) indicate statistically significant at 1% level. The long-run run estimation is based on the following formula: $R_t = d_0 + d_1 \ MMR_t + d_2 \ FED_t + et$, where R_t stands for retail rates.

Source: Own calculations

The estimated d_0 is regarded as the fixed mark-up of the retail interest rates. Meanwhile, d_1 is the degree of the pass-through effect of the money market rate while d_2 represents the impact of the U.S. federal funds rate on Indonesian retail interest rates. The statistical significance of both d_1 and d_2 indicates that the money market rate and the U.S. federal funds rate do have an impact on the lending rate, but for the DR model, d_2 is statistically insignificant. It can be seen from the results that an incomplete pass-through effect is found in both retail interest rates as parameter d_1 for both retail interest rates is less than 1. This finding indicates that the cost of adjustment for the money market rate is not fully and immediately passed-through to the retail interest rates.

As the money market rate and retail interest rates may exhibit an asymmetrical adjustment in interest rate pass-through, the TAR and MTAR tests were carried out in this study. In order to avoid biased results caused by the offset of the money market rate or misplaced of exogenous variables, the relationship between retail interest rates and the money market rate is examined separately. Table 2 provides summary results for the TAR and MTAR tests. The results show that cointegration exists in both the DR and LR models where the null hypothesis of no cointegration is rejected by the significance of ϕ. Since cointegration vectors are found in the money market rate and retail interest rates, we analyse whether the cointegration adjustments are symmetric or asymmetric. Based on the results, the null hypothesis of symmetric adjustment is rejected at the 5% significance level in the DR and LR models. Thus, there is statistical evidence of an asymmetrical adjustment in the deposit and lending rates with respect to monetary policy.

With the preliminary results, an asymmetric error correction model was constructed to capture the short-run and long-run dynamic of the interest rates. Table 3 displayed the results of the asymmetric error correction model with

Tab. 2: **Results of TAR and MTAR Test**

Test	Model	τ	ρ_1	ρ_2	$F(\rho_1 = \rho_2)$	$\phi(\rho_1 = \rho_2 = 0)$
TAR	DR	-0.986	-0.242	-0.657	12.727**	19.042**
	LR	-1.031	-0.077	-0.388	12.263**	11.951**
MTAR	DR	-0.552	-0.188	-0.777	28.114**	27.631**
	LR	-0.200	-0.036	-0.286	9.225**	10.947**

Notes: τ represents threshold value. Asterisks (**) indicate statistically significant at 5% levels. The critical value of ϕ and F is obtained from [1].

Source: Own calculations

the TAR and MTAR specification for the deposit rate, while Table 4 provided the results for the lending rate. The significance of the overall F-statistics in Table 3 and Table 4 reflected that all of the models have predictive power. Moreover, the Box-Pierce Q-statistic test and the Breuch-Godfrey serial correlation LM test indicated that the residuals in each model are free from serial correlation problems.

The error correction terms for ΔDR revealed that the deposit rate has upward rigidity where the adjustment of the deposit rate responds faster when it is above the threshold. However, contrary to the deposit rate, the error correction terms for ΔLR showed downward rigidity in the lending rate. It means that the

Tab. 3: **Coefficients of Asymmetrical Error Correction Models - DR Model**

ECM	Z^+	Z^-	PF_{τ_i}	PF_{ϕ_i}	PF_{β_i}	$Q(4)$	LM	F
TAR-Specification								
ΔDR	−0.113***	−0.089***	29.205***	9.567***	2.616*	0.108	0.070	26.380***
ΔMMR	0.249*	0.691***	4.104**	4.144**	4.925**	0.692	2.000	7.944***
ΔFED	−0.035	0.018	11.949***	1.599	15.265***	0.6498	0.121	4.826***
MTAR-Specification								
ΔDR	−0.090***	−0.069***	76.847***	8.726***	2.358*	0.894	0.480	34.236***
ΔMMR	0.307***	0.851***	11.260***	4.217**	5.732***	1.994	1.741	9.368***
ΔFED	−0.010	−0.009	5.159***	1.069	13.853***	0.758	1.854	4.236***

Notes: Z^+ and Z^- are the asymmetric error correction terms. PF_{τ_i}, PF_{ϕ_i} and PF_{β_i} are the partial F-statistics for lagged values of change in the deposit rate, money market rate and federal fund rate, for Granger-causality test respectively. $Q(4)$ is the Box-Pierce Q-statistic and LM is the Breuch-Godfrey LM test. F-statistics is the overall F-statistics for the respective error correction models. Probability values are reported in brackets. (*), (**) and (***) indicate statistically significant at 10%, 5% and 1% levels, respectively.

Source: Own calculations

Tab. 4: **Coefficients of Asymmetrical Error Correction Models - LR model**

ECM	Z^+	Z^-	PF_{α_i}	PF_{ϕ_i}	PF_{β_i}	$Q(4)$	LM	F
TAR-Specification								
ΔLR	−0.026**	−0.069***	5.829**	3.689**	6.926***	5.651	0.957	19.502***
ΔMMR	−0.031	0.551***	2.792*	10.490***	9.385***	1.226	0.386	7.125***
ΔFED	0.055*	0.093***	11.117***	4.351**	8.136***	0.405	0.057	6.074***
MTAR-Specification								
ΔLR	−0.039***	−0.050***	15.703***	3.543**	4.782***	6.273	1.837	16.698***
ΔMMR	0.069	0.282**	5.468***	15.573***	9.042***	1.625	1.666	6.360***
ΔFED	0.077***	0.052*	10.562***	5.588***	9.730***	0.897	0.487	5748***

Notes: Notes: Z^+ and Z^- are the asymmetric error correction terms. PF_{α_i}, PF_{ϕ_i} and PF_{β_i}, are the partial F-statistics for lagged values of change in the lending rate, money market rate and federal fund rate, respectively. $Q(4)$ is the Box-Pierce Q-statistic and LM is the Breuch-Godfrey LM test. F is the overall F-statistics for the respective error correction models. Probability values are reported in brackets. (*), (**) and (***) indicate statistically significant at 10%, 5% and 1% levels, respectively.

Source: Own calculations

lending rate has a larger response toward the rise of the money market rate and the federal funds rate than the decline in the money market rate and the federal funds rate. From the empirical results, the federal funds rate is found to be weakly exogenous to the deposit rate. The partial F-statistics indicated that both the deposit rate and the lending rate do have a bi-directional Granger-causality toward the money market rate. As for the federal funds rate, a bi-directional Granger-causality was found in the lending rate while only the uni-directional Granger-causality was discovered in the deposit rate.

5. Conclusion

This study has extended the understanding of the interest rate pass-through in Indonesia and identified the evidence of asymmetric behaviour in the banking system. The asymmetric threshold cointegration tests, TAR and MTAR, proposed by Enders and Siklos (2001), as well as asymmetric error correction models, are employed in this study. In order to examine the interest rate pass-through of the money market rate to the banking retail interest rates and the impact of foreign interest rates, monthly data of the money market rate, the U.S. federal funds rate, deposit rates and lending rates covering the period from 1999: M1 to 2016: M12 are obtained.

Despite having an incomplete pass-through process, our findings indicate that the money market rate has a significant impact on deposit and lending rates. The degree of pass-through is stronger on the deposit rate compared to the lending rate. This finding is consistent with the observation of Bruna (2008) who pointed out that deposit rate reacts quicker

than the lending rate to the change of the money market rate. The work of Tai et al. (2012) and Tang et al. (2015) also reported that the deposit rate has a higher degree of pass-through than the lending rate. Our results further show that the U.S. federal funds rate is found to have an impact on the lending rate but not on the deposit rate.

In the analysis of asymmetric threshold cointegration, the deposit and lending rates are found to have a long-run relationship with the money market rate. From the results, we uncover that the adjustments of interest rate toward the path of long-run equilibrium are asymmetric in behaviour. This finding corroborates the ideas of Wang and Thi (2010) Karagiannis et al. (2011) and Ahmad et al. (2013) who suggest that there is an asymmetric adjustment in the pass-through process.

In addition, the deposit rate in Indonesia is found to have upward rigidity, where the deposit rate responds sluggishly to an increase in the money market rate but faster when the money market rate decreases. This finding is similar to those described by Chong (2010) and Holmes et al. (2015). On the other hand, the lending rate in Indonesia is found to have downward rigidity and adjusted faster in an upward direction. This finding is in tandem with the work of Payne and Waters (2008). The evidence from this study suggests that aggregate demand can be more effectively influenced by the deposit rate, as it adjusted faster than lending rate to the change of money market rate. Moreover, when implementing monetary policy, monetary authorities need to be aware of the asymmetric behaviour in interest rates, as this may affect the efficiency of the policy.

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