

# ASYMMETRIES IN RESPONSES OF COMMERCIAL BANKS IN A TRANSITIONAL ECONOMY TO COUNTERCYCLICAL MONETARY POLICY: THE CASE OF ROMANIA

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## ABSTRACT

The empirical results of this study reveal the following interesting characteristics of the Romanian banking sector over the December 1993 through August 2017 period. First, the spread between the lending-Central Bank's discount rates was stable and adjusted to its long-run threshold asymmetrically. Second, lending institutions respond faster to contractionary than expansionary countercyclical monetary policy actions. This empirical finding suggests that Romanian commercial banks exhibit predatory rate setting behavior, which is consistent with those of their counterparts in advanced and emerging economies. Third, lending institutions respond to countercyclical monetary policy and the Romanian Central Bank authority effectively utilizes monetary policy to manage the economy as evidenced by the short-run dynamic and long-run Granger-causality from the discount rate to the banks' lending rate. With respect to the time lags of the Romanian monetary policy found within the banking sector, the empirical results suggest that it takes almost two years for the lending rate to adjust to a monetary policy action completely.

**Keywords:** Asymmetry, Countercyclical monetary policy, Commercial banks' lending rate, Central Bank's discount rate, Commercial banks' lending-Central Bank's discount rate spread, Time lag, Romania.

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## INTRODUCTION

The cyclical fluctuations associated with economic activities have contributed to periodic changes in unemployment and inflation rates as

well as balance of payment disequilibria (Gbosi, 2001). Domestically, fluctuations in investment and consumption patterns, improper implementation of public policies, and changes

in expectations for policy outcomes are the factors responsible for economic instability. Externally, war and social upheaval, population growth and migration, and the accelerating rate of technological transfer are the factors, which have been found to negatively affect economic stability.

Keynes (1936) argued the market forces of supply and demand cannot restore these macroeconomic variables back to their long-term trends. Economic authorities should use countercyclical monetary and fiscal policy instruments to manage their economies. Fiscal policy is to use taxation and spending powers of the governments to influence the economy, while monetary policy is to manipulate interest rates or the money supply to achieve macroeconomic objectives. Even though monetary and fiscal policies have differing effects, both can be used simultaneously to ensure economic stability and other macroeconomic objectives.

Since its inception, Keynesian fiscal policy has played a critical role in the macroeconomic stabilization of market economies. Changes in international economic conditions the 1960s resulted in persistently significant government budget deficits in the international economies. Mishkin (1995) argued that concerns over persistent budget shortfalls and rising deficits, and growing doubts about the effectiveness of fiscal policy in stabilizing economic outcomes caused fiscal policy to lose its dominant role. Consequently, monetary policy has been largely utilized in the stabilization of output and inflation.

Additionally, Bernanke and Gertler (1995) articulated that monetary policy can affect the real macroeconomic variables. In this context, Romer and Romer (1990), Bernanke and Blinder (1992), and Christiano, Eichenbaum, and Evans (1994) empirically confirmed earlier findings by Friedman and Schwartz (1963) that monetary policy actions affect the real output of an economy for two years or more. However, Mishkin (1995) argued that a powerful monetary policy can have unintended consequences. To minimize these negative consequences, the author argued that the monetary authorities must have accurate knowledge as to the time lags and the effect of their policy actions on the economy. Therefore, policymakers should understand the mechanism through which monetary policy

affects the economy.

In light of aforementioned developments, monetary policy has become an important instrument for macroeconomic policy-making and macroeconomic stabilization. However, Bernanke and Gertler (1995) argued that the research, which established that changes in monetary policy are eventually followed by changes in real output, fails to investigate what happens in the interim. To address this void in the literature, the Fall 1995 issue of the *Journal of Economic Perspectives* published papers by prominent economists such as Frederic S. Mishkin, John B. Taylor, Ben S. Bernanke and Mark Gertler, Allan H. Meltzer, Maurice Obstfeld and Kenneth Rogoff. In the editorial summary of the publication, Mishkin (1995) articulated that these authors identified that the interest rate, the exchange rate, other asset price effects, and the credit channel are important channels through which monetary policy actions are transmitted to real economic activities.

As to the role of commercial banks, these institutions derive their interest income from the spread between the lending rate charged to borrowers and the cost of funds, which is affected by monetary policy actions. From the economic policy perspective, if the spread were high, it would reflect inefficiency and/or lack of competition, indicating that these institutions would not be able to fulfill their expected role in promoting economic growth and social progress. Furthermore, in setting their lending and deposit rates, the commercial banks significantly influence the effectiveness of the monetary authority in its monetary policymaking. Sellon (2002) provides a nice summary of the impact of the changing U.S. financial system on the interest rate channel for monetary policy transmission.

Two of the most important pieces of empirical information necessary for policy makers in the market economies to implement countercyclical policy effectively, are how the intended macroeconomic variable responds to policy actions and time lags. The transition processes in Eastern European economies have been going on for almost 30 years and their time series financial data from some economies is now available for meaningful econometric analyses. The Romanian banking sector in a transition economy provides an interesting and important opportunity to investigate how lending institutions respond to counter-cyclical

monetary policy actions as reflected in changes in the Central Bank's discount rates, and therefore the difference or the spread between the commercial banks' lending rate and the Central Bank's discount rate. Specifically, this investigation first determines whether the spread between the commercial banks' lending rate and the Central Bank's discount rate spread experienced a structural break over the period between December 1993 and August 2017, where the data is available. Second, the issue of how Romanian commercial banks respond to countercyclical monetary policy actions as reflected in symmetric/asymmetric adjustments to the long-term threshold of the spread is studied. Finally, if asymmetries do exist, do such asymmetries reveal predatory/collusive or competitive behavior by Romanian commercial banks?

The remainder of this paper is organized as follows. The next section briefly reviews the literature. The section that follows characterizes the Romanian banking sector. The following section briefly describes the methodological issues and analytical framework used in the investigation. The next section reports the estimation results. The following section discusses the empirical findings; and the final section provides some concluding remarks.

### A BRIEF LITERATURE REVIEW

The basis for hypothesizing asymmetric responses to the national countercyclical monetary policy is the documented asymmetric rate-setting behavior of the commercial banks in the context of rates of return on financial market instruments in the literature. Empirical studies by Arak et al. (1983), Goldberg (1984), Forbes and Mayne (1989), Levine and Loeb (1989), Mester and Saunders (1995), Dueker (2000), and Tkacz (2001) have reported asymmetries in the U.S. lending rate. Asymmetries in the U.S. prime lending and deposit rates were reported by Thompson (2006). Additionally, Cook and Hahn (1989), Moazzami (1999), and Sarno and Thornton (2003) empirically confirmed asymmetries in U.S. Treasury securities in their studies. Asymmetries in the Thai lending and deposit rates were found by Nguyen and Islam (2010) and these authors attributed this adjustment pattern to the oligopolistic nature of the Thai banking industry. Elsewhere, Frost and Bowden (1999) and Scholnick (1999) found asymmetries

in mortgage rates in New Zealand, and Canada. In Europe, Heffernan (1997) and Hofmann and Mizen (2004) indicated asymmetric behavior of retail rates in the United Kingdom. Hannan and Berger (1991), Neumark and Sharpe (1992), and Diebold and Sharpe (1990) examined various deposit rates for the same behavior, and also found asymmetric adjustments. In his investigation of the Canadian mortgage market, Scholnick (1999) provided an exhaustive review of literature on asymmetric behavior of market interest rates and reported asymmetries.

In the literature, the bank concentration hypothesis, the consumer characteristic hypothesis, and the consumer reaction hypothesis are the three main theoretical explanations for commercial bank interest rate asymmetries. The bank concentration hypothesis (Neumark and Sharpe, 1992; Hannan and Berger, 1991) argued that banks in more concentrated markets are slower in adjusting their deposit rates upward but faster in adjusting them downward, while behaving in the opposite manner with respect to lending rates. The consumer characteristic hypothesis (Calem and Mester, 1995; Hutchison, 1995; Rosen, 2002) posited that the greater the proportion of unsophisticated consumers relative to sophisticated consumers in the market, together with potential search-and-switching costs, the greater the banks' likelihood to adjust interest rates to their advantage.

In the opposite direction, the consumer reaction hypothesis articulated that the asymmetric adjustment in lending rates may actually benefit consumers. Stiglitz and Weiss (1981) argued that the presence of asymmetric information may create an adverse selection problem in lending markets because riskier borrowers are more likely to be willing to borrow at higher interest rates, in a given market condition. Therefore, lending institutions would be reluctant to increase lending rates, even if the market rates rise. The expected cost to the banks of not raising lending rates, when their marginal cost of fund increases, will be offset by the benefits of not encouraging the higher-risk consumers to borrow.

### ROMANIAN BANKING SECTOR

#### The Central Bank

As described by Miclaus (2008) in a summary

titled "Brief History" on the website of the National Bank of Romania (NBR), the Central Bank of Romania has an interesting history. NBR was commissioned on April 17, 1880, based on the Romanian liberal way of thinking, centered on the idea of putting in place a solid credit system. Only lei 10 million of the start-up capital of lei 30 million was state owned. The National Bank of Romania was first housed in a small space on the premises of The Rural Estate Credit. On December 16, 1880, the Romanian government withdrew from the association with the NBR. This withdrawal turned the NBR into a privileged privately owned bank, and the government's rights were transferred to the shareholders. The Bank was granted the power to issue currency by December 31, 1920, and subsequently was extended to December 31<sup>st</sup>, 1930.

Miclaus (2008) further argued that, because of the war, the Romanian Government, the National Bank, and other central institutions moved to Jassy on November 15, 1916. These institutions moved back to Bucharest on December 31, 1918. Since the economy was destroyed by the war and a government was without resources, the National Bank of Romania was the only support the state could utilize to restore the war-torn economy and unify the circulation of money.

Also, as reported by Miclaus (2008), the National Bank of Romania was reorganized after 1924. An enacted law in 1925 extended the National Bank of Romania the authority to issue currency for another thirty years and provided an increase in capital from lei 30 million to lei 100 million. Moreover, the state rejoined the NBR as shareholders. Operationally, since the Great Depression in 1929-1933, the NBR has provided loans to the government to balance the national budget. The Bank's authority and role in the financial sector of the country had steadily increased to such an extent that it was eventually empowered to control the banking sector, the circulation of foreign exchange, and map out the country's financial and monetary policies.

Historically, Miclaus (2008) reported that after the communist regime seized power on March 6, 1945, the Romanian banking system came under state ownership in two stages. Additionally, Communist Party members forced their way into the NBR Board on November 28, 1945. In addition, banks and credit institutions,

except for the NBR and the CEC (The Savings House), were dissolved on August 11, 1948. In 1990, the National Bank of Romania started to resume the operations that it had performed before 1946.

### **The State of the Romanian Deposit taking Institutions**

Preda (2014) argued that changes in the Romanian financial system since 2000 have increased the effectiveness of its interest rate channel. Preda (2014) also reported that even if the Romanian financial intermediation increased considerably during 2000-2013 (from 9.3 percent in 2000 to 40 percent in 2011, encountering a decrease of 5 percent at the end of 2013), its level remained low, as compared to Central and Eastern Europe.

Preda (2014) noted the followings. The banking institutions in Romania play a major role in the financial sector. During Romania's transition process, the number of credit institutions, mostly private-owned institutions, maintained the dominant position in the financial system. However, the financial intermediation level of the credit to the private sector as percentage of GDP diminished from about 38.0 percent in December 2012 to roughly 37.0 percent in June 2013. Preda (2014) argued that the lowering trend is mostly caused by poor lending activity of the Romanian banking system. However, the ratio of the deposits to the GDP is similar to that over the 2011-2013 period.

As to the degree of concentration in the Romanian banking industry, Preda (2014) argued that the concentration level has evolved for the Romanian banking system between 2008 and 2013. The author reported that according to the NBR 2013 Report on banking system, the five-bank concentration ratio has increased from about 54.3 in 2008 to 54.6 in 2012 and slightly diminished to 54.0 percent in 2013.

The author reported that the 2013 Herfindahl-Hirschman index shows a higher concentration of credits (875 points), while the concentration of deposits is 825 points and that of assets reached 834 points. However, based on the Herfindahl-Hirschman index, Preda (2014) concluded that the market concentration of the Romanian banking system was below the EU average and the relative decline in the banking system's concentration in the first half of 2013 was due to the stiffer competition among credit

institutions in terms of deposits taken.

More interestingly, Preda (2014) argued that lending is critical for economic growth in Romania because the self-funding capacity of the firms is low, the small and medium sized business sectors are small, and the role played in the financial market by other institutions is still insignificant. Consequently, financial intermediation is a banking process because banks have been holding the great majority of financial assets. Finally, Preda (2014) articulated that the Romanian banking system, in spite of the recent rapid development, considers itself in an early stage of financial enlargement as compared to the majority emerging economies.

$$SP_t = \mu + \theta DU + \alpha t + \gamma DT + \delta D(T_b) + \beta SP_{t-1} + \sum_{i=1}^k \psi_i \Delta SP_{t-i} + \nu_t \quad (1)$$

where  $DU = 1(t > T_b)$  is a post-break constant dummy variable;  $t$  is a linear time trend;  $DT = 1(t > T_b)$  is a post-break slope dummy variable;  $D(T_b) = 1(t = T_b + 1)$  is the break dummy variable; and  $\varepsilon_t$  are white-noise error terms. Perron (1997) demonstrated that the null hypothesis of a unit root can be expressed as  $\beta = 1$ , and the break date,  $T_b$ , is selected based on the minimum t-statistic for testing  $\beta = 1$ .

$$SP_t = \varphi_0 + \varphi_1 Trend_t - \varphi_2 Dummy_t + \varepsilon_t \quad (2)$$

where  $SP_t$  is the Romanian lending-Central Bank's discount rate spread,  $\varphi_g$ , and  $g = 1, 2$ , and 3 are coefficients to be estimated. The residuals from the above estimated model,

$$\Delta \hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t) \rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \hat{\varepsilon}_{t-p} + \hat{u}_t \quad (3)$$

where  $\hat{u}_t \sim i.i.d.(0, \sigma^2)$ , and the lagged values of  $\Delta \hat{\varepsilon}_t$  are included to assure uncorrelated residuals. Additionally, Enders and Granger (1998) demonstrated that the Heaviside indicator function for the TAR specification can be expressed as:

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

The threshold autoregressive (TAR) model allows the level of autoregressive decay to

## METHODOLOGICAL ISSUES AND ANALYTICAL FRAMEWORK

### Structural Break

Long time series data is expected to experience structural breaks. To search endogenously for the possibility of any structural break in the commercial banks' lending rate-Central Bank's discount rate spread, this investigation estimated Perron's (1997) endogenous unit root test function with the intercept, slope, and the trend dummy to empirically test the hypothesis that the spread has a unit root.

### Threshold Autoregressive (TAR) model

To perform the empirical analysis, this investigation first follows Thompson (2006) to regress the spread,  $SP_t$ , on a constant, a linear trend and an intercept dummy (with values of zero prior to the structural break point and values of one at the structural break point and thereafter) to formally examine the Romanian commercial banks' lending rates, the Central Bank's discount rates and their spread.

denoted by  $\hat{\varepsilon}_t$ , are then used to estimate the following TAR model:

depend on the state of the commercial bank lending rate-Central Bank's discount rate spread, or the "deepness" of cycles. The estimated TAR model can be used to determine if the commercial bank lending rate-Central Bank's discount rate spread tends to revert back to the long run position faster when the spread is above or below the threshold. Therefore, the estimated TAR model reveals whether troughs or peaks persist more when shocks or countercyclical monetary policy actions push the commercial bank lending rate-Central

Bank's discount rate spread out of its long-run path. The null hypothesis that the commercial bank lending rate-Central Bank's discount rate spread contains a unit root can be expressed as  $\rho_1 = \rho_2 = 0$ , and the hypothesis that the spread is stationary with symmetric adjustments can be stated as  $\rho_1 = \rho_2$ .

### Asymmetric Error-Correction Model

If the results of the tests on the above TAR model are positive, the following Threshold Autoregressive Vector Error-Correction (TAR-VEC) model, specified by equations (4), (5) and

$$\Delta LR_t = \alpha_0 + \rho_1 I_t \hat{\varepsilon}_{t-1} + \rho_2 (1 - I_t) \hat{\varepsilon}_{t-1} + \sum_{i=1}^n \alpha_i \Delta LR_{t-i} + \sum_{i=1}^q \gamma_i \Delta DR_{t-i} + u_{1t} \quad (5)$$

$$\Delta DR_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I_t \hat{\varepsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t) \hat{\varepsilon}_{t-1} + \sum_{i=1}^n \tilde{\alpha}_i \Delta LR_{t-i} + \sum_{i=1}^q \tilde{\gamma}_i \Delta DR_{t-i} + u_{2t} \quad (6)$$

where  $u_{i,t} \sim i.i.d.(0, \sigma^2)$ ,  $i = 1, 2$  and  $I_t$  is set in accordance with equation (4).

Additionally, as pointed out by Thompson (2006), the above-specified TAR-VEC model differs from the convention error-correction models by allowing asymmetric adjustments toward the long-run equilibrium. The asymmetric error correctional model replaces the single symmetric error correction term with two error correction terms. Thus, in addition to estimating the long-run equilibrium relationship and asymmetric adjustment, this model allows for tests of the short-run effects (dynamics) between changes in lending rate and Central Bank's discount rate. This in turn reveals the nature of the Granger causality between the two rates.

## DATA, DESCRIPTIVE STATISTICS AND EMPIRICAL RESULTS

### Data and Descriptive Statistics

This study uses the monthly Romanian commercial bank's lending rates and Central Bank's discount rates over the period from December 1993 through August 2017 (1993:12-2017:08), when the data is available. These two series of time series data were collected from the database maintained by the International Monetary Fund. The commercial bank lending rate, the Central Bank's discount rate, and their spread are denoted by  $LR_t$ ,  $DR_t$ , and  $SP_t$ ,

(6), is used to further investigate the asymmetric dynamic behavior of the Romanian lending rate ( $LR_t$ ) and the Central Bank's discount rate ( $DR_t$ ). The estimation results of this model empirically reveal the nature of the Granger causality between the Romanian lending rates and the Central Bank's discount rates. The statistical nature of the Granger causality will help empirically evaluate whether, and how the lending rate and the Central Bank's discount rate respond to changes in the lending-Central Bank's discount rate spread.

respectively. Figure 1 displays the behavior of the commercial bank lending rate, the Central Bank's discount rate and their spread over the sample period.

As illustrated in Figure 1, the Romanian commercial banks' lending rate and Central Bank's discount rate generally tracked each other fairly well and were closer to each other, resulting in a fairly stable lending-Central Bank's discount rate spread, except for the earlier years of transition (from 1993 through 2003) when the spread fluctuated widely. Over the sample period, especially from 2003 forward, the lending rate and Central Bank's discount rate oscillated around moderate downward trends.

Additionally, descriptive statistical analysis reveals that the mean Romanian lending rate during the sample period was 30.93 percent, and ranged from 5.41 percent to 112.70 percent, with a standard deviation of 25.13 percent. The mean Central Bank's discount rate averaged 20.25 percent, and ranged from 1.75 percent to 70.00 percent, with a standard deviation of 17.51 percent. Also, the mean lending-Central Bank's discount rate spread over the sample period was 10.67 percent, and ranged from 2.90 percent to 62.70 percent, with a standard deviation of 9.54 percent. The correlation between the Romanian lending rate and the Central Bank's discount rate is 95.75 percent. Numerically, for a given level of the lending rate, a monetary policy action or an economic

shock causing the Romanian Central Bank to decrease its discount rate would increase the lending-Central Bank's discount rate spread. The

opposite is true if the Central Bank's discount rate were to change in the other direction.

### Romina's Lending Rates, Discount Rates, and Lending-Discount Rate Spread

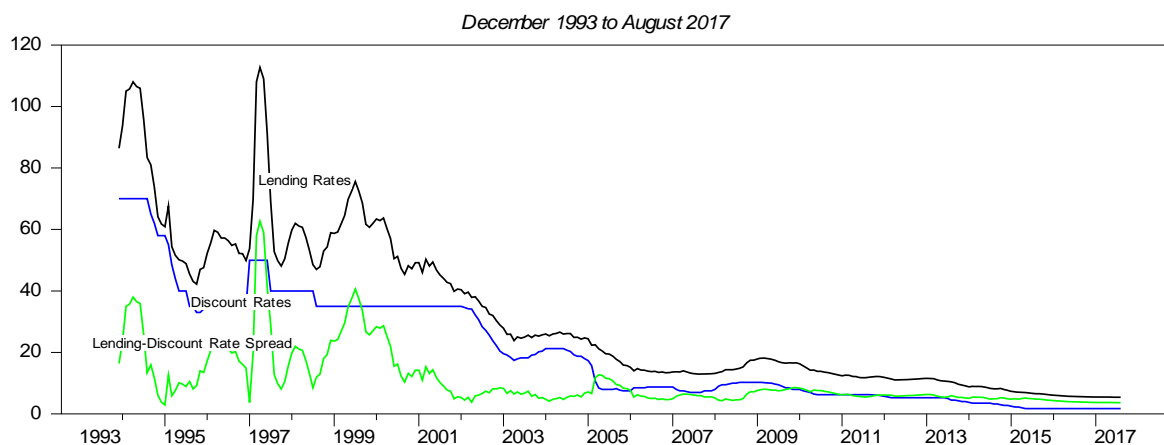


Figure 1.

#### Results of Perron's Test for Structural Break

The estimation results of Perron's endogenous unit root tests are summarized in Exhibit 1. An analysis of the estimation results suggested that the post-break intercept dummy variable,  $DU$ , is positive and is significant at any conventional level. The post-break slope dummy variable,  $DT$ , is negative and the time trend is positive, and both are insignificant at 1 percent level. The empirical results suggest that the Romanian commercial bank lending-Central Bank's

discount rate spread followed a trend stationary process with a break date of February 2000. This structural break in the spread between the Romanian lending rate and the Central Bank's discount rate may be attributable to the economic uncertainty precipitated by the miners striking in 1999 and the upcoming presidential election in December 2000 when the ex-communist candidate Ion Iliescu defeated far-right rival Corneliu Vadim Tudor.

#### Exhibit 1. Perron's Endogenous Unit Root Test, Romanian Data 1993:12 to 2017:08

$$SP_t = 3.54108 - 0.90848 DU + 0.04048 t - 0.04639 DT + 5.52393 D(T_b) + 0.76103 SP_{t-1} + \nu_t$$

(3.96754<sup>\*</sup>) (-0.88701) (2.30129<sup>\*</sup>) (-2.55474<sup>\*</sup>) (1.74607<sup>\*\*\*</sup>) (26.57522)

No. of augmented lags:  $k = 1$       Break Date: February 2000       $t(\alpha = 1) = -8.34501^*$

**Notes:** Critical values for  $t$ -statistics in parentheses: Critical values based  $n = 100$  sample for the break-date (Perron, 1997). <sup>\*</sup> and <sup>\*\*\*</sup> indicate significance at the 1 percent and the 10 percent levels.

### Results of the Cointegration Test with Asymmetric Adjustment

The estimation results of equation (2) are reported in Exhibit 2.

**Exhibit 2.** Estimation Results, Equation (2), Romanian Monthly Data, 1993:12 - 2017:08

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$$SP_t = 22.42029 - 0.02341 Trend_t - 11.40048 Dummy_t + \varepsilon_t$$

$$(26.43656^*) \quad (-3.04937^*) \quad (-7.94792^*)$$


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$\ln L = -953.2216$      $\bar{R}^2 = 0.47760$     DW statistic<sup>(a)</sup> = 0.3021     $F_{(2,282)} = 130.8211^*$

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**Notes:** "\*" indicates significance at 1 percent level.

<sup>(a)</sup> As articulated by Enders and Siklos (2001, p. 166), in this type of model specification,  $\varepsilon_t$  may be contemporaneously correlated.

Given the estimation results of equation (2), the estimation results of the TAR model are summarized in Exhibit 3. Overall empirical results indicate that the estimation results are devoid of serial correlation, and have good predicting power as evidenced by the Ljung-Box statistics and the overall  $F$ -statistics, respectively. The estimated statistic  $\Phi_\mu = 31.43505$  indicates that the null hypothesis of no co-integration,  $\rho_1 = \rho_2 = 0$ , should be rejected at the 1 percent significant level, confirming that the Romanian commercial banks' lending-Central Bank's discount rate spread is stationary.

The estimation results for the model further suggested that both  $\rho_1$  and  $\rho_2$  are statistically

significant at any conventional level. Actually, the point estimates reveal that the Romanian commercial bank lending rate-Central Bank's discount rate spread tends to decay at the rate of  $|\rho_1| = 0.24239$  for  $\hat{\varepsilon}_{t-1}$  above the threshold,  $\tau = -3.14893$  and at the rate of  $|\rho_2| = 0.44756$  for  $\hat{\varepsilon}_{t-1}$  below the threshold. Additionally, the empirical results reveal that, based on the partial  $F = 3.40619$ , the null hypothesis of symmetry,  $\rho_1 = \rho_2$ , should be rejected at any conventional significance level, indicating that adjustments around the threshold value of the commercial banks' lending rate-Central Bank's discount rate spread are asymmetric.

**Exhibit 3.** Unit Root and Tests of Asymmetry, Romanian Monthly Data 1993:12 to 2017:08

$\rho_1$	$\rho_2$	$\tau$	$H_0 : \rho_1 = \rho_2 = 0$	$H_0 : \rho_1 = \rho_2$	aic	sic
-0.24239*	-0.44756*	-3.14893	$\Phi_\mu = 31.43505^*$	$F = 3.40619^{**}$	-2.33782 2.40773	-
$Q_{LB(12)} = 11.7540(0.46563)$		$\ln L = -727.3613$	$F_{(4,278)} = 28.6953^*$	D.W. = 2.0491		

**Notes:** The null hypothesis of a unit root,  $H_0 : \rho_1 = \rho_2 = 0$ , uses the critical values from Enders and Siklos (2001, p. 170, Table 1 for four lagged changes and  $n = 100$ ). "\*\*\*" and "\*" indicate the 1 percent and the 10 percent levels of significance. The null hypothesis of symmetry,  $H_0 : \rho_1 = \rho_2$ , uses the standard  $F$  distribution.  $\tau$  is the threshold value determined via the Chan (1993) method.  $Q_{LB(12)}$  denotes the Ljung-Box  $Q$ -statistic with 12 lags.



### Results of the Asymmetric Error-Correction Model

The estimation results of the asymmetric error correction model are reported in Exhibit 4. In the summary of the estimation results, the partial  $F_{ij}$  represents the calculated partial  $F$ -statistics, with the p-value in parentheses, testing the null hypothesis that all coefficients  $ij$  are equal to zero. “\*” indicates the 1 percent significant level of the  $t$ -statistics.  $Q_{LB(12)}$  is the

Ljung-Box statistics and its significance is in parentheses, testing for the first twelve of the residual autocorrelations to be jointly equal to zero.  $\ln L$  is the log likelihood. The overall  $F$ -statistic, with the p-value in parentheses, tests the overall fitness of the model. The retained estimated coefficients  $\alpha_i, \gamma_i, \tilde{\alpha}_i,$  and  $\tilde{\gamma}_i$  are based on the 5 percent level of significance of the calculated  $t$ -statistics.

**Exhibit 4.** Asymmetric Error Correction Model, Romanian Monthly Data, 1993:12-2017:08

Independent Variables				
Eq. (5)	$Overall F_{(28,231)} = 45.0731(0.0000); \ln L = -461.6078; Q_{(12)} = 14.5950(0.2643); \bar{R}^2 = 0.84653$			
$\Delta LR_t$	$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6$ $= \alpha_8 = \alpha_{10} = \alpha_{16} = \alpha_{19} = \alpha_{20}$ $= \alpha_{21} = \alpha_{23} = \alpha_{24} = 0$	$\gamma_1 = \gamma_2 = \gamma_3 = \gamma_7$ $= \gamma_8 = \gamma_9 = \gamma_{11} = \gamma_{14}$ $= \gamma_{15} = \gamma_{16} = \gamma_{19} = \gamma_{20} = 0$	$\rho_1$	$\rho_2$
	$Partial F_{11} = 31.5224(0.0000)$	$Partial F_{12} = 32.3519(0.0000)$	- 0.12895*	- 0.23435*
Independent Variables				
Eq. (6)	$Overall F_{(22,237)} = 9.4815(0.0000); \ln L = -349.5479; Q_{(12)} = 14.4700(0.27171); \bar{R}^2 = 0.41875$			
$\Delta DR_t$	$\tilde{\alpha}_1 = \tilde{\alpha}_4 = \tilde{\alpha}_{14}$ $= \tilde{\alpha}_{17} = \tilde{\alpha}_{18} = \tilde{\alpha}_{20}$ $= \tilde{\alpha}_{21} = \tilde{\alpha}_{22} = \tilde{\alpha}_{23} = 0$	$\tilde{\gamma}_2 = \tilde{\gamma}_3 = \tilde{\gamma}_4 = \tilde{\gamma}_6$ $= \tilde{\gamma}_{11} = \tilde{\gamma}_{13} = \tilde{\gamma}_{17} = \tilde{\gamma}_{20}$ $= \tilde{\gamma}_{21} = \tilde{\gamma}_{22} = \tilde{\gamma}_{24} = 0$	$\tilde{\rho}_1$	$\tilde{\rho}_2$
	$Partial F_{21} = 9.1555(0.0000)$	$Partial F_{22} = 5.0200(0.0006)$	0.00225	-0.01607

**Notes:** *Partial F-statistics for lagged values of changes in the lending rate and Central Bank's discount rate, respectively, are reported under the specified null hypotheses.  $Q_{(12)}$  is the Ljung-Box Q-statistic to test for serial correlation up to 12 lags. “\*” indicates the 1 percent level of significance; other levels of significance are in the parentheses.*

An analysis of the overall empirical results indicates that the estimated equations (5) and (6) are devoid of serial correlation and have good predicting power as evidenced by the Ljung-Box statistics and the overall  $F$ -statistics, respectively. As to the short-run dynamic adjustment, the calculated partial  $F$ -statistics in equations (5) and (6) indicate bidirectional Granger-causality between the Romanian lending and Central Bank's discount rates. These

results imply that the Romanian lending rate and Central Bank's discount rate adjustments affected each other's movements.

In addition to revealing the short-run dynamic Granger-causality, the asymmetric error correction model also allows the investigation of the long-run adjustments of the lending rate. Inconsistent with the empirical results of the TAR model, the estimation of equation (5)

indicated that  $|\rho_2| > |\rho_1|$  when the short-run factors were incorporated in to the model. Additionally, both  $\rho_1$  and  $\rho_2$  are significant at the 5 percent level. With regard to the long-run behavior of the Romanian Central Bank, as evidenced by the behavior of the discount rate, the estimation results for equation (6) show that  $|\tilde{\rho}_2| > |\tilde{\rho}_1|$ , after controlling for short-run factors; however, both  $\tilde{\rho}_1$  and  $\tilde{\rho}_2$  are insignificant at any significance level.

### DISCUSSIONS OF THE EMPIRICAL RESULTS

This investigation used monthly time series data maintained by the International Monetary Fund over the December, 1993 through August 2017 period where the data is available, to study how Romanian commercial banks responded to the countercyclical monetary policy measures, as reflected in changes in the Central Bank's discount rate. Descriptive statistics indicated that Romanian Central Bank's discount rate and commercial banks' generally tracked each other fairly well and were closer to each other, resulting in a fairly stable lending-Central Bank's discount rate spread. Their correlation is 95.75 percent. Perron's endogenous unit root tests suggested that the Romanian commercial bank lending-Central Bank's discount rate spread followed a stationary process with a break date of February 2000, which may be attributable to the economic uncertainty precipitated by the miners striking over in 1999 and the upcoming presidential election when the ex-communist candidate Ion Iliescu defeated far-right rival Corneliu Vadim Tudor.

As to the nature of the responses of the commercial banks to the countercyclical monetary policy, the estimation results suggested that the null hypothesis of symmetry,  $\rho_1 = \rho_2$ , should be rejected at the 1 percent significance level, indicating that adjustments around the threshold value of the commercial banks' lending rate-Central Bank's discount rate spread are asymmetric. Economically, this result seems to suggest that the Romanian lending institutions responded to the expansionary policy measures differently that they do the contractionary monetary policy measures.

As to the time lags, coincidentally, the estimation results for equation (5) reveal that the longest time lags for  $\alpha_i$  is 24 months and  $\gamma_i$

is 20 months; while those for  $\tilde{\alpha}_i$  and  $\tilde{\gamma}_i$  are 23 and 24 months, respectively. These findings suggest that the Romanian monetary authority considered the lending rate by lending institutions 23 months back in formulating its countercyclical monetary policies; while the lending institutions took up to 20 months to respond to the monetary policies completely. It is also noted here that it will take a longer time, for the lending institutions' responses (complete changes in their lending rates) affected the real output of the economy in Romania. These empirical findings are consistent with those reported for the US by Bernanke and Gertler (1995), Romer and Romer (1990), Bernanke and Blinder (1992), and Christiano, Eichenbaum, and Evans (1994), which confirmed earlier findings by Friedman and Schwartz (1963) that prior monetary policy actions affected the real output of the economy for the succeeding two years or more.

Perhaps, an important contribution of this investigation to the empirical literature is the finding of  $|\rho_2| > |\rho_1|$ , given the high rate environment and the high concentration of the Romanian banking sector. This finding suggests that the adjustment of the spread between commercial banks' lending rate and the Central Bank's discount rate toward the long-run equilibrium tends to persist more when the spread is widening than when it is shrinking.

### CONCLUDING REMARKS

In the market economies, two important pieces of empirical information necessary for policy makers to conduct countercyclical policy effectively are how the target variable responds to policy actions and time lags. The transition processes in Eastern European economies have been going on for almost 30 years and their time series financial data is now available for meaningful econometric analyses. To this end, this paper empirically investigates how Romanian commercial banks in a transition economy respond to countercyclical monetary policy actions as reflected in changes in the Central Bank's discount rates, and therefore the spread between the commercial banks' lending rate and the Central Bank's discount rate.

To discern the aforementioned issues, the Romanian lending rates, the Central Bank's discount rates, and their spreads from December 1993 through August 2017, where

the data is available, are used to estimate the TAR model, specified by equations (1), (2), (3) and (4). First, the study tested the hypothesis that the Romanian spread has a unit root by specifying and estimating Perron's (1997) endogenous unit root test function with the intercept, slope, and trend. This test suggested that the spread followed a stationary trend process with a structural break in February 2000, which may be attributable to the economic uncertainty precipitated by the miners striking over in 1999 and the upcoming presidential election in December 2000.

Second, the estimation results of the TAR model reveal that the Romanian commercial banks react differently to expansionary monetary policy than to contractionary. Furthermore, these results on asymmetric responses reveal the predatory pricing behavior of the Romanian lending institutions. Given the current characteristics of the Romanian financial sector, this result is consistent with those reported by Thompson (2006) for the U.S. and most advanced and emerging economies as well as the bank concentration hypothesis and the consumer characteristic hypothesis in the literature.

Furthermore, the estimation results of the Asymmetric Error-Correction Model suggest a bidirectional Granger-causality between the Romanian commercial banks' lending and Central Bank's discount rates. These results imply that the Romanian lending rate and the Central Bank's discount rate adjustments affected each other's movements. This finding suggests that Romanian lending institutions respond to countercyclical monetary policy actions and that the Central Bank authority successfully utilizes monetary policy to manage the economy in the short run.

Finally, as to the countercyclical monetary policy time lags in the banking sector, the estimation results suggest that the Romanian monetary authority considers the lending rate 23 months back in formulating its countercyclical monetary policies, while lending institutions also take up to 20 months to respond to the monetary policies completely. These findings seem to be consistent with results reported for the U.S. economy in which monetary policy actions affect the real output of the economy for the succeeding two years or more.

## REFERENCES

- Arak, M., Englander, S., and Tang, E. (1983). "Credit Cycles and the Pricing of the Prime Rate," *Federal Reserve Bank of New York Quarterly Review*, 12-18.
- Bernanke, S. B., and Gertler, M. (1995). "Inside the Black Box: The Credit Channel of Monetary Policy Instrument," *Journal of Economic Perspectives*, 9(4). pp. 27-48.
- Bernanke, B. S., and Blinder, A. (1992). "The Federal Funds Rate and the Channels of Monetary Transmission," *American Economic Review*, 82, pp. 901- 921.
- Christiano, L., Eichenbaum, M., and Evans, C. (1994). "Identification and Effects of Monetary Policy Shocks," *Federal Reserve Bank of Chicago Working Paper WP-94-7*.
- Calem, P.S., and Mester, L.J. (1995). "Consumer Behavior and the Stickiness of Credit-Card Interest Rate," *American Economic Review*, 85(5). pp. 1327-1336.
- Chan, K.S. (1993). "Consistency and Limiting Distribution of the Least Squares Estimator of a Threshold Autoregressive Model," *Annals of Statistics*, 21(2). pp. 520-533.
- Cook, T., and Hahn, T. (1989). "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal of Monetary Economics*, 24. pp. 331- 351.
- Diebold, F.X., and Sharpe, S. A. (1990). "Post-Deregulation Bank-Deposit-Rate Pricing: The Multivariate Dynamics," *Journal of Business & Economic Statistics*, 8(3). pp. 281- 291.
- Dueker, M.J. (2000). "Are Prime Rate Changes Asymmetric?" *Federal Reserve Bank of St. Louis Economic Review*, September/October. pp. 33-40.
- Enders, W., and Granger, C.W.J. (1998). "Unit Root Tests and Asymmetric Adjustment with an Example Using the Term Structure of Interest Rates," *Journal of Business and Economic Statistics*, 16(3). pp. 304-311.
- Enders, W. & Siklos, P.L. (2001). "Cointegration and Threshold Adjustment," *Journal of Business & Economic Statistics*, 19(2), pp. 304-311.
- Forbes, S.M., and Mayne, L. S. (1989). "A Friction Model of the Prime," *Journal of Banking and Finance*, 13. pp. 127-135.
- Friedman, M., and Schwartz, A. J. (1963). *A Monetary History of the United States*,

- 1867-1960. Princeton, N.J.: Princeton University Press.
- Frost, D., and Bowden, R. (1999). "An Asymmetry Generator for Error-Correction Mechanisms, with Application to Bank Mortgage-Rate Dynamics," *Journal of Business & Economic Statistics*, 17(2). pp. 253 - 263.
- Gbosi, A. N. (2001). *Contemporary Macroeconomic Problems and Stabilization Policies in Nigeria*, Antovic Ventures, Port Harcourt.
- Goldberg, M.A. (1984). "The Sensitivity of the Prime Rate to Money Market Conditions," *Journal of Financial Research*, 7(4). pp. 269-280.
- Hannan, T.H., and Berger, A. N. (1991). "The Rigidity of Prices: Evidence from the Banking Industry," *American Economic Review*, 81(4). pp. 938 - 945.
- Heffernan, S.A. (1997). "Modeling British Interest Rate Adjustment: An Error Correction Approach," *Economica*, 64. pp. 211-231.
- Hofmann, B., and Mizen, P. (2004). "Interest Rate Pass-Through and Monetary Transmission: Evidence from Individual Financial Institutions' Retail Rates," *Economica*, 71. pp. 99 - 123.
- Hutchison, D.E. (1995). "Retail Bank Deposit Pricing: An Intertemporal Asset Pricing Approach," *Journal of Money, Credit, and Banking*, 27. pp. 217-231.
- Keynes, J. M. (1936). *The General Theory of Employment, interest and Money*. New York.
- Levine, P., and Loeb, P. D. (1989). "Asymmetric Behavior of the Prime Rate of Interest," *American Economist*, 33. pp. 34 - 38.
- Meltzer, A. H. (1995). "Monetary, Credit (and Other) Transmission Processes: A Monetarist Perspective," *Journal of Economic Perspectives*, 9(4). pp. 49-72.
- Mester, L. J., and Saunders, A. (1995). "When Does the Prime Rate Change?" *Journal of Banking and Finance*, 19. pp. 743-764.
- Mishkin, F. S. (1995). "Symposium on the Monetary Transmission Mechanism," *Journal of Economic Perspectives*, 9(4). pp. 3-10.
- Moazzami, B. (1999). "Lending Rate Stickiness and Monetary Transmission Mechanism: The Case of Canada and the United States," *Applied Financial Economics*, 9. pp. 533-538.
- Neumark, D., and Sharpe, S. (1992). "Market Structure and the Nature of Price Rigidity: Evidence from the Market for Consumer Deposits," *Quarterly Journal of Economics*, 107(2). pp. 657-680.
- Nguyen, C., and Islam, A. (2010). "Asymmetries in the Thai lending-deposit rate Spread: an econometric analysis," *Applied Economics Letters*, 17(13). pp. 1229-1236.
- Nguyen, Chu V. (2015). "The Vietnamese Lending Rate, Policy Related Rate, and Monetary Policy Post 1997 Asian Financial Crisis," *Cogent-Economics & Finance*, Vol. 3(1), Routledge-Taylor & Francis Group. <http://www.tandfonline.com/doi/full/10.1080/23322039.2015.1007808>.
- Miclaus, C. (2008). "Brief History," Banca Nationala A Romaniei. <http://www.bnr.ro/Brief-History-of-the-NBR-2730.aspx>; or <https://www.ibuzzle.com/articles/economy-the-national-bank-of-romania.html>
- Obstfeld, M., and Rogoff, K. (1995). "The Mirage of Fixed Exchange Rates," *Journal of Economic Perspectives*, 9(4). pp. 73-96.
- Perron, P. (1997). "Further Evidence on Breaking Trend Functions in Macroeconomic Variables," *Journal of Econometrics*, 80. pp. 355-385.
- Preda, G. (2014). "Features of the Romanian Financial System Regarding the Interest Rate Transmission," *Revista Economică*, 66(6), pp. 87-96. <http://economice.ulbsibiu.ro/revista.economica/archive/66606preda.pdf>
- Romer, C., and Romer, D. (1990). "New Evidence on the Monetary Transmission Mechanism," *Brooking Papers on Economic Activity*, 1. pp. 149 - 214.
- Rosen, R.J. (2002). "What Goes Up Must Come Down? Asymmetries and Persistence in Bank Deposit Rates," *Journal of Financial Services Research*, 21(3). pp. 173-193.
- Sarno, L., and Thornton, D. L. (2003). "The Dynamic Relationship between the Federal Funds Rate and the Treasury Bill Rate: An Empirical Investigation," *Journal of Banking and Finance*, 27. pp. 1079-1110.
- Scholnick, B. (1999). "Interest Rate Asymmetries in Long-Term Loan and Deposit Markets,"

*Journal of Financial Services Research*, 16, pp. 5-26.

Sellon, G.H. (2002). "The Changing U.S. Financial System: Some Implications for the Monetary Transmission Mechanism," *Federal Reserve Bank of Kansas City Economic Review*, First Quarter. pp. 5-35.

Stiglitz, J.E., and Weiss, A. (1981). "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, 71(3). pp. 393-410.

Taylor, J. B. (1995). "The Monetary Transmission Mechanism: An Empirical Framework," *Journal of Economic Perspectives*, 9(4). pp. 11-26.

Thompson, M.A. (2006). "Asymmetric Adjustment in the Prime Lending-Deposit Rate Spread," *Review of Financial Economics*, 15(4). pp. 323-329.

Tkacz, G. (2001). "Endogenous Thresholds and Tests of Asymmetry in U.S. Prime Rate Movements," *Economic Letters*, 73, pp. 207-211.

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