IJEM
International Journal of Economics and Management
Journal homepage: http://www.ijem.upm.edu.my

Impact of Central Bank Policy on Bank Lending Rate: Developing Nations Evidence

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ABSTRACT

The pass-through of the policy rate to the bank lending rate gauges the effectiveness of monetary policy in stabilizing the economy. This paper investigates how effectively the policy rates pass through to the bank lending rates, and whether the policy rate pass-through is symmetric or asymmetric in two developing nations. The paper applies the momentum threshold auto-regressive and asymmetric error correction models. The results of the latter indicate that the Malaysian and South African commercial banks adjust their lending rates downward but the lending rates seem rigid upward supporting the customer reaction theory. The paper suggests that the speed of monetary transmission is unequal across the banking sectors and that a contractionary monetary policy takes a longer time to impact the economy than an expansionary monetary policy.

JEL Classification: E52, G28 C22

Keywords: Monetary policy; policy rate pass-through; Asymmetric co-integration; Asymmetric error-correction modeling; developing nations

Article history:
Received: 18 June 2018
Accepted: 21 November 2018

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INTRODUCTION

Embedded in the monetary transmission mechanism is the pass-through of the policy rate to the retail rate, and the speed of the pass-through rate indicates the effectiveness of monetary policy (Becker et al., 2012). Monetary policy is effective when changes in policy rate are transmitted to bank lending rates (BLR), subsequently influencing aggregate domestic demand and investment (Apergis et al., 2015; Aristei and Gallo, 2014). Recent recessions in economies worldwide have put monetary policy in a new spotlight. Monetary policy is the first line of defense against economic slowdowns, especially when there is a need to take immediate action to restore stability in the economy (Kaplan et al., 2018; Fiordelisi et al., 2014). However, how fast economic stability is restored depends on the policy rate pass-through to the BLR and the level of financial market development.

The issue of policy rate pass-through to the BLR is important in a developing country such as South Africa and Malaysia because they have experienced financial reforms over the years that could affect the effectiveness of their monetary policy. South African financial reforms have led to an increase in the number of banks and competition between banks as well as other financial intermediaries (South African Reserve Bank, 2013**)**. These financial reforms may affect the efficiency of the banking sector, and influence the effectiveness of monetary policy in stabilizing the economy. Likewise, Malaysia has experienced financial reforms such as financial liberalization over the years. As the World Bank has ascribed importance to the problems and benefits of financial liberalization in the Asia-Pacific region, it is necessary to understand the behavior of BLR in Malaysia using monetary policy to maintain low inflation. Although, the financial environment in Malaysia and South Africa have undergone significant changes, a systematic study of how effectively the policy rates pass through to the bank lending rates and whether the policy rate pass-through is symmetric or asymmetric in both countries is rarely investigated.

The study contributes to the research in the field of monetary policy in two ways. Firstly, we apply Enders and Siklos (2001) momentum threshold autoregressive model to investigate the long-run interest rate pass-through of the MMR to the BLR and the asymmetric adjustments of bank lending rate in two developing nations that are rarely investigated. To our knowledge, Scholnick (1996) and Tai et al. (2012) are the only studies that discussed the pass-through rate among various retail and wholesale rates in Malaysia, but they use a Johansen co-integration. However, Johansen co-integration has low power in making inferences if the bank lending rate shows asymmetric adjustment when policy rate changes (Payne and Waters, 2008). Secondly, the paper conducts a comparative analysis of asymmetric adjustment in the BLR using Malaysian and South African data. We are unaware of prior studies that have conducted a comparative analysis using sample data from countries in two different continents, Asia and Africa. Comparison of these two countries is necessary because they have common monetary policy goal – namely, to keep the inflation rate low – but they apply different intermediate monetary policy targets to keep it low. The asymmetric error correction result indicates that the BLR adjusts downward in South Africa and Malaysia, but the BLR is rigid upward in both countries. The results suggest that the speed of monetary transmission is unequal across the banking sectors and that a contractionary monetary policy takes a longer time to impact the economy than an expansionary monetary policy

The rest of the paper is organized as follows. Section 1 gives the introduction. Section 2 explains the policy rates of the selected countries. Section 3 reviews the literature on the interest rate pass-through. Section 4 describes methodology. Section 5 discusses data and the results, and Section 6 concludes.

POLICY RATE IN MALAYSIA AND SOUTH AFRICA

Overnight policy rate is the official interest rate currently use in Malaysia. Bank Negara Malaysia makes loans to the commercial banks using overnight policy rate. An increase in the overnight policy rate makes it expensive for the banks to borrow money curtailing the bank's lending activities. A decrease in bank lending activities reduces money supply in circulation, and then inflation rate should decline. Conversely, a decrease in overnight policy rate increase the bank lending activities, this increase money supply in circulation, and inflation rate increases (Bank Negara Malaysia, 2013).

Conversely, the repo (repurchase) rate is the official interest rate currently use in South Africa. The South African Reserve Bank uses the repo (repurchase) rate to buy back securities it has previously sold in the money markets. Repo is the rate that central banks lend or discount eligible papers for deposit money banks.

The South African Reserve bank (SARB) raises the repo rate to curb expected inflationary pressure. When the SASRB increases the repo (repurchase) rate, it becomes expensive for the banks to borrow money and the bank lending activities decrease. A reduction in bank lending activities reduces money supply in circulation, leading to a decrease in inflation, and vice versa (South African Reserve Bank, 2013**)**.

Overview of Policy Rate Changes in Malaysia

Malaysia witnesses several interest rate regimes and prior to the liberalization era (Bany-Ariffin et al., 2016), monetary policy was conducted using direct control measures. The base lending rate framework was introduced in 1983, and banks quoted rates based on their bank lending rate which reflects costs of funds. This base lending rate framework was revised several times in subsequent years. In 1987, a variant of the base lending rate followed a two-lead bank system where each bank lending rate is expected not to deviate much in percentage terms from those of the two lead banks. A more liberalized framework was adopted in 1991 and bank lending rate was directly linked to bank's costs of funds. In subsequent years, the bank lending rate was directly linked to the daily average 3-month interbank rate but the transition effect was slow because the formula for computing the bank lending rate uses averaging technique. The drawback of averaging technique was improved upon in 1998 and since then, the 3- month intervention rate was used as the anchor rates for computing the bank lending rate. At the moment, overnight policy rate which is based on market mechanism, has replaced the 3-month intervention rate. The advantage of using the overnight policy rate as a monetary policy tool is that it has minimal expectation content and high degree of controllability (Zulkhibri, 2012).

Overview of Policy Rate Changes in South Africa

The South African Reserve Bank (SARB) uses different policy instruments to effectively influence interest rate or quantity of money supply. Unlike the direct measures applied in earlier years, SARB emphasis is now on market-oriented policy measures seeking to encourage financial institutions to take certain actions on a voluntary basis. A good example of such a policy instrument is repo (repurchase) rate. The repo rate is the rate that the South African Reserve Bank grants assistance to the banking sector and therefore it represents costs of credit to the banking sector. Changes in repo rate change the interest rates on overdrafts and other loans extended by the banks. In this way, the SARB indirectly affects the interest rates in the economy (South African Reserve Bank, 2013). Before the deregulation era of the late 1980's, SARB conducted monetary policy using direct control measures. Extensive controls of the 1970's period slow down financial markets development and the financial intermediation were adversely affected. After the deregulation era, SARB used the money supply targeting but targeting money supply became very difficult due to financial liberalization, and the increasing openness of the capital account.

Between 1990 and 1995, the SARB shifted to monetary policy guidelines and adopted eclectic monetary policy approach which supplements the money supply guidelines by a set of indicators which include asset prices, exchange rates, balance of payments, output gap, wage settlements, fiscal stance, and total credit extension (Aziakpono and Wilson, 2010). Attempting to make monetary policy more flexibility, the South African Reserved Bank introduced repo (repurchase) rate system in March 1998, and adopted informal inflation targeting. From February 2000 to date, the SARB conducted monetary policy using the repo rate, and adopted formal inflation rate targeting. SARB adopts the repo (repurchase) system because it improves safety, efficiency and flexibility of liquidity management (Aziakpono and Wilson, 2010). The limitation of the repo system is that if the commercial banks purchase securities using their excess reserve, the bank lending power may not decrease. As a result, the effectiveness of contractionary monetary policy may be affected. Malaysia and South Africa use different monetary policy tools but they have common monetary policy goal to maintain low inflation. Moreover, the two countries have common motivation to strengthen the effectiveness of their monetary transmission mechanism.

LITERATURE REVIEW

A high interest rate pass-through signals a closer link between policy rate or money market rate and bank lending rate. Also, a high pass-through from the money market rate to the bank lending rate indicates that the

banking system is efficient and the monetary policy is effective (Fuertes et al., 2010). The effectiveness of monetary policy on the economy has received wider interest among monetary economists and policy-makers in recent times (Martin and Milas, 2013). Bank lending rate may respond to changes (increase or decrease) in policy rate asymmetrically (Leuvensteijn et al., 2013). Two competing theories- the collusive behavior of banks and customer reaction theory explain the asymmetric adjustment of interest rate.

The customer reaction theory is related to the reaction of borrowers to policy rate changes. The theory states that banks that operate in a highly competitive environment may not increase the lending rate because they fear negative reactions from customers. The customer reaction theory suggests that lending rates will be rigid upward with an increase in the policy rate (De Bondt, 2005). Conversely, the collusive behavior theory is related to the degree of competition among banks and the level of concentration of the retail market. The theory states that banks may not decrease lending rates because they do not want to disrupt their collusive arrangement. The collusive behavior theory suggests that lending rates would be rigid downward following a decrease in the policy rate. (De Bondt, 2005).

Other related theories that explain asymmetric adjustment of interest rates are adverse selection theory and consumer behavior theory. The consumer behavior theory put emphasis on the degree of consumer sophistication regarding the financial markets and the search and switching costs of alternative sources of financing. A high proportion of uninformed consumers compare to informed consumers together with the switching and search costs give banks more market power to adjust interest rates to their advantage. Like the collusive behavior theory, the consumer behavior theory suggests that bank lending rate is rigid downward (Stiglitz and Weiss, 1981). Conversely, the adverse selection theory postulates that information asymmetry creates an adverse selection problem in the loan markets because high interest rates attract riskier borrowers (Stiglitz and Weiss, 1981). As a result, banks are reluctant to increase their lending rates and ration credit to prevent loan default by riskier borrowers. Like the customer reaction theory, the adverse selection theory suggests that bank lending rate is rigid upward.

The theories above are commonly used to interpret empirical findings on the interest rates pass-through and adjustment process. Following Hannan and Berger (1991) and Neumark and Sharpe (1992) that focus on interest rate adjustment in the United States banking industry, there have been rapid growth of empirical studies that examine the degree of interest rates rigidity and their asymmetric adjustment (e.g. Horvath et al., 2018; Borio and Gambacorta, 2017; Apergis et al., 2015; Tai et al., 2012; Kwapil and Scharler 2010; Wang and Lee 2009; Marotta, 2009; Liu et al., 2008; Egert et al., 2007). However, empirical evidence from these literatures remains inconclusive. Firstly, most studies report slow and incomplete interest rates pass-through. Secondly, significant differences exist in the interest rates pass-through across countries and over time. Third, there is variation in interest rates pass-through depending on the type of interest rate use to conduct the research.

Borio and Gambacorta (2017) analyse the effectiveness of monetary policy on bank lending in a low interest rate environment. Using 108 large international banks, the analysis suggests that monetary policy is less effective in stimulating bank lending growth when interest rates reach a very low level. The results remain unchanged after controlling for financial cycle and business conditions, and different bank-specific characteristics (e.g. liquidity, capitalization). The findings show that the impact of low interest rates on the profitability of bank's intermediation function helps explain the subdued evolution of lending in the period 2010–2014. Recently, Horvath et al. (2018) examine interest rate pass-through in the euro area and investigate the effects of financial market fragmentation, European Central Bank balance sheet policies and negative rates on the nature of pass-through. Applying heterogeneous panel co-integration methods and bank interest rates for four different loan categories. The results reveal that interest rate pass-through is complete only for small firm loans. But incomplete for large firms, consumers and housing loans categories. Lower financial market fragmentation reduce lending rates. Moreover, they find no evidence that bank interest rates become less responsive to market rates when market rates became negative.

Holton and Rodriguez d'Acri† (2018) use individual bank data for twelve euro area countries covering almost a decade since the start of the crisis; they identify the balance sheet characteristics that contributed to fragmentation in the transmission of monetary policy and heterogeneity in interest rate pricing within countries. Interest rate pass-through heterogeneity is estimated using an error correction framework, and includes standard bank-specific characteristics (e.g. size, capital and liquidity, funding access, risk and asset quality). Results show incomplete pass-through of changes in money market rates to bank lending rates, and

market concentration is associated with smaller reductions in lending rates. With regard to bank characteristics, asset impairment leads to a significant decrease in interest rate pass-though. Bank size and reliance on central bank funding affect interest rate pass-through for smaller loans, while capital is more significant for larger loans.

In an earlier study, Kwapil and Scharler (2010) conduct a comparative analysis of the interest rate pass-through from money market rate to bank lending rates in the United States and the Euro area using monthly data and Engel-Granger co-integration as well as autoregressive distributed lag methodology. The authors' empirical findings reveal that interest rate pass-through is faster in the United States than the European countries. Likewise, Wang and Lee (2009) apply asymmetric co-integration test in their study. They argue that differences exist in the degree of interest rates pass-through between deposits and bank lending rates in nine Asian countries and the United States. They document an asymmetric adjustment in bank lending rates for three out of ten countries. Wang and Lee (2009) empirical findings reveal that there is complete pass-through in the United States deposit rate, but the lending rates in Hong Kong, Philippines, and Taiwan are rigid downward.

On the issue of asymmetric interest rate pass through, Aristei and Gallo (2014) analyse the asymmetric interest rate pass-through between interbank and retail bank rates in the Euro area. They apply Markov-switching vector autoregressive model and their empirical findings indicate that during periods of financial distress, the degree of pass-through from the money market rate to bank lending rates (to both households and non-financial corporations) reduces. Aristei and Gallo (2014) findings support asymmetric pass-through where rates on loans to non-financial firms appear more affected by changes in the money market rate than loans to households. Similarly, Marotta (2009) investigates nine European countries and the United Kingdom. Marotta confirms asymmetric adjustment in only Netherlands and France. Liu et al. (2008) apply Engel-Granger co-integration and autoregressive regressive distributed lag, in New Zealand. They find weak evidence of interest rate pass-through but short-term rate has the highest degree of pass-through and faster degree of adjustment than long-term rate.

Turning to few studies conducted in developing countries, Tai et al. (2012) examine the effectiveness of interest rate pass-through from the money market rates to the retail rates in Asian countries. The results show no differences between the money market pass-through rate into deposit and lending rates, but the money market rate pass-through into deposit rate is marginally higher compared to the bank lending rate. Additionally, adjustment rates are slower in most Asian countries after the Asian 1997 financial crisis (Tai et al., 2012). Within an asymmetric interest rate pass-through framework, Charoenseang and Manakit (2007) report lower and incomplete pass-through in all interest rates in Thailand, but the pass-through rate from inter-bank rates to lending rate is complete. Moreover, their results reveal absence of a significant asymmetric adjustment but short-term deposit rates and short-term lending rate show downward rigid when money market rate increases.

Asymmetric interest rate pass-through is rarely investigated in Africa. However, Jankee (2004) applies momentum threshold autoregressive and threshold autoregressive models with monthly data and their results indicate presence of asymmetric adjustment and the bank lending rate is rigid upward in Mauritius. Precisely, the bank lending rate slowly adjust following an increase in the money market rate, but it adjusts faster when the money market rate decreases. De Angelis et al. (2005) applies Engel-Granger (1987) and error correction modeling to investigate the interest rates pass-through but their focus is on the relationship between wholesale interest rate and money market rate, and there is no attempt to explore whether the bank lending rate respond asymmetrically to changes in policy rate. Our study allow for asymmetric adjustment in South African bank lending rate. Moreover, unlike prior studies, we compare South Africa and Malaysia. These countries both use monetary policy to keep inflation low, but use strategy unique to each country.

In prior studies (Tai et al., 2012; Wang and Thi, 2010; Wang and Lee, 2009; Payne and Waters 2008), the bank lending rate adjust faster when there is an increase than when there is a decrease in the policy rates. In other words, bank lending rate is rigid downward when policy rate or money market rate decreases. Asymmetric adjustment of the bank lending rate is determined by a number of factors such as adjustment costs and uncertainty conditions about the future market (Becker et al., 2012).

METHODOLOGY

Prior to testing for co-integration, the bank lending rates and money market rates should be integrated of order one. Augmented Dickey-Fuller (ADF) and Philip-Perrons (PP) unit roots test are used to determine the stationary of the two variables. If we cannot reject the null hypothesis of a unit root at level, then we test whether the variables are stationary at first difference. When null hypothesis is rejected after taking first difference, the corresponding variable is said to be integrated of order one, that is I (1).

Asymmetric Co-integration Test Using Zero Threshold and Consistent Threshold Procedure

The linear co-integration and error correction model (ECM) are traditional methods to test for long-run and short-run relationships. The above mentioned methods only capture linear relation between variables, but they ignore the nonlinear relation between the policy rate or money market rate and the bank lending rate (Enders and Siklos, 2001; Payne and Waters, 2008). Thus, the linear methods are unable to explain the asymmetric adjustment process of the interest rates in the short-run. Recently developed methods (e.g. threshold autoregressive and momentum threshold autoregressive) now capture and explain interest rates asymmetric adjustment process. These methods have been applied by influential studies (e.g. Becker et al., 2012 and Wang and Lee, 2009). These methods are suitable techniques to determine how effectively the money market rate (MMR) pass-through to the bank lending rate (BLR) and they capture both exogenous and endogenous threshold values. One of the main advantages of the threshold techniques is that bank lending rate are allowed to respond differently to positive and negative disequilibrium changes in the policy rate or money market rate (Enders and Siklos, 2001; Becker et al., 2012).

The conventional test of co-integration in Engel and Granger (1987) is residual-based test and it assumes symmetric adjustment in the long-run. The Engel and Granger two step procedures is the simplest co-integration test for a bivariate model. The co-integrating regression or the degree of interest rate pass through in the long-run between the bank lending rates and the money market rates can be expressed as:

$$BLR_t = +\beta_1 + \beta_2 MMR_t + \mu_t \tag{1a}$$

$$\Delta\mu_t = \rho\mu_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta\mu_{t-1} + \varepsilon_t \tag{1b}$$

Where BLR is the bank lending rate and MMR is the money market rate. The error term is μ_t. Before conducting co-integration test, the papers extract residuals (μ_t) after running a static OLS regression on Equation (1a), in the first step. In the second step, stationary test is performed on the residuals, using Augmented Dickey Fuller (1979) test run on Equation (1b). For the two variables to be co-integrated, the residuals must be stationary and $\beta_1 \neq 0$.

Linearity and symmetric adjustments of the bank lending rate to positive and negative deviation from the equilibrium are the implicit assumption in tests of unit roots in Equation 1b, but asymmetric adjustment may exist. Enders and Siklos (2001) threshold autoregressive and momentum threshold autoregressive (M-TAR) models modify the Engel and Granger (1987) method and they have good power and size properties relative to the assumption of symmetric adjustment. Within the asymmetric adjustment method, two partitions are established for the residuals classifying them as above threshold and below threshold (Enders and Siklos, 2001). Our study allows asymmetric adjustment in the residuals following Enders and Siklos (2001) and specifies the equation below:

$$\Delta\mu_t = I_t\rho_1 + (1 - I_t)\rho_2\mu_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta\mu_{t-1} + \varepsilon_t \tag{2}$$

In order to determine the above and below threshold (τ), a dummy variable called Heavy side indicator function is used, where,

$$T_t = \begin{cases} 1 & \text{if } \mu_{t-1} \geq \tau \\ 0 & \text{if } \mu_{t-1} < \tau \end{cases} \quad (3a)$$

$$M_t = \begin{cases} 1 & \text{if } \Delta\mu_{t-1} \geq \tau \\ 0 & \text{if } \Delta\mu_{t-1} < \tau \end{cases} \quad (3b)$$

Equation 2 and 3a develop the threshold autoregressive model (TAR) while Equation 2 and 3b develop the momentum threshold autoregressive Model (M-TAR). The TAR model captures the deviation from the equilibrium in level while M-TAR captures accumulation of change in the deviation. The M-TAR model is more important when the adjustment exhibits more momentum in one direction (Payne and Waters, 2008). The models above assume that threshold value (τ) is known but it is estimated by a grid search (Enders and Siklos, 2001). Firstly, the residuals from the TAR (μ_t) and M-TAR ($\Delta\mu_t$) model are sorted in sequence, in an ascending order. Secondly, to ensure that there are reasonable numbers of observations in each regime, each (μ_t) that falls between the highest 85 percent and the lowest 15 percent of the series are selected as potential threshold. Third, our paper runs regression on Equation (2) and uses each (μ_t) as a potential value of the threshold. Lastly, the value that has the lowest residual sum of squares is chosen as consistent estimate of the threshold. M-TAR model is our choice model of analysis and upon confirmation of asymmetric co-integration; we apply it to estimate asymmetric error correction models for bank lending rates. If $\Delta\mu_{t-1}$ is above the threshold, the adjustment coefficient is $\rho_1 \mu_{t-1}$, and if μ_{t-1} is below the threshold, the adjustment coefficient is $\rho_2 \mu_{t-1}$. The M-TAR model null hypothesis of no co-integration is $\rho_1 = \rho_2 = 0$ while the null hypothesis of symmetry is $\rho_1 = \rho_2$.

EMPIRICAL RESULTS

Data

The Malaysian monthly data starts from January 1997 to December 2012 due to data availability. The sample consists of South African bank lending rate (BLR) and money market (MMR) rate monthly data from January 1978 to December 2012. The data sources for the analysis were obtained from DataStream and Bank Negara Malaysia. The sample years cover interest rate liberalization period in the selected countries. The countries are chosen because they have a similar monetary policy goal to keep the inflation rate low. The BLR data is the rates the banks charge on loan to customers (Becker et al. 2012). The money market rate is chosen because policy rate changes affect money market rate, then bank lending rates. Therefore, the effects of changes in money market rate are more closely related to bank lending rate.

The results of the unit root tests are presented in Table 1A. The order of the lag length in Augmented Dickey-Fuller (ADF) test is selected by Schwarz Info Criteria (SIC). The results of the ADF and PP unit root tests are consistent where we fail to reject the null hypothesis at level. However, all the variables are stationary after first differencing where we reject the null hypothesis at the 1 % significance level. Thus, all the variables are integrated of same order one - that is I (1) and this permit us to proceed with co-integration test.

Table 1A Unit root tests: South Africa and Malaysia

	South Africa		Malaysia	
Variables	ADF – C + T	PP – C + T	ADF – C + T	PP – C + T
BLR	-1.447	-1.525	-2.204	-2.035
ΔBLR	-62.541***	-62.622***	-7.940***	-8.061***
MMR	-2.123	-1.806	-1.968	-2.348
ΔMMR	-54.667***	-55.196***	-5.900***	-35.247***

Note: For ADF test, Schwarz Info Criteria (SIC) are used to select the optimal lag length. For PP test, Barlett Kernel is used as the estimation method. The bandwidth is selected using the Newey-West method. ADF – C + T = ADF test with constant and Trend and PP – C + T = PP test with constant and Trend. *** indicates significant at the 1 % level.

The Augmented Dickey Fuller tests of the residual from the regression of the bank lending rates (BLR) on money market rate (MMR) are contained in Table 1B. The null of no co-integration can be rejected at the 1% level. The slope coefficient is significantly less than 1 and the results indicate a high, but incomplete pass through from the money market rates (MMR) to the bank lending rates (BLR) in Malaysia and South Africa. Then, the residuals in Equation (1a) are examined with ADF stationary test excluding intercept and trend. The ADF unit root test on the residuals from the co-integrating equation is significant at 1% level (i.e. the residual is stationary) for both countries. Our results are consistent with Wang and Lee (2009) that report high but incomplete interest rates pass-through for the USA and nine Asian countries. Conversely, our result is inconsistent with Charoenseang and Manakit (2007) that report low and incomplete pass-through in all interest rates except the interbank rates where the pass-through is complete in Thailand.

Table 1B Symmetric Co-integration results

	Malaysia	South Africa
Constant	3.319*** (24.414)	3.677*** (39.87)
MMR	0.929*** (29.354)	0.748*** (74.56)
K	1	3
ADF-test on residual	-2.680***	-2.449***

Note: For ADF test, Schwarz Info Criteria (SIC) is used to select the optimal lag length (K). Numbers in parenthesis are test statistics. K*** indicates significance at 1% level.

The main focus of the paper is on asymmetric co-integration results. Table 2A and 2B reports the results of the threshold autoregressive (TAR) model and the momentum threshold autoregressive (M-TAR) model for South Africa and Malaysia respectively. The TAR and M-TAR models allow for asymmetric adjustment which is more realistic. The paper uses the maximum lag automatically selected by the system. Moreover, the Monte Carlo experiment is used to search for the critical value of 5%.

For South Africa, the TAR model with zero threshold value, the value of Φ is (25.331) which is greater than (5.484) at 5% critical value. Similarly, for Malaysia, the TAR model with zero threshold value, the value of Φ is (6.023) which is greater than (5.440) at 5% critical value. Hence, the paper rejects the null hypothesis of no co-integration. Given that the bank lending rate and the money market rate are co-integrated, the paper tests for symmetric adjustment ($\rho_1 = \rho_2$). However, for South Africa, F-equality statistics (0.330) is less than (2.176) at 5% critical value, therefore the paper cannot reject the null of symmetric adjustment. Conversely, for Malaysia, F-equality statistics (3.531) is greater than (2.776) at 5% critical value. Thus, the paper rejects the null of symmetric adjustment. For the TAR consistent model, the threshold value are (0.032) and (0.77) for South Africa and Malaysia respectively. The value of Φ (25.358) is greater than (7.539) at 5% critical value, in South Africa. Similarly, the value of Φ (7.835) is greater than (7.359) at 5% critical value, in Malaysia. Thus, the paper rejects the null hypothesis of no co-integration. Given that the bank lending rate and the money market rate are co-integrated, the paper tests for symmetric adjustment ($\rho_1 = \rho_2$). The F-equality statistics (0.385) is less than the critical value (7.278) at 5% in South Africa and the F-equality statistics (5.112) is less than the critical value (6.048) at 5% in Malaysia. Thus, the paper cannot reject the null hypothesis of symmetric adjustment (See Table 2A) for South Africa. Similarly, the paper cannot reject the null hypothesis of symmetric adjustment for Malaysia (See Table 2B)

We turn to the momentum threshold autoregressive (M-TAR) model with zero threshold value, the value of Φ (36.337) is greater than (6.308) at 5% critical value provided by Monte Carlo simulation in South Africa, and the value of Φ (6.825) is greater than (5.459) at 5% critical value provided by Monte Carlo simulation in Malaysia. Similarly, in the M-TAR consistent model, the value of Φ (36.788) is greater than the critical value (7.529) provided by Monte Carlo simulation at 5% in South Africa, and the value of Φ (12.049) is greater than the critical value (8.341) provided by Monte Carlo simulation at 5% in Malaysia. Hence, the paper rejects the null hypothesis of no co-integration.

Referring to F-equality statistics, the M-TAR consistent F-statistics (22.699) exceed F-critical value (7.822) at the 5 % level, in South Africa and the M-TAR consistent F-statistics (19.173) exceed F-critical value (8.918) at the 5 % level in Malaysia. Likewise, the M-TAR with zero thresholds F-statistics (22.062) exceeds the F-critical value (3.832) at the 5 % level in South Africa, and the M-TAR with zero thresholds F-statistics (5.094) exceeds the F-critical value (3.581) at the 5 % level in Malaysia. Thus, the null hypothesis of symmetric adjustment is rejected at the 5 % level. The results indicate that bank lending rates (BLR) and

money market rates (MMR) are co-integrated and the adjustment process is asymmetric in Malaysia and South Africa. The M-TAR consistent is the main estimation results and it shows that bank lending rate adjust faster (in absolute term) when it is below the equilibrium level in South Africa while bank lending rate adjusts downward in Malaysia.

Table 2A Estimates of TAR and M-TAR co-integration for South Africa

	TAR (zero)	TAR-consistent	M-TAR(zero)	M-TAR-consistent
ρ_1 [b]	-0.051(-3.656)	-0.051(-3.620)	-0.050(6.028)	-0.051 (-6.033)
ρ_2 [b]	-0.060(-6.555)	-0.061(-6.575)	-0.158 (6.924)	-0.159 (-6.927)
τ [c]	0	0.032	0	0.089
F-joint stat. (Φ)	25.331** [5.484]	25.358** [7.539]	36.337** [6.308]	36.788** [7.529]
F-equal:	0.330 [2.176]	0.385 [7.278]	22.062** [3.832]	22.699** [7.822]

Note: [b] indicates the value of ρ. ** indicates significance at 5% and numbers in parenthesis are test statistics. Numbers in brackets are simulated critical values obtained from Monte Carlo simulation. [C] indicates the threshold value of τ.

Table 2B Estimates of TAR and M-TAR co-integration for Malaysia

	TAR (zero)	TAR-consistent	M-TAR(zero)	M-TAR-consistent
ρ_1 [b]	-0.195(-2.781)	-0.198(-2.931)	-0.229(-3.058)	-0.463 (-4.829)
ρ_2 [b]	-0.019 (-0.225)	-0.024 (-0.261)	-0.087 (-0.133)	-0.003 (-0.052)
τ [c]	0	0.770	0	0.090
F-joint stat. (Φ)	6.023 [5.440]	7.835 [7.359]	6.825** [5.459]	12.049** [8.341]
F-equal:	3.531 [2.776]	5.112 [6.048]	5.094** [3.581]	19.173** [8.918]

Notes: [b] indicates the value of ρ. ** indicates significance at 5% and numbers in parenthesis are test statistics. Numbers in brackets are simulated critical values obtained from Monte Carlo simulation. [C] indicates the threshold value of τ.

Given the existence of co-integration between the bank lending rate (BLR) and money market rate (MMR) and asymmetric adjustment within the M-TAR consistent models for South Africa and Malaysia, the paper conducts asymmetric error correction model to capture the short-run and long run dynamics. The models below are specified:

$$\Delta BLR_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i \Delta BLR_{t-i} + \sum_{i=1}^{q} \gamma_i \Delta MMR_{t-i} + I_t \rho_1 \mu_{t-1} + (1 - I_t)\rho_2 \mu_{t-1} + \varepsilon_{1t} \quad (4)$$

$$\Delta MMR_t = \lambda_0 + \sum_{i=1}^{n} \lambda_i \Delta BLR_{t-i} + \sum_{i=1}^{q} \phi_i \Delta MMR_{t-i} + I_t \rho_1 \mu_{t-1} + (1 - I_t)\rho_2 \mu_{t-1} + \varepsilon_{2t} \quad (5)$$

Where ε_{1t} and ε_{2t} are I.I.D $(0, \partial^2)$, $\mu_{t-1} = BLR_{t-1} - (\hat{\alpha}_0 + \hat{\beta}_1 MMR_{t-1})$ and I_t takes the form given in equation 3b. With respect to equation 4, if the bank lending rate is above the threshold value following a decrease in the money market rate, then the bank lending rate adjusts by ρ_1. Conversely, if the bank lending rate is below the threshold value following an increase in the money market rate, then the bank lending rate adjusts by ρ_2. Our paper assumes that the money market rate is exogenous to the lending rate but this assumption is valid if the asymmetric error correction terms in Equation 5 are each statistically insignificant. Table 3A and 3B summarize the results of the asymmetric error correction models.

Durbin Watson (DW) statistics and Q-statistics, for higher order lags up to 4, indicate absent of serial correlation in the residuals and both statistics show evidence of predictive power because the overall F-statistics are statistically significant. Moreover, the money market rate is regarded as weakly exogenous because the error correction terms in equation 5 are statistically insignificant. The test-statistics of the error correction term in equation 4 reveals that the bank lending rate (BLR) only responds faster to a decline in the money market rate (MMR) in Malaysia. Likewise, bank lending rate responds faster to a decline in the money market rate in South Africa. Therefore, the South African results (Table 3A) and Malaysian results (Table 3B) are inconsistent with some empirical findings in the literature that bank lending rates exhibit downward rigidity. However, the result is consistent with Jankee (2004) findings that bank lending rates show

asymmetric adjustment because bank lending rates exhibit upward rigidity when there is an increase in the money market rates, but it adjusts faster following a decrease in the money market rates in Mauritius.

South Africa and Malaysia empirical results support the customer reaction theory which states that banks operating in a highly competitive environment are unable to increase the lending rate because they fear negative reactions from their customers. The customer reaction theory suggests that lending rates will be rigid upward with an increase in the policy rate (De Bondt, 2005). Similarly, the adverse selection theory postulates that information asymmetry creates adverse selection problems in lending markets because high interest rate attracts riskier borrowers (Stiglitz and Weiss, 1981). Consequently, banks avoid increasing lending rate and ration credit to prevent riskier borrowers from loan default. Like the customer reaction theory, the adverse selection theory suggests that bank lending rate is rigid upward.

The South African banking has undergone tremendous changes over the last two decades. But the South African banking system is well developed, very competitive, and compares favorably with many industrialized countries as the World Economic Forum (WEF) Competitiveness Survey 2012/2013 ranks South Africa 2nd out of 144 countries. Moreover, there are large number of foreign banks establishing branches or representative offices in South Africa and others acquiring stakes in major banks such as the Industrial and Commercial Bank of China, Standard Bank and Barclay. Legislation, technology, products and the number of participants have changed the banking sector and injected high levels of competition. Thus, the banking sector has become more competitive (Banking Association of South Africa, 2012). This increasing level of competition may partly explain why the lending rates appear rigid upward. Similarly, Malaysian banking industry went through significant changes over the past two decades resulting in mergers of some banks but the banking industry remains competitive. There is presence of foreign banks competing freely with the domestic banks (Rahim et al., 2011). The increasing level of competition in both the Malaysian and South African banking industries may partly explain why the lending rates appear rigid upward.

Table 3A Asymmetric error correction using M-TAR consistent model (South Africa)

	ρ_1	ρ_2	DW	Q-statistics	F-statistics
Equation 4					
ΔBLR	-0.0600**	-0.0301	2.0442	[0.36]	22.528
	(-2.9590)	(-1.1890)			[0.0000]
Equation 5					
	-0.0351	-0.0020	2.0101	[0.18]	10.147
ΔMMR	(-1.6903)	(-1.5300)			(0.0000)

Note: ** indicates significance at 5%. T-test statistics are reported in parenthesis while p-value of the F-test statistics is in brackets. DW is Durbin Watson statistics under the null hypothesis of no serial correlation in the residuals. Q-statistics are the Correlogram Q-statistics to test for serial correlation up to 4 lags, under the null hypothesis of no serial correlation in the residuals.

ρ_1 and ρ_2 are speeds of adjustment to long-run equilibrium. They are both insignificant in equation 5 as expected indicating that the money market rate is exogenous to the bank lending rate.

Table 3B Asymmetric error correction using M-TAR consistent model (Malaysia)

	ρ_1	ρ_2	DW	Q-statistics	F-statistics
Equation 4					
ΔBLR	-0.0610**	-0.0080	2.020	[0.54]	13.872
	(-2.43)	(-0.607)			[0000]
Equation 5					
	0.0070	0.0120	2.097	[0.39]	11.837
ΔMMR	(0.075)	(0.054)			(0.000)

Note: ** indicates significance at 5%. T-test statistics are reported in parenthesis while p-value of the F-test statistics is in brackets. DW is Durbin Watson statistics under the null hypothesis of no serial correlation in the residuals. Q-statistics are the Correlogram Q-statistics to test for serial correlation up to 4 lags, under the null hypothesis of no serial correlation in the residuals.

ρ_1 and ρ_2 are speed of adjustment to long-run equilibrium. They are both insignificant in equation 5 as expected indicating that the money market rate is exogenous to the bank lending rate.

CONCLUSION AND POLICY IMPLICATION

The paper is unaware of a study that compares asymmetric adjustments in bank lending rate (BLR) to changes in money market rates (MMR) using sample data from two different continents, Asia and Africa. The asymmetric error correction results show that BLR responds faster to a decrease in the MMR in both Malaysia and South Africa, but the BLR does not respond to an increase in the MMR suggesting that commercial banks are rigid to adjust their lending rates upward in both countries. These findings support the customer reaction theory. The evidence of upward rigidity in bank lending rates found in our results is due to the increasing level of competition in both the Malaysian and South African banking industry. These findings are important because recent literature, especially in developed countries, is focusing on asymmetric behavior of various retail rates. Studies have shown that it is important to model asymmetric behavior of retail rates in order to gauge the effectiveness of monetary policy to stabilize the economy.

The finding of this paper, hence, has important implications for the conduct of monetary policy. Firstly, it implies that the speed of monetary transmission is not uniform across the banking sectors of the economy and that a contractionary monetary policy takes longer time to impact the economy than an expansionary monetary policy. Secondly, upward rigidity in the bank lending rates is consistent with the prediction of the credit rationing hypothesis cited in the Stiglitz and Weiss (1981) asymmetric information model. Upward rigidity in bank lending rates suggest that commercial banks in both countries are unable to raise their lending rates following an increase in the policy rate or money market rate.

Consequently, one of the options open to the commercial banks in both countries is credit rationing where borrower with good credit history and less information asymmetry problems are mostly likely to obtain bank credit. Therefore, the study suggests more transparency and further development of the Malaysian and South African banking system to reduce information asymmetry in the loan markets. If the information asymmetry costs are low, banks may be willing to raise their loan rates significantly over a short period of time. Third, in order to enhance the effectiveness of monetary policy and achieve monetary policy goal, the study suggests the need for more competition in the bank markets. One would expect that the higher the degree of competition, the higher is the bank efficiency in terms of allocating funds and acting as an intermediary between depositors and borrowers.

The study contributes to the monetary policy research in the following ways: firstly, we apply Enders and Siklos (2001) momentum threshold autoregressive model to investigate the long-run interest rate pass-through of the MMR to the BLR and the asymmetric adjustments of the bank lending rate in two developing nations that are rarely investigated. Secondly, the paper conducts a comparative analysis of asymmetric adjustment in the BLR using Malaysian and South African data. We are unaware of prior studies that have conducted a comparative analysis using sample data from countries in two different continents, Asia and Africa. Future research could examine the interaction between the various interest rates and their response to changes in policy rates.

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