DISCOUNT RATE AS A MEASURE OF MONETARY POLICY FOR MARKET STABILIZATION: AN EXAMPLE OF THE NATIONAL BANK OF SERBIA

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ABSTRACT

The increase in interest rate is related to the efforts of monetary authorities to neutralize inflationary pressures; while the rate reduction can be interpreted as an invitation to business sector to access more favorable lending conditions. The effectiveness of these changes largely depends on the development level of financial system, the role of the central bank as a creditor and current economic situation. In this research an econometric regression double-logarithmic model was applied, with the main goal of examining the relationship between discount rate and its influence on interest rates and money supply on the example of the National Bank of Serbia. The results show the correlation between the NBS discount rate and interest rates of commercial banks and the amount of money in circulation, indicating their influence on market stability.

1. INTRODUCTION

Regulating the interest rate at which the Central Bank gives loans to commercial banks, and the interest rate at which commercial banks give loans to their clients, make a direct influence to the size of credit demand and money circulation. When a certain discount rate is established, the Central Bank exercises its powers by changing the rate or other conditions for discounting. The discount rate is the cost of borrowing from the Central Bank. Changes in the discount rate play a significant role in internal movements, affecting the availability of money and the price of credit, thus affecting the country's international position. The increase in the rate will lead to a general increase in other interest rates, including

those paid on deposits, and therefore, monetary authorities can expect an inflow of international funds. A rate decrease will have the opposite effect.

The subject of this paper is the analysis of the impact of discount rate on the interest rate and the amount of money in circulation by using the example of change in the discount rate of the National Bank of Serbia (NBS). The National Bank of Serbia is an independent and unique institution of the monetary system, responsible for monetary policy, currency stability, and financial discipline. In searching for an adequate strategy to achieve market stability, the National Bank of Serbia followed the example of other countries, especially in Central and Eastern Europe. Taking into account the specifics of each country, ensuring the security and efficiency of payment transactions, the Central Bank strives to fulfill the goal of financial stability and achieve sustainable development. Long-term strategic goals are aimed at development, which is reflected in achieving the optimal rate of economic growth, employment, and stability of the value of money. Monetary policy is considered expansionary if it is aimed at increasing the money supply, and restrictive if it is aimed at reducing the money supply. Monetary policy is most closely related to credit policy since the regulation of money circulation cannot be limited only to the control of cash, but also to the control and regulation of deposits (Sovtić, Ilić & Maksimović, 2012). Other instruments of monetary policy, such as operations in the open market of securities with longer maturities or required reserves, have a secondary role in achieving the goals of stability because of chronic inflation.

In previous years, the National Bank of Serbia has consistently applied a restrictive monetary policy. The goal of this policy was to maintain price stability by reducing the money supply, so that aggregate demand is in line with aggregate supply.

If the monetary authority assesses that the amount of money and credit in the economy have reached the level that threatens economic stability by monitoring the material-financial flows and inflationary changes, the Central Bank will increase the discount rate, which would result in the increase in the cost of credit, causing a general increase in the interest rates in the country (Komazec, 2006).

The subject investigated in this paper is whether and in which way the National Bank of Serbia affects market stability. Actually, the subject of the research is the impact of the discount rate on the interest rate and the money supply. Hypothesis states that there is an influence of the discount rate of the National Bank of Serbia on the interest rates of commercial banks and the amount of money in circulation.

The secondary hypothesis reads: The discount rate of the National Bank of Serbia has a more significant influence and a strong correlation on the interest rate of commercial banks than on the amount of money in circulation.

The paper is designed to contain five parts. The second part, which follows the introductory part provides insight into the previous research and the theoretical framework of the observed topic. In the third part the applied research methodology is presented along with the draft of the research. The econometric regression double-logarithmic model was used in the paper. The fourth part presents the analysis and empirical results of research, based on collected data suitable for research. Dependent and independent variables are defined, and the outcome of the measurement will clearly show the relation between the discount rate, the interest rate of commercial banks, and the money supply. Discussion and concluding remarks are described in the last chapter.

2. LITERATURE OVERVIEW

Monetary policy is one of the most important policies in every modern state. With its goals and instruments, it affects prices, investments, the amount of money in circulation, interest rates, etc. The National Bank of Serbia implements an expansive monetary policy and a policy of maintaining the stability of dinar against euro, which is the main prerequisite for maintaining financial stability.

Observing the dilemma of selecting the monetary policy model and the exchange rate regime, numerous classifications of the regime can be found. This subject is of particular relevance for small and open economies in which the existing political, economic and social specificities should be taken into account when choosing a monetary policy model. According to the definition of Frenkel (2003), there are nine arrangements, ranging from rigid to arrangements with increasing flexibility. Rigid currency arrangements include monetary union, dollarization, and currency boards. Monetary system is the bloodstream of every country since its goal is to provide each segment with the optimal amount of money in circulation in order to make the system function smoothly. If there is too much money in circulation, inflation occurs. If it is the other way around and there is too little money in circulation, deflation and recession occur, which are undesirable situations in the market (Bordo & Filardo, 2005).

Srithilat and Sun (2017) conclude that changes in the money supply can have negative consequences for the economic development of a country. Based on research conducted on Nigeria's example, Adaramola and Dada (2020) show that inflation and the exchange rate have a negative impact on domestic product movements, while money supply and interest rates have a positive impact.

Monetary-credit policy presents a set of rules, regulations, measures, instruments in the monetary-credit sphere of social reproduction, which regulate the level, structure and dynamics of the money supply, monetary circulation, structure and dynamics of credit, liquidity of the economy, and the economic stability. The national economy achieves numerous tasks and goals by using the monetary-credit policy as an instrument of economic policy: employment increase, price stability, stable rate of economic growth, balance of payments, etc. In this way, the necessary amount of money in circulation is ensured for the smooth development of production and transport, as well as liquidity of the national economy and the country's external liquidity, together with harmonization of supply and demand for money and credit, etc. (Benazić & Tomić, 2014).

In the new Keynesian models, as well as in earlier theories of natural rates, the presence of positive or negative gaps in real rates are directly linked to changes in price levels. This has led to suggestions that inflation itself could serve as a good proxy for the real rate gap. Other variables, such as the production gap, should also be good indicators of the movement of the gap in the real interest rate. This has led to a large number of the latest literature on the rules of interest rates, which has increased alongside the development of New Keynesian models. The most famous example is the Taylor (1993) rule, which says that the Central Bank set its interest rate in response to the deviations of inflation from the target inflation, the production gap, and an estimate of the long-term natural interest rate.

Certainly, the suggestion that the Central Bank should follow such rule for the purpose of eliminating real interest rate gaps has a long-term history (Kasman, 1992). By changing the discount rate, the Central Bank tries to influence the supply and demand of money on the money market and the conditions prevailing in the field of interest rate policy in the entire credit system. An increase in the discount rate should automatically lead to a decrease in the demand for bank loans. On the contrary, the decrease in the discount rate should lead to an increase in the demand for bank loans. Therefore, when the loan price becomes higher and credit more expensive, there should occur a credit contraction, and vice versa, when the loan price becomes lower and credit cheaper, credit expansion occurs (Ilić, 2006).

There is an extensive literature on evaluation of Central Bank reaction functions evidencing that Central Banks indeed controlled interest rates in this way (Judd & Rudebusch, 1998; Amato & Laubach, 1999; Gerlach & Schnabel, 2000). Theoretically speaking, while some studies (Taylor, 1999) confirmed the importance of the Central Bank responding not only to inflation but also to

production fluctuations, Woodford (2003) argues that it may be better for Central Bank to follow the rule with respect to observable variables since the natural rates of production are of inconspicuous levels. In fact, some authors showed that interest rate rules specified exclusively in terms of inflation represent a good approximation to optimal monetary policy in various spin-offs of the basic New Keynesian model (Amato & Laubach 2003; Giannoni, 2012; Giannoni & Woodford, 2003).

With the discount policy, the Central Bank determines the price of the loans it grants to commercial banks, either through rediscount loans or other forms of loans. It is the 'official' price of money in the economy, which further determines the interest rate at which commercial banks will grant loans to their clients. Increasing the discount rate creates unfavorable conditions for rediscount loans, which affects the general interest rate and the demand for loans. An increase in the interest rate is applied when there is greater amount of money in the market and inflationary disturbances. On the contrary, the decrease in the interest rate should lead to the increase in monetary demand and increase in economic activity: when its decline is a consequence of deflation, i.e. lack of money in the economy.

The operation of the Central Bank cannot be carried out according to a uniform way for all countries of a market economy. The following has to be taken into account: the level of economic development, and the structure of the financial system in the specific country. The methods of the Central Bank interventions on the money market determine the capacities and scope of monetary policy. The Central Bank controls the operation of the money market through discount rates and open market operations. With these instruments, the Central Bank keeps the necessary balance of supply and demand on the money market, regulating the performance of transactions by the level of the interest rate, i.e. the purchase and sales of securities. In addition to influencing the credit potential and liquidity of banks, the Central Bank uses these instruments to influence interest rates in the financial market, as well as to maintain the economic motives of holders of free funds for investing in securities (Zivković & Kozetinac, 2012).

The literature on transition economies also focuses on the exchange rate as a shock absorber and group of authors (Fetai, Koku, Caushi & Fetai, 2016) empirically examine the relationship between exchange rates and inflation in the Western Balkans. In order to evaluate the effect of exchange rate changes on inflation in Western Balkan countries they analyzed whether fixed exchange rates play an important role in inflation developments or whether flexible exchange rates are a better instrument for shock absorption. The result shows that the exchange rate is still the main source of inflationary pressure in the Western Balkans. The

decision to adopt a particular exchange rate regime depends on the costs and benefits associated with abandoning an exchange rate instrument.

The main goal of most central banks is to maintain price stability, which in practice means using conventional monetary policy instruments to support low and stable inflation. Conventional monetary policy instruments are used to keep inflation in line with the objective and policies of the country's monetary authorities. Ayuso & Repullo (2003) identified CB open market operations as a standard tool which the CB should use to manage the liquidity target. Blanchard, Dell'Ariccia and Mauro (2014) believe that managing short-term interest rates is the best operational objective for central banks. However, under the exceptional circumstances that led to a rapid decline in key economic parameters around the world, central banks opted for unconventional monetary policy measures.

The general conclusions from previous research are that the inflation rate is close to being a sufficient statistic for monetary policies even in the monetary policy theories that are based on natural rates. The conclusion that Central Banks should move interest rates in response to changes in the aggregate price level or price inflation rests on the assumption that the mismatch in the prices of goods and services is the main cause of incomplete nominal adjustment. Finally, as it was noted in the previous section, the existence of financial market imperfections implies that there may not be a clear link between the real rate gap and the cost of financing household and business consumption. The financial accelerator model of Bernanke, Gertler, and Gilchrist (1999) says that shocks have an enhanced and lasting effect on investment spending because of countercyclical movements in risk premiums (Laurens, 1994). The foregoing suggests that credit spreads or growth in credit aggregates can provide valuable information on margins, far beyond the aggregate price movements alone.

3. RESEARCH METHODOLOGY

The research methodology is based on the econometric model of multiple regression analysis, i.e., the double logarithmic function that will measure the impact of the discount rate. The objective is to examine the dependence between the discount rate and the impact on both interest rate and the money supply.

$$\hat{Y} = \beta_0 X^{\beta}$$

where Y is a dependent variable, X is independent variable, β_0 is a segment on the ordinate and β_1 is an inclination.

The following formulas give parameter ratings:

$$\beta_1 = \frac{\sum x_i^* \cdot y_i^*}{\sum x_i^{*2}}; \quad \beta_0 = \overline{Y} - \beta_1 X^*$$

A non-linear function can be converted to a linear form by logarithm:

$$\ln \hat{Y} = \ln \beta_0 + \beta_1 \ln X_i$$

Evaluating a multiple regression model means finding the value of parameters β_0, β_1, β_2 = regression parameters that need to be evaluated, i = stochastic term (random deviation, error or residual), i.e. find the estimated value of the model that looks like:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon_i$$

The following graph represents the trend and size of the discount rate of the National Bank of Serbia of the observed variables for the period 2007-2021.

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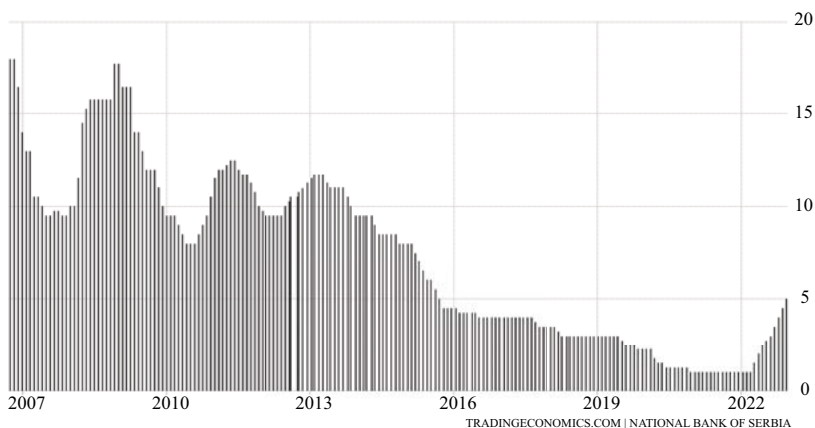
Graph 1: Trend of the discount rate of the National Bank of Serbia from 2007 to 2022
Source: Trading economics, https://tradingeconomics.com/

As it can be seen on the Graph 1, since 2010, there has been a noticeable growth in the discount rate of the National Bank of Serbia. Under the influence of the worldwide market crisis, a significant growth was recorded and a maximum rate of 11% was reached. After 2014, the growth trend did not continue, and a significant drop in the discount rate was noted, i.e. it reached 1% in 2021,

likewise in the Central Banks of developed countries. In the following chapter, the regression analysis method will be applied and consequently the obtained results will be presented.

4. RESULTS

The research used the secondary data of the National Bank of Serbia published on the official website. A universal and original model will be presented based on the downloaded data and the application of a multiple regression model. There will be a correlation presented in order to have the comprehensiveness of the model, before presenting the model itself.

The model is presented in a form of a function, with the value of parameters based on which the influence of independent variables on dependent variables will be determined.

The subject of this paper is the analysis of the impact of the discount rate on the interest rate and the money supply.

Taking these indicators into account, the thesis as to whether there is a relationship between the discount rate, the interest rate and the amount of money in circulation will be proven or disproved.

For this purpose, the dependent variable (regressor, explained, exogenous) is the discount rate of the agency during the observed years, while the independent variables (regressor, explained, explanatory, endogenous) are the interest rates and the amount of money in circulation. The paper will present correlation, regression, determination, T test on the significance of parameters, and F test on the significance of the model.
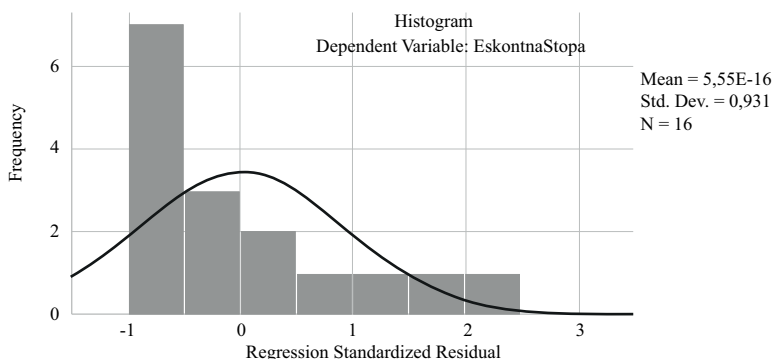
Graph 2. Histogram
Source: Authors' calculation in the SPSS program26

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: EskontnaStopa
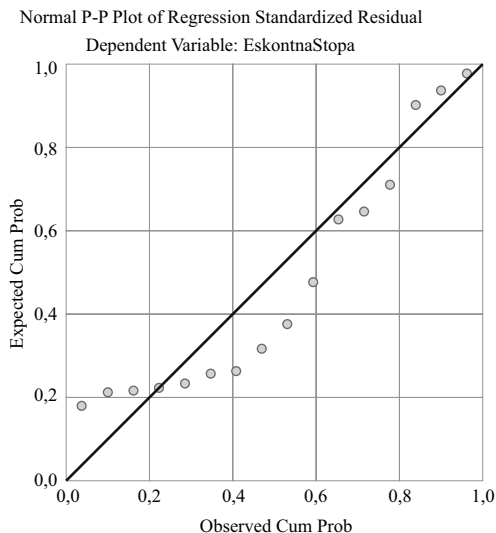
Graph 3. Scattering plot
Source: Authors' calculation in the SPSS program26

In order to estimate/calculate a multiple regression model, the value of parameters βo, β1, β2= regression parameters that need to be calculated/estimated, with i=stochastic term (random deviation, error or residual) have to be found.

Finding the rated value of the model as presented:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon_i$$

The money supply is taken as a dependent variable in the model, and the influence of the discount rate and interest rate on the amount of money in circulation is examined. This is multiple and reliable method (for example, it mutually excludes positive and negative errors). For the needs and purposes of calculation, the best way to present the observed variables is to use the average linear relation.

The linear dependence can be evaluated based on the following model:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i}, \ i = 1,\dots,16$$

The statistical program analysis showed that $b_0 = 10,085$; $b_1 = 0,158$ i $b_2 = -3,501e\text{-}5$

Therefore, the regression equation reads:

$$Y = 10,085 + 0,158X_1 - 3,501e - 5X_2$$

If there are no interest rates and money in circulation, the discount rate will be 10.0849%. If the discount rate increases by 1 unit (by 1%), the interest rate will increase by 0.1577 units. If the money in circulation increases by 1 unit (expressed in millions), the discount rate will decrease by 3.501 units (%).

R^2 dependence of the interest rate and money in circulation on the discount rate is 74.3%, which represents a high interdependence of the parameters. The F statistic is 18.778, and the theoretical value of the t-statistic is smaller, so it can be said that the evaluated model is of high quality according to the criteria of the t and F statistics. This also means that the hypothesis about the statistically significant impact of the discount rate on the amount of money in circulation and the interest rate is accepted.

Table 1: Results of multiple regression analysis

Variable	Coefficient	Std. error
b_0	10,085	3,868
b_1	0,158	0,173
b_2	-3,501	
R^2	74,3%	
$\overline{R}^2$	70,3%	
F^2	18,778	
F'	4,26	
T	0,9126	
T'	2,160	
Durbin-Watson	0,549	
Pearson	0,792	

Source: Author's calculation

The Durbin-Watson value is less than 2 and it is 0.549, indicating positive serial autocorrelation between the residuals. The interest rate increase by 1% leads to the increase in the discount rate by 0.15%, while the decrease in the discount rate by 3.5% leads to the increase in the amount of money in circulation by 1%. Also, it can be seen from the analysis that the decrease in the discount rate of the National Bank of Serbia leads to the decrease in the interest rates of commercial banks that they offer to citizens and the increase in the amount of

money in circulation. The coefficient of determination is 0.743%, which shows that variations in the discount rate are determined by variations in interest rates and the amount of money in circulation with 74.3%.

Based on the obtained results, it can be said that hypothesis H1 is accepted.

$$t = \left| (b_1 - \beta_2) / Sb_2 \right| = 0,9126$$

$$t' = 2,160$$

$t' > t$ with risk of 5% and probability of 95%, hypothesis H1 is accepted. Actually, the claim that the parameter β_2 is statistically significant is accepted, i.e. the claim that there is a relationship between the discount rate and the interest rate is accepted.

The Pearson correlation coefficient for the interest rate as per strength level 1[1] is 0.792, which can be characterized as a strong correlation level. It also shows that there is a linear linkage and a continuous normal distribution. The Pearson's coefficient is -0.852 for the amount of money in circulation, i.e. there is a strong correlation level. The sign of the correlation is determined by the regression trend.

The histogram shows that there is standard deviation of 0.931 and that the graph is of a normal distribution, i.e. the curve has a so-called bell shape. The scatter diagram shows a direct positive linear relation amongst the discount rate, interest rate and the amount of money in circulation.

5. DISCUSSIONS

There has been a significant change in the role of the Central Bank in regulating money flows. Collection and development of deposits in the banking system, coupled with liquidity assets of non-banking sectors (especially households) occupies a greater attention of banks. The role and function of the Central Bank in the monetary system strongly determines the operations of the financial and economic system as a whole. This fact further leads to the conclusion that the Central Bank, within its scope of work, should ensure the rational operations

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1 Strength levels:

$0 < |p| \leq 0,5$ – low correlation level;

$0,5 < |p| \leq 0,7$ – significant correlation level;

$0,7 < |p| \leq 0,9$ – strong correlation level;

$0,9 \leq |p| < 1$ – very strong correlation level.

of financial and monetary system, and in this context determine a clear and economically consistent modern policy. The operation of a whole economic system requires this kind of approach in order to determine a realistic economic policy with precisely projected economic expectations.

Kantur and Özcan (2021) pointed out that in an environment of uncertainty, policymakers, especially monetary authorities have doubts about the policy models they routinely use. The policy is tailored to insure against the worst-case outcomes. They show that model ambiguity on the financial side requires a passive monetary policy stance. However, if the uncertainty originates from the supply side of the economy, an aggressive response of interest rate is required.

Today, in the economic literature, the prevailing understanding is that increase in the official discount rate and price of loans resulting out of it, do not cause a lower demand for loans from commercial banks. It is considered that the reduction in discount rate, i.e., lowering the costs of loans, without the influence of other factors, cannot have such an impact and sufficiency for the revival of the economy by itself (Komazec & Ristić, 2010). This especially applies to the small and medium enterprises, where the inflation rate is significantly above the Central Bank's cost of money, thus creating conditions for regular occurrence of a negative real interest rate, which really represents a "premium" for taking a loan (Gerlach & Schnabel, 2000).

The discount policy must be conducted in close coordination with other segments of macroeconomic regulation, and above all with the various policies such as - market and price policy, income policy, fiscal policy, foreign trade policy, foreign exchange policy, general interest policy in the banking system, etc. The measures must be taken simultaneously and with a change in the positive and negative effects of these measures, as well as their mutual effects, especially when the economy is in a deep crisis and high inflation. In this case, many instruments are opposed to each other, actually, they are contraindicated (Barjaktarovic, 2010). The stability of monetary aggregates is of great importance for central banks of developed economies, where special attention is paid to the stability of the discount rate. First of all, this is a sign that there has been a need for a turnaround of monetary policy and conjuncture, but also in the behavior of all subjects in the economy. Monetary basis and other elementary aggregates are observed in the closest connection with the economy trends (especially the trends of prices, stability of money, level of employment, real social product, investments, budget spending, etc.).

The discount rate is considered as an efficient part of the state instruments of macroeconomic policy, but also it is the most closely related to the economic and monetary trends.

6. CONCLUSIONS

The results of the research proved the hypothesis of the influence of the discount rate on the interest rate at which banks provide finances to the economy and population, and thus the influence on the amount of money in circulation. Moreover, the analysis shows that the decrease in the discount rate of the National Bank of Serbia leads to the decrease in the interest rate offered by commercial banks to citizens and increases the amount of money in circulation. The coefficient of determination is 0.743%, which shows that variations in the discount rate are determined by variations in interest rates and the amount of money in circulation with 74.3%.

It is known that the discount rate of the Central Bank affects individual commercial banks differently within the entire banking system. Also, general operations of the central bank actually act as a weight of a large number of different influences on individual commercial banks. The greater the share of Central Bank loans in the structure of the total assets of a commercial bank, the greater will be the impact of the discount rate on the interest rate policy of that bank, and vice versa. The efficiency of the discount rate in financially developed countries as well as countries with developed money and credit market, is significantly higher than in the economies that do not have such characteristics.

The discount rate of the Central Bank in economies with a developed financial market is one of the most effective quantitative instruments of monetary policy. There are large differences in the movement of central banks' discount rates, as well as their changes. Changes are more common in developed than in underdeveloped countries. In developed countries, operations in the money market through changes in the discount rate are far more frequent because there is a greater sensitivity to even minor changes in this rate compared to underdeveloped countries.

It can be said that the Central Bank is mainly responsible for money and monetary policy. Therefore it must have the absolute insight into the mutual linkages and factors together with all other elements of the economic system if it wants to achieve the desired results with its monetary policy. The Central Bank regulates the amounts of reserves as well as the size of loans to commercial banks. However, it cannot influence other flows of money and factors determining the

various forms of assets. Therefore, the most important role of the Central Bank is to regulate the amount of money in circulation, credit volume in the country and thereby maintain financial and market stability.

Conflict of interests

The authors declare there is no conflict of interest.

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Appendix

Worksheet

Years	Y	X1	X2	X1Y1	X1Y	X2Y	Y²
2006	8,50	16,50	68,461	1.129,606	104,25	581.91	72,25
2007	8,50	16	77,000	1.179,836,	136	654.5	72,25
2008	8,50	18	90,075	1.232,000	153	765.63	72,25
2009	8,50	21	95,519	1.621,350	178,5	811.91	72,25
2010	9,50	12	91,750	2.005,899	114	871.62	90,25
2011	11,75	11	114,190	1.101,000	129,25	1.341.73	1,380,625
2012	10,95	14	110,547	1.256,090	153,3	1.210.48	1,199,025
2013	11,00	14	122,439	1.547,658	154	5	121
2014	8,50	12	130,468	1.714,146	102	1346.82	72,25
2015	6,00	11	139,818	1.565,616	66	1.108	36
2016	4	6,2	156,265	1.537,998	24,8	838.908	16
2017	3,75	5,9	163,931	987,443	22,115	637.06	140,625
2018	3,25	5	182,615	967,192	16,25	614.74	105,625
2019	2,75	3,9	209,568	913,075	10,725	593.49	75,625
2020	1,25	3,9	266,725	817,315	4,875	576.32	15,625
2021	1	3,9	295,311	1.040,227	3,9	333.40	1
		134	2,314,682	3,685,025	38440	4930.243	2,917,324

Source: Authors' calculation

ДИСКОНТНА СТОПА КАО МЈЕРА МОНЕТАРНЕ ПОЛИТИКЕ У СТАБИЛИЗАЦИЈИ ТРЖИШТА - ПРИМЈЕР НАРОДНЕ БАНКЕ СРБИЈЕ

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САЖЕТАК

Повећање каматне стопе повезано је са настојањем монетарних власти да неутралишу инфлаторне притиске; док се смањење стопе може тумачити као позив пословном сектору да приступи повољнијим условима кредитирања. Ефикасност ових промјена у великој мјери зависи од развијености финансијског система, улоге централне банке као кредитора и тренутне економске ситуације. У овом истраживању примијењен је економетријски регресиони двологаритамски модел, са основним циљем да се испита однос дисконтне стопе и њеног утицаја на каматне стопе и новчану масу

на примјеру Народне банке Србије. Резултати показују корелацију између дисконтне стопе НБС и каматних стопа пословних банака и количине новца у оптицају, што указује на њихов утицај на стабилизацију тржишта.

Кључне ријечи: *монетарна политика, централна банка, каматна стопа, стабилност тржишта, комерцијалне банке.*