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THE ROLE OF INFLATION IN CREATING THE KEY POLICY RATE – VALIDATION OF TAYLOR'S RULE IN CASE OF SERBIA

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Abstract

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Due to high inflation expectations, the National Bank of Serbia has chosen price stability as the primary objective of monetary policy and the key policy rate as the main instrument of monetary regulation. However, despite a clearly defined Taylor rule, the key policy rate does not always follow the movement of the rate of inflation. Accordingly, the aim of this study is to test the effects of inflation rate on the key policy rate and the possibility of using Taylor rule in the original conditions of low inflation. Based on the defined object of the research, we tested the following hypothesis: inflation rate had statistically significant impact on the key policy rate in the whole analyzed period, between 2007 and 2015. The same observation was tested for two sub-periods between 2007 and 2011 and between 2012 and 2015. Therefore, it can be concluded that there is statistically significant moderate impact of inflation rate on the key policy rate, but representativeness of the model could be higher. The lack of reaction of the key policy rate to inflation stresses the need for redefining monetary policy instruments and modifying the strategy of inflation targeting.

Keywords: *Inflation, Key policy rate, Monetary policy, Taylor rule.*

JEL: *E31, E32, E37.*

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EL PAPEL DE LA INFLACIÓN EN LA CREACIÓN DE LA TASA DE POLÍTICA CLAVE – LA VALIDACIÓN DE LA REGLA DE TAYLOR EN EL CASO SERBIA

Resumen

Debido a las altas expectativas de inflación, el Banco Nacional de Serbia ha elegido la estabilidad de precios como el objetivo principal de la política monetaria y la tasa de política clave como el principal instrumento de regulación monetaria. Sin embargo, a pesar de la regla de Taylor claramente definida, la tasa de política clave no siempre sigue el movimiento de la tasa de inflación. En consecuencia, el objetivo de este estudio es evaluar los efectos de la tasa de inflación en la tasa clave de política y la posibilidad de utilizar la regla de Taylor en las condiciones originales de baja inflación. Con base en el objeto definido de la investigación, probamos la siguiente hipótesis: la tasa de inflación tuvo un impacto estadísticamente significativo en la tasa de política clave en todo el período analizado, entre 2007 y 2015. La misma observación se probó para dos subperíodos entre 2007 y 2011 y entre 2012 y 2015. Por lo tanto, se puede concluir que existe un impacto medio estadísticamente significativo de la tasa de inflación en la tasa de política clave, pero la representatividad del modelo podría ser mayor. La falta de reacción de la tasa clave de política monetaria a la inflación enfatiza la necesidad de redefinir los instrumentos de política monetaria y modificar la estrategia de metas de inflación.

Palabras Claves: *Inflación, Tasa de política clave, Política Monetaria, Regla de Taylor.*

JEL: *E31, E32, E37.*

1. Introduction

Monetary authorities, as a rule, define price stability as the primary and most important objective of their monetary policy. The same is the case with Serbia. Republic of Serbia is a country that is struggling with a huge inflation in last century and in 1993 have almost the greatest hyperinflation in the world. According that, The National Bank of Serbia has defined price stability as the primary objective of monetary policy. In accordance with the process of harmonization with the European Central Bank, with the Memorandum on the New Monetary Policy Framework, adopted in August 2006, the practice of inflation targeting has been introduced gradually. Formal implementation of the inflation targeting regime was defined by the Memorandum on Inflation Targeting as Monetary Strategy, as of 1 January 2009, which defined key policy rate as the main instrument of monetary regulation. Despite the underdeveloped financial market in Serbia, the emphasis was put on the open market operations and the key policy rate, while interventions in the foreign exchange market, which are commonly used, have secondary importance which was defined by the Memorandum on Inflation Targeting as Monetary Strategy in Serbia.

For this reason, we tested the following hypothesis: Inflation rate had statistically significant impact on the key policy rate (reference interest rate of the National bank of Serbia) in the between 2007 and 2015.This time framework is choose because new monetary policy framework was adopted in August 2006. The same hypothesis was tested for two sub-periods between 2007 and 2011 and between 2012 and 2015. The dataset is separating because in 2012 the National Bank of Serbia gets new governor.

In addition to the introduction and concluding remarks, the paper also contains three single and logically related sections. The first section presents theoretical framework and literature review. The second gives a description of the research methodology and data collection, while the third contains research results with discussion.

2. Literature review

The first country to introduce explicit inflation targeting was New Zealand in 1990 (Svensson, 2015). The strategy of inflation targeting uses interest rates channel as the main channel of monetary transmission mechanism. The mechanism is used by central banks to influence the change in long-term interest rates, through the short-term interest rates in accordance with inflation expectations. The National Bank of Serbia used the strategy of inflation targeting in medium term. One of the reasons is because the ‘long run’ is a theoretical concept, and economic theory offers no guidance as to how long the long run might be in practice (Ormerod, Rosewell and Phelps, 2013). Long-term real interest rates affect the scope and structure of consumption and propensity towards saving and investment. Since any decisions that significantly impact long-term rates would inevitably have implications for both monetary and financial stability (Chadha et al, 2013:549), it is necessary to examine the

impact of short-term changes in the key policy rate due to the time lags in the effects of monetary policy measures.

The National bank of Serbia uses the strategy of inflation targeting in accordance with modern monetary policy trends, because a sort of flexible inflation targeting regime seemed to have been adopted by both Federal Reserve System and European Central Bank (Di Giorgio, 2014). But the key problem in Serbia is in the non-functioning of the traditional interest rate mechanisms of monetary policy, because dominance of exchange rate channel an unofficial Eurisation. The exchange rate channel has the strongest impact on both real economic activity and prices in Serbia, regardless of the time frame (short/long run), while in both cases the interest rate channel was substantially weaker (Jevdjović, 2015). According to Benazić and Tomić (2014), a logical conclusion why interest rate transmission channel does not work is that monetary authorities do not influence money market interest rates, which is not the case in developed financial systems of the EU or United States.

An important signal of the non-functioning of financial market (due to various limiting factors) is the non-functioning of the interest rate channel. Moreover, in conditions of a loss of confidence and increased risk assessment, banks put additional restrictions on lending, which weakened the effect of the credit channel (Nekipelov and Golovnin, 2010).with unofficial Eurisation make dominance of exchange rate channel and reduce impact of interest rate.

Inflation targeting also includes a commitment to regularly publish projections on the basis of which decisions are made, usually through a variety of newsletters or similar reports. These publications make a statement of the central bank and its actions easily verifiable to allow the public at regular intervals to check the implementation of monetary policy (Benić, 2014). The problem arises when the central bank does not change the expected benchmark interest rate in line with inflation rates, which is not in accordance with the application of the Taylor rule.

From a historical perspective, the Taylor rule has been a useful yardstick for assessing monetary policy performance (Hofmann and Bogdanova, 2012). Starting with Taylor (1993) and Taylor (1999), the interest rate reaction function known as the Taylor rule, where the nominal interest rate responds to the inflation rate, the difference between inflation and its target, the output gap, the equilibrium real interest rate, and (sometimes) the lagged interest rate and the real exchange rate, has become the dominant method for evaluating monetary policy. A major focus of Taylor rule, pioneered by Orphanides, is the use of real-time data that reflect the information available to central banks when they make their interest-rate-setting decisions (Molodtsova et al, 2011). Bernanke has shown that the FED’s interest rate policies in the early and mid-2000s actually followed the conventional Taylor Rules closely, and that raising rates much sooner than mid-2004 would have been an extraordinary change in Federal Reserve policy (Bivens, 2014). Taylor (1993) proposed a simple rule to guide the Federal Reserve in setting its nominal federal-funds-rate target, thereby joining the long-standing debate on whether rules-based or discretionary monetary policy better achieves price stability consistent with high employment, goals mandated by the Employment Act of 1946 (Mitchell and Pearce, 2010).

The key policy rate has three main characteristics: it is calculated in a competitive market without manipulative influence of market participants, it has to be placed under the influence of the money market basic interest rate, and it has to be representative.

Central banks can determine the key policy rate ex post and ex ante usually in three ways (Furtula, 2008):

• *The key policy rate can be determined as a constant path that does not change within the stipulated time of analysis? (Typically 8 quarters),*

• *The key policy rate can be determined based on the expectations of market without obligation of the Central Bank to follow these expectations,*

• *The key policy rate can be determined as the projected path, which contains reaction of the monetary policy response. This model of the key policy rate projection is implemented by the National Bank of Serbia.*

As Goodhart said that in most standard macro-models, there is a single risk-free rate, set by the Central Bank in accord with some reaction function, as developed by John Taylor (1993/1999) (Goodhart, 2013). The National Bank of Serbia uses the projected inflation path based on the key policy rate, which it intends to follow. Inflation projection of the National Bank of Serbia is made and published on a quarterly basis since 2006, based on endogenously determined key policy rate, as monetary policy response to the movement of the inflation rate. The model for projection of Taylor-type rule (NBS, Inflation Report, 2007) is:

$$it = a(it-1)+(1-a)((r^*+\pi t) +b(\pi t- \pi^*)) \quad (1)$$

it-1 represents previous key policy rate;

r^* is equilibrium (neutral) real key policy rate (so that $r^*+\pi t$ is equilibrium (neutral) nominal

key policy rate);

$\pi t- \pi^*$ represents deviation of inflation from the target.

The rule defines that the key policy rate should be below neutral when projected inflation is below the target and vice versa. In accordance with standard practice of central banks, the rule has an element which refers to the mitigation of changes in the key policy rate (the relative importance of stabilization of the main monetary policy instrument is expressed in the value of parameter, from 0 to 1). The basic deviation from the Taylor rule is the exclusion of the impact of gap between real and projected GDP, but if we observe a traditional Taylor rule, it is notable that it is considerably more rigid compared to modified Taylor rule used by NBS. Traditional Taylor rule is (Taylor, 1999):

$$it = (r^*+ \pi^*)+1,5(\pi t- \pi^*)+0,5(yt-y^*) \quad (2)$$

Where *(yt-y*)* is output gap for current period. In the modified Taylor's rule, used by NBS, the value of the parameters a and b is not defined, as is the case in traditional Taylor's rule. All of the abovementioned suggests that there is a high level of discretion in the implementation of monetary policy of the NBS. This leads to the fact that the key policy rate is not moving in line with the inflation rate, hence the rate of inflation is beyond the boundaries defined by the inflation target most of the time.

3. Research methodology and data collection

Exploring the impact of inflation on the key policy rate was performed using linear regression model in the statistical program Minitab 15. The impact was measured by means of linear regression model, which has the following form:

$$it = \beta 0 + \beta 1 \pi t\text{-}1 + \varepsilon t \qquad (3)$$

where it is the key policy rate in month t, $\pi t\text{-}1$ inflation rate in the month preceding the month t, $\beta 0$ and $\beta 1$ are the parameters of the regression model and εt is random error.

The research was carried out on the basis of data obtained from the National Bank of Serbia (NBS). First we carried out the preliminary assessment of the changing inflation rates and key policy rates, and subsequently we explored the impact of the inflation rate in a particular month on the key policy rate in the next month. Due to the impact of inflation on the change in the key policy rate, inflation is taken as the basic determinant of the key policy rate. The research was conducted in the period between 2007 and 2015, where we performed the analysis for two sub-periods between 2007 and 2011 and between 2011 and 2015. The division between these two periods was performed due to differently guided monetary policy in the two periods.

4. Empirical results and discussions

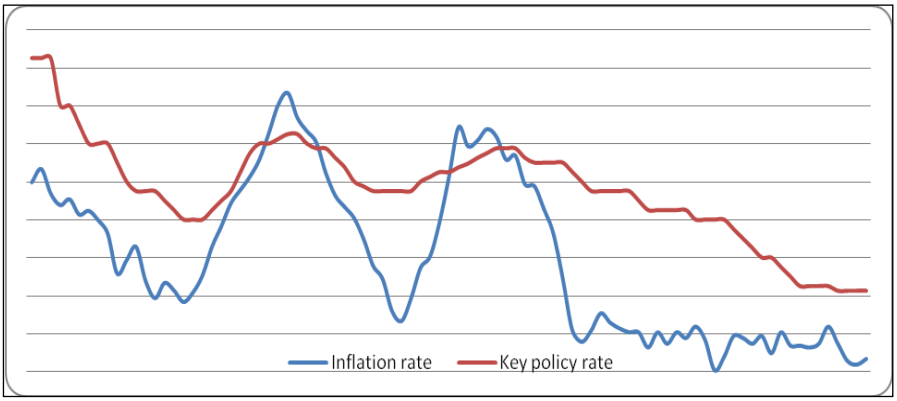
The inflation target is defined as the rate of inflation with a tolerance. It is set continuously and should contribute to the stabilization of inflation expectations in situations where a powerful shock results in temporary deviations of inflation from target level. Stabilization of expectations and increase in the credibility of NBS's monetary policy can be seen in Figure 1, which shows the rate of inflation in the period between 2009 and 2015. It was outside the allowable limit inflation corridor for more than 70% of the time in the last eight years. In the last three years there is a deviation of up to 90%.

Figure 1. Target and actual inflation in Serbia between January 01st, 2009 and September 30th, 2016 (annual growth, in %)

Source: NBS

There were no corrections of the key policy rate of NBS in accordance with the established inflation deviations from inflation corridor. We can notice the inefficiency of this instrument of monetary regulation in the last three years in Figure 2. Modified Taylor-type rule is not implemented because the Executive board has bringing unreasonable change in the key policy rate for the last three years. Which is not in accordance with the application of the Taylor rule. This is especially important if we observe other key policy rates in Europe, which were below the minimum level of 1%, insufficient demand, recessionary trends, the reduction of production and employment, which imposes the necessity of lowering key policy rate.

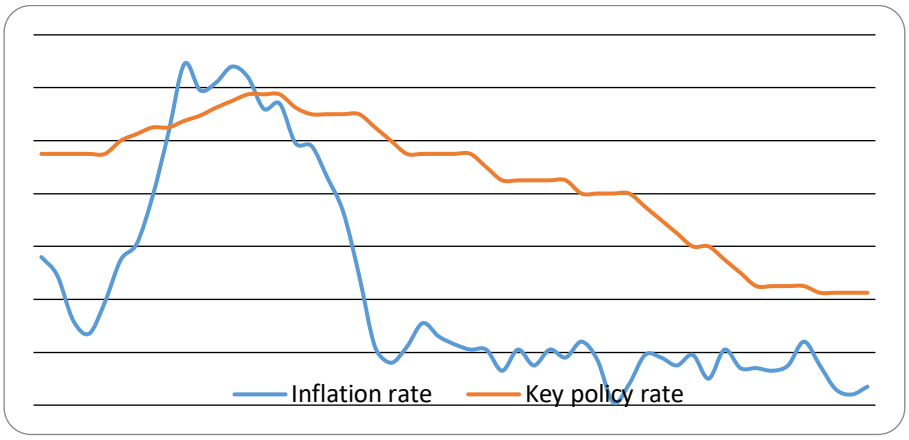
Figure 2. NBS key policy rate and the inflation rate in the period 2009-2016



Source: Author's calculations

As opposed to the period of 2009-2012, if we look at the period from 2012 it is evident that there is a huge collision in the movement of the key policy rate and inflation rate, as can be seen in Figure 3.

Figure 3. NBS key policy rate and the inflation rate in the period 2012-2015

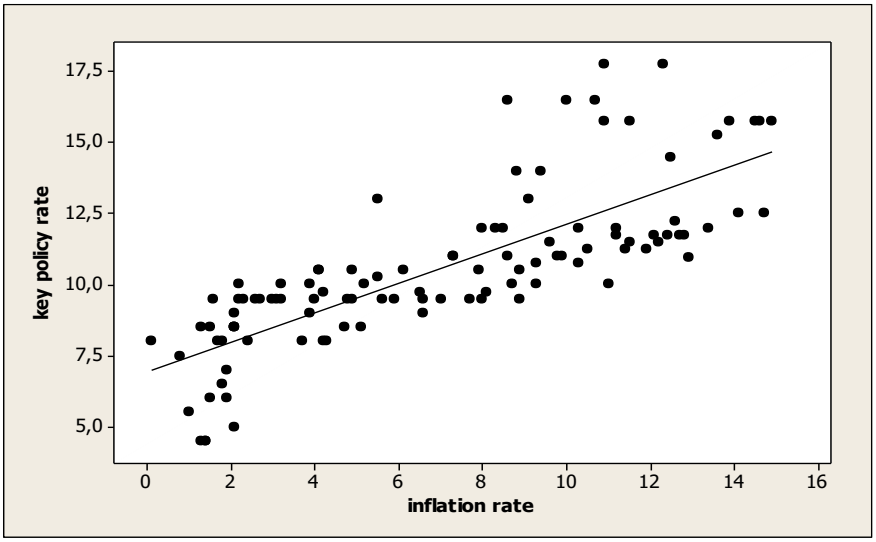


Source: Author's calculations

It can be concluded, because the graph lines are not parallel, that there are differences in the conduct of monetary policy and reactions in the key policy rate compared to the rate of inflation before 2012 and after 2012, and for this reason it is necessary to analyze both periods specifically.

In accordance with previous research we tested the impact of inflation rate on the key policy rate. Analysis of the impact of inflation on the key policy rate in the period between 2007 and 2015 can be seen in Figure 4 and Table 1.

Figure 4. Scatterplot of inflation rate and key policy rate (2007-2015)



Source: Author's calculations

Table 1. Regression statistics for period 2007-2015

Predictor	Coef	SE Coef	T	P
Constant	6.9251	0.3321	20.85	0.000
β_1	0.51918	0.04070	12.76	0.000
		S=1,76436	R-Sq=60.8%	R-Sq(adj)=60.4%

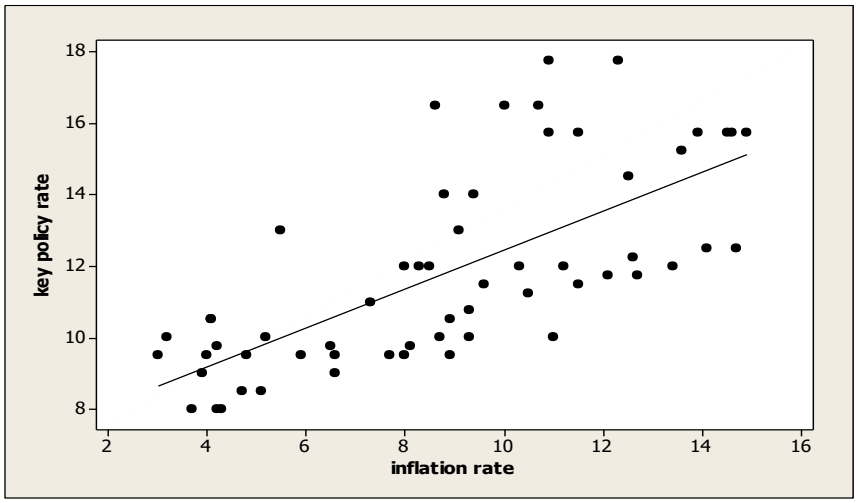
Source: Author's calculations

For the whole analyzed period (2007-2015) we can say that the increase in inflation rate of 1% leads to an increase in the key policy rate of 0.52%, as the decrease of 1% decreases this rate by 0.52%. The impact of inflation rate on the key policy rate is very strong and statistically significant, which is indicated by the value of p (p = 0.000). It is important to note that 60.4% of the key policy rate variability can be explained by the influence of the inflation rate (Table 1). The following equation shows the impact of inflation rate on the key policy rate in the period between 2007 and 2015.

$$i_t = 6.93+0.52\pi_{t-1} \qquad (4)$$

The following analysis is related to the impact of inflation rate on the key policy rate in sub-period between 2007 and 2011 and it is presented in Figure 5 and Table 2.

Figure 5. Scatterplot of inflation rate and key policy rate (2007-2011)



Source: Author's calculations

Table 2. Regression statistics for period 2007-2011

Predictor	Coef	SE Coef	T	P
Constant	7.0177	0.7018	10.00	0.000
β_1	0.54506	0.07416	7.35	0.000
		S=1.95201	R-Sq=48.7%	R-Sq(adj)=47.8%

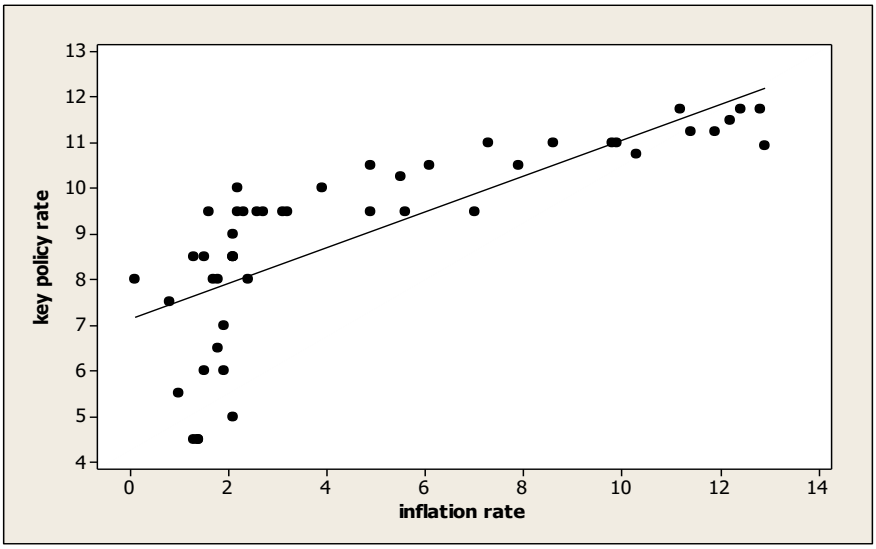
Source: Author's calculations

As one can see, in the sub-period between 2007 and 2011 the increase in inflation rate of 1% leads to an increase in the key policy rate of 0.54%, as the decrease of 1% decreases this rate by 0.54%. This impact is statistically significant which is indicated by the value of p (p = 0.000). What is important to note is that 47.8% of the key policy rate variability can be explained by the influence of the inflation rate, and the rest by the impact of other variables (Table 2). This leads to lower representativeness of this model compared to the previous one. The following equation shows the impact of inflation rate on the key policy rate in the sub-period between 2007 and 2011:

$$i_t = 7.02 + 0.54\pi_{t-1} \quad (5)$$

The following analysis, shown in Figure 6 and Table 3, is related to the impact of inflation rate on the key policy rate in the sub-period between 2012 and 2015.

Figure 6. Scatterplot of inflation rate and key policy rate (2012-2015)



Source: Author's calculations

Table 3. Regression statistics for period 2012-2015

Predictor		Coef	SE Coef	T	P
Constant		7.1323	0.3049	23.40	0.000
β_1		0.39286	0.04924	7.98	0.000
			S=1.34877	R-Sq=58.1%	R-Sq(adj)=57.1%

Source: Author's calculations

In the second sub-period (2012-2015) the increase in inflation rate of 1% leads to an increase in the key policy rate of 0.39%, as the decrease of 1% decreases this rate by 0.39%. As in other periods, the impact of inflation rate on the key policy rate is statistically significant which is indicated by the value of p (p = 0.000) (Table3). The following equation shows the impact of inflation rate on the key policy rate in the period between 2012 and 2015:

$$i_t = 7.13 + 0.39\pi_{t-}1 \qquad (6)$$

Furthermore, the representativeness of the model is lower compared with the model that represents the entire period, but higher compared with the period between 2007 and 2011. Specifically, 57.1% of the key policy rate variability can be explained by the influence of the inflation rate, and the rest by the operation of other variables that are not part of this model (Table 3).

5. Conclusions and limitations of the research

Based on the above empirical analysis, we can say that the impact of inflation rate on the key policy rate is medium in the whole analyzed period. If we look at the two sub periods, the impact of inflation rate on the key policy rate is higher in first than in second period. During the whole period, the impact of inflation rate on the key policy rate is lower (0.51) than in the first sub-period (0.54), but higher than in the second sub-period (0.39). It is important to note that in the whole analyzed period 60.4% of the key policy rate variability can be explained by the influence of the inflation rate, and the rest by the impact of other factors. In the first sub-period this presence is 47.8%, and in the second sub-period it is 57.1%.

It can be concluded that the stated hypothesis is completely confirmed. There is statistically significant impact of inflation rate on the key policy rate, but representativeness of the model can be higher. Since the representativeness of the model is not high (especially in the period between 2007 and 2011), there are some other factors which will influence the key policy rate and inflation in future, such as insufficient demand or economic growth.

The limitation of the research is length of the time series, which can be longer, and in further research we will use other factors to increase representativeness of the model.

Nevertheless, this is one of the first studies of the influence of inflation rate on the key policy rate in Serbia and West Balkans region, and can be a starting point for further studies. These results provide the conclusion that Serbia with a choice of inflation targeting and interest rate channel directed towards accession to the European Union, but it is necessary precisely implement monetary policy in future.

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