INFLATION TARGETING AND ECONOMIC GROWTH IN THE CESEE COUNTRIES

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Abstract

The paper compares the economic performance of countries that apply the monetary regime of inflation targeting (IT) and countries that apply alternative monetary regimes in the CESEE (Central, Eastern, and Southeastern Europe) region. The paper aims to assess whether the IT monetary regime has contributed to greater positive effects on economic performance in the group of countries that use inflation targeting as a monetary strategy compared to other groups of countries with alternative monetary strategies. The methodology of comparison was applied, namely the statistical technique Difference in Difference (DID), according to Ball and Sheridan (2005) and Goncalves and Salles (2008). After the introduction of IT, there was a fall in inflation rates (but the significance of IT is artificial) and a reduction in the volatility of inflation and gross domestic product (GDP), leading to a stabilisation of economic growth. The results of the analysis indicate that during the period of analysis (1990–2020), there was an improvement in economic performance after the introduction of inflation targeting in the group of countries that use that monetary strategy, but also in other groups of countries. However, the results show that economic performance is a little better in the group of countries that applied inflation targeting as a monetary regime.

Key words: inflation targeting, inflation, economic growth, GDP, CESEE.

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ЦИЉАЊЕ ИНФЛАЦИЈЕ И ПРИВРЕДНИ РАСТ У ЗЕМЉАМА ЦЕНТРАЛНЕ, ИСТОЧНЕ И ЈУГОИСТОЧНЕ ЕВРОПЕ

Апстракт

У раду се врши поређење остварених економских перформанси земаља које примењују монетарни режим циљања инфлације и земаља које примењују алтернативне монетарне режиме у земљама Централне, Источне и Југоисточне Европе. Циљ рада је да се процени да ли је монетарни режим циљања инфлације допринео већим позитивним ефектима на економске перформансе у групи земаља које примењују циљање инфлације као монетарну стратегију у односу на другу групу земаља које користе алтернативне монетарне стратегије. Примењена је методологија поређења према студијама Бол и Шеридан (2005) и Гонсалвес и Салз (2008). Након увођења циљања инфлације, дошло је до пада стопа инфлације (али је значај варијабле циљања инфлације вештачки) и смањења волатилности инфлације и бруто домаћег производа (БДП), што доводи до стабилизације привредног раста. Резултати анализе указују да је током периода анализе (1990-2020.) дошло до побољшања економских перформанси након увођења циљања инфлације код земаља таргетара, али и до побољшања и код земаља нетаргетара. Ипак резултати указују да су економске перформансе мало боље код земаља које примењују циљање инфлације као монетарни режим.

Кључне речи: циљање инфлације инфлација, привредни раст, БДП, ЦЕСЕЕ.

INTRODUCTION

The monetary strategy of targeting inflation was a revolutionary idea that was primarily 'born' in economically developed countries. After a long period of hyperinflation, industrially developed countries (for example, Latin America) successfully established control over the level of inflation and reduced it to a single-digit level. Later, the application of this concept experienced an expansion from more prosperous, developed countries to developing countries and countries in transition. The central banks of these countries have successfully controlled inflation through profound changes in the conduct of monetary policy and anti-inflationary policy. This monetary policy is based on transparency, independence, and credibility, and the only monetary scheme that combines these virtues of the central bank with the pragmatic use of policy instruments is certainly inflation targeting (Loayza & Soto, 2002, p. 5). Although the application of this monetary regime is widespread, there are conflicting opinions regarding its effectiveness. As other monetary strategies did not result in the desired outcome, many countries started implementing the concept of inflation targeting.

The concept of inflation targeting was first introduced and adopted in New Zealand in 1990. The Central Bank of New Zealand adopted a formal inflation-targeting framework in 1989, which was introduced un-

der the Central Bank of New Zealand. Milenković and Davidović (2009) state in their study that the application of inflation-targeting helps target countries maintain stable and low inflation in the long term, which resists the influence of external shocks (oil shocks, exchange rate shocks). With this, the monetary policy gains efficiency, which is reflected in keeping the inflation level close to the target. Malović (2014) points out that in practice, especially in countries in transition, flexible inflation targeting is applied more often, which targets inflation in a slightly wider target range, thus leaving room for the national economy's development. In this paper, we dealt with the effectiveness of the monetary regime targeting inflation on economic performance through macroeconomic variables: inflation, volatility of inflation, gross domestic product, and volatility of the gross domestic product. We chose a sample consisting of the countries of Central, Eastern, and Southeastern Europe (CESEE). The reason for choosing this sample lies in the different economic developments of these countries, as well as the differences in terms of the monetary policy strategies that they apply. The sample consists of a total of 19 countries (Russia and Ukraine are excluded from the sample due to the short period of implementation of inflation targeting), 8 target countries, and 11 non-target countries. The analysis is performed with annual data for the period between 1990 and 2020.

The research problem is a practical and econometric examination of the impact of the monetary strategy of inflation targeting on economic growth, and a comparison of the achieved economic performances of target countries and non-target countries in the CESEE region. Since the main goal of this monetary policy strategy is to ensure low and stable inflation, it should have a positive effect on economic growth, that is, on the growth of the real gross domestic product rate, as its indicator. As there are controversies regarding the relationship between inflation and economic growth, as well as the effectiveness of inflation targeting as a monetary policy regime, we will try to prove that stabilising inflation encourages real GDP growth, or at least does not hinder its growth, and that the monetary strategy of targeting inflation has proven to be more effective compared to other regimes of monetary policy, which consequently leads to the growth of the real gross domestic product of the countries in the sample. To determine the effectiveness of the aforementioned monetary strategy, we will compare the realised effects of inflation targeting on the economic performance of the target countries (the treatment group) and non-target countries (the control group) using the DID statistical technique.

The main objective of the analysis is to assess whether the adopted inflation targeting regime contributed to greater positive effects on economic performance for the countries that apply it, using non-target countries as a 'control group.'

H0 – The application of the monetary strategy of targeting inflation leads to the lowering of the level of inflation rates, reducing the volatility of inflation and the volatility of GDP, which leads to the stabilisation of the GDP growth rate and, thus, to the stabilisation of economic growth.

H1 – Inflation targeting leads to a reduction in the level of inflation, inflation volatility, and GDP volatility in the target countries.

H2 – The positive effects of IT on the economic performance of the target countries are greater than the positive effects of other (alternative) monetary regimes.

The paper is divided into six parts. In the first part, the research methodology used is presented. A description of the variables and the model used in the analysis is given in the second part. The third part includes all the results of the analysis. The discussion and conclusion are presented in the fifth and sixth parts of the paper.

LITERATURE REVIEW

Despite extensive research, the empirical evidence on the performance of the monetary regime inflation targeting is still inconclusive. Inflation targeting as a monetary strategy has stable and low inflation as its primary goal. There are numerous studies on whether it is effective in achieving its main goal. The optimistic view on inflation targeting is based on empirical evidence from research that shows that the application of this monetary regime leads to the reduction of high levels of inflation rates to acceptable percentages (it is considered that the inflation rate in the range of 3-5% has a stimulating effect on the economy), and reduces its volatility. The authors who proved this thesis conducted research in a large number of countries and presented it in their works: Mishkin and Schmidt-Hebbel (2007), Batini and Laxton (2007), Goncalves and Salles (2008), Lin and Ye (2009), De Mendonca and De Guimaraes e Souza (2012), Valera, Holmes, and Hassan (2018), and Samarina, Terpstra, and De Haan (2014).

On the other hand, the opponents of this position and opinion, through the results of their research, indicate that there is a weak correlation link or that the introduction of a monetary strategy of inflation targeting has no effect on the inflation movement itself. This is evidenced by the works of Ball and Sheridan (2005), Goncalves and Carvalho (2009), and Brito and Bystedt (2010), while the authors Dueker and Fisher (2006) as well as Lin and Ye (2007), through their research on a sample of target countries and non-target countries, indicate that there are no significant differences in inflation levels. Also, there are conflicting opinions on whether inflation targeting has a positive effect on economic growth. In the research of the theoretical assumptions for this thesis, it is emphasised that the effect of the introduction of the monetary regime of inflation tar-

geting depends on the initial level of economic growth (e.g., Gupta (2011)), while other authors, such as Cordero (2007), emphasise the negative impact of inflation targeting on economic growth. One group of authors, such as Bernake, Laubach, and Mishkin (1999), Mishkin (1999), Bernake (2003), and Svensson (2007), indicates that after the introduction of the monetary regime of inflation targeting, a certain degree of stabilisation is achieved in the real economy. Empirical evidence on the effects of inflation targeting real economic growth is also far from conclusive and uniform. After reviewing previous empirical research, a certain group of empirical studies, conducted by Mishkin (2001), Neumann and von Hagen (2002), Ball and Sheridan (2003), Apergis and Panethimitaki (2008), Mollick, Cabral and Carniero (2011), Amira, Mouldi and Feridun (2013), Ayeres, Belasen and Kutan (2014), Aquir (2014), and Souza, Mendoca and Andrade (2016), indicates that there is a positive impact of the monetary strategy of targeting inflation on economic growth, while another group of researchers who oppose this opinion, such as Lavoie (2002), Fraga, Goldfain and Minella (2003), Libanio (2005), Mishkin and Schmidt-Hebbel (2007), Frang, Lee and Miller (2009), and Brito and Bystedt (2010), suggest the opposite with their results. Examining the impact of this monetary strategy on economic growth, Ayeres, Belasen, and Kutan (2014) stated that it is minimal, but that there is a statistically significant increase only in certain regions, such as Europe, Latin America, and the Middle East.

According to the study, Brito and Bystedt (2010) point out with empirical evidence that there are variations in the introduction of this monetary regime by country, as well as that there is a negative relationship between average inflation and its volatility, and that there is a strong negative relationship between inflation and economic growth. Molick, Cabral, and Garneiro (2011) studied the impact of inflation targeting on economic growth in a group of 55 countries, of which 22 are developed countries and 33 are developing countries. The results of the study indicate that, with the transition to strict inflation targeting (IT-full fledged), real GDP growth rates are also higher, regardless of whether developing countries or developed countries are examined. Contrary to the static model of the panel analysis, the dynamic model estimated that the long-term effect of inflation targeting developing countries is lower than with the static model. The reason lies in the fact that developing countries switched to this monetary regime much later, so the full effects on real economic performance were lagging compared to developed countries. Abo-Zaid and Tuzemen (2012), using the Diff-in-Diff methodology, point out that after a comparative review of the implementation of inflation targeting in the analysed countries, inflation rates were reduced, which supported economic growth. Souza, Mendoca, and Andrade (2016) highlighted the period of the financial crisis (2008), wherein they con-

cluded that in those countries that applied inflation targeting as a monetary strategy, economic performance was significantly better after the financial crisis compared to non-targeting countries. The conclusion of the study by author Aquir (2014) was based on the fact that the application of this monetary regime ensures better macroeconomic performance, thus enabling sustainable economic growth through low and stable inflation. Soe and Kakinaka (2018) calculated the volatility of income, inflation, GDP, the growth of the amount of money in circulation, and the real growth of the money balance (money balance growth). The results of the study present the argument that the effectiveness of the application of the monetary regime of inflation targeting could be increased if the monetary aggregate M1 (money supply) was included as an appropriate instrument within this regime in developing countries.

The research conducted by Valera, Holmes, and Hassan (2018) was aimed at examining the relationship between inflation targeting and its volatility through the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) volatility model. The results of the research indicate that the analysed countries that apply this type of monetary inflation targeting strategy, compared to those countries that do not apply it, managed to reduce inflation levels and inflation volatility. Also, the results show that inflationary shocks are increasing for both groups of observed countries (targeters and non-targeters). In their study, Amira, Mouldi, and Feridun (2013) examined the impact of the application of the monetary regime of inflation targeting on the growth of real GDP and its volatility. The results showed that there is a significant relationship between inflation targeting and the volatility of real economic growth, which also implies the stabilisation of economic growth in the short term due to the stimulus of inflationary expectations. Empirical evidence shows that, although the implementation of the monetary regime of inflation targeting results in higher economic growth, it does not guarantee the stability of real GDP growth. The reason for this is that the effectiveness of this way of conducting monetary policy decisively depends on the structural parameters of the country's economy and external dynamics. In an empirical study conducted by Goncalves and Salles (2008), target countries and non-target countries were compared. The results of the research proved that the choice of applying the monetary regime of inflation targeting proved to be beneficial for developing countries and new economies, in the sense that the decline in high inflation rates in developing countries can be attributed to the application of this monetary regime. Also, the authors point out that the volatility of economic growth in target countries is reduced compared to countries that apply other alternative monetary strategies. Apergis, Miller, Panethimitakis, and Vamvakidis (2005) used the IS-LM model in their research on a sample of OECD countries (the Organization of Economic Cooperation and Development)

for the period between 1974 and 2001. The results of the study point out that the gap between the average GDP and the average inflation rate decreases at higher targeted inflation rates. Also, there is a negative correlation between the average GDP rate and the average inflation rate. If monetary and fiscal policy is directed towards the stabilisation of inflation, it will automatically lead to the stabilisation of the GDP if the economy faces shocks arising from the demand side. If the shocks are manifested on the supply side, the stabilisation of inflation will lead to an increase in the variability of real GDP.

Öztürk, Sözdemir, and Űgler (2014) analysed GDP rates in developed and developing countries that apply a monetary strategy of targeting inflation. The results of the studies indicate that both groups of countries applying this monetary regime managed to reduce inflation rates. Before and after the country's financial crisis, the targeters recorded fewer fluctuations in inflation rates. Also, the authors point out that target countries have better macroeconomic performance compared to non-target countries, except for the period between 2007 and 2009, when the effects of the financial crisis were most intense. In a paper that deals with the connection between the monetary strategy of inflation targeting and its uncertainty, Taț (2012) introduces the GARCH methodology (a basic model that is upgraded with leverage effects) and GARCH into the conventional model of inflation variances. The author examines the relationship between the level and volatility of inflation in a sample of 26 countries, which are divided into groups of developing countries and developed countries. Empirical results indicate that the monetary strategy of inflation targeting helps countries that implement it conduct monetary policy in the best possible way. This study supports the monetary strategy of inflation targeting, and the author of the paper suggests that those countries struggling with high levels of inflation rates should consider introducing this monetary strategy.

DATA AND METHODOLOGY

By the set goals and hypotheses of the paper, the need to analyse a larger group of data over a longer period is highlighted. As the effects of the introduction of the monetary strategy of inflation targeting do not stand out significantly in shorter periods, 1990 was taken as the starting year in the analysis, because that year marked the first presentation of this alternative monetary strategy in New Zealand. The sample of countries consists of 19 European countries (Russia and Ukraine are excluded from the analysis) which make up the CESEE region of European countries compiled by the International Monetary Fund. The following table (Table 1) shows the CESEE countries included in the sample for analysis. The countries are divided into two groups: 8 target countries — countries that

apply the IT monetary regime, and 11 non-IT countries — countries that apply other alternative monetary regimes.

Table 1. Countries in the CESEE region included in the Sample

IT countries	Year of adoption IT	Non-IT countries	
Czech Republic	1998	Bulgaria	Montenegro
Poland	1999	Croatia	North Macedonia
Hungary	2001	Estonia	Belarus
Albania	2009	Latvia	
Romania	2005	Lithuania	
Serbia	2009	Slovakia	
Turkey	2006	Slovenia	
Moldova	1998	Bosnia and Herzegovina	

Note: Russia and Ukraine were excluded from the analysis due to the short period of application of the IT monetary regime. Russia implemented the IT regime in 2015, and Ukraine in 2017.

The specificity of the selection of this sample lies in the heterogeneity and specificity of the countries in terms of economic development, membership in the European Union, and the European Monetary Union, as well as in terms of the process of transition. The planned analysis will be carried out for the period between 1990 and 2020 to see the effects of the monetary inflation targeting regime on economic growth as clearly as possible. Also, the longer period of the analysis and assessment is connected with the fact that countries implemented this way of conducting monetary policy in different periods (years), namely: Albania (2009), Czech Republic (1998), Hungary (2001), Moldova (2010), Poland (1999), Romania (2005), Serbia (2009), and Turkey (2009). Therefore, the effects themselves are different by country.

THE DESCRIPTION OF VARIABLES AND MODELS

As there is a problem – namely, that the significant reduction in inflation rates after the introduction of the IT regime in countries that initially had high inflation rates is not a direct result of the IT regime, Ball and Sheridan (2005) introduce an independent variable, which is the initial value of the dependent variable. This approach involves determining the average value of the observed economic variable for each country and determining whether there has been an improvement. However, to attribute that improvement to inflation targeting, one must compare the improvements in target and non-IT countries.

We applied the DID methodology. Difference-in-differences is an analytical approach that facilitates causal inference even when randomisation is not possible. Difference-in-differences combines two methods to

compare the before-and-after changes in outcomes for treatment and control groups, and to estimate the overall impact of the program. The DID methodology was used by Ball and Sheridan (2005) and Gonclaves and Salles (2008). We also examined whether changes in the movement of average inflation, volatility of inflation, and volatility of gross domestic product were greater in target countries compared to non-target countries.

We used annual inflation rates and annual gross domestic product growth rates from International Financial Statistics. We estimated the following regression:

$$X_{post} - X_{pre} = a_0 + a_1 IT + \varepsilon \tag{1}$$

X_{post} – the value of the variable in the post-target period;
X_{pre} – the value of variable X in the period before targeting;
IT – an artificial variable that takes the value 1 if the country uses inflation targeting as a monetary strategy, or 0 if it is not;
a_1 – regression parameter that measures the effects of targeting on the dependent variable.

It is possible to evaluate several models by varying the pre-targeting period in the sample. Since the initial value of the observed dependent variable can differ significantly, the initial value of the dependent variable is also included in the model as an independent variable. Namely, this regression model can lead to wrong conclusions. According to Ball and Sheridan (2005), the transition to an inflation-targeting regime was most attractive for those countries that had very poor economic performance. Therefore, the level of improvement will also depend on the starting conditions, so often the average values of inflation in the pre-target period in these countries are very bad, so the improvement is greater than in those countries that are not in the inflation targeting regime. Hence, the following regression model is evaluated to determine the influence of the initial value of the dependent variable on its improvement.

$$X_{post} - X_{pre} = a_0 + a_1 IT + a_2 X_{pre} + \varepsilon \tag{2}$$

In this regression, the coefficient with the artificial variable shows the effect of targeting the dependent variable with the given initial performance. If that coefficient is statistically significant, then the improvement in the target countries with initially poor performance is greater than the improvement in the non-target countries with similar initial economic performance.

The analysis aims to assess the effectiveness of the inflation targeting regime in improving the economic performance of the target countries in comparison to the non-target countries, which we used as a 'control group.' That is, we are interested in the economic and statistical significance of the parameter a1. This analysis requires defining the dividing

line between what is called the 'start' and 'end' periods. Defining the demarcation date between the end of the initial period and the beginning of the final period is simple for the target countries, that is, countries that apply inflation targeting as a monetary strategy. For the group of IT countries, this date includes the year in which a certain country adopted the inflation targeting regime in the first six months of that year, or the following year otherwise.

Setting dates for non-IT countries involves an inevitable degree of arbitrariness. Ball and Sheridan (2005), as well as Gonclaves and Salles (2008), defined this date for non-target countries as the average date of adoption for a group of target countries by calculating the arithmetic mean. In our sample, the calculated average adoption date for the target countries was 2005. Since we used the countries of the CESEE region as our sample, most of the countries had periods of hyperinflation during the early 1990s. Some such target countries are Poland, Serbia, Turkey, Albania, Romania, and Moldova, and some such non-target countries are Croatia, Bulgaria, Estonia, Latvia, Lithuania, Slovenia, North Macedonia, and Belarus. In order not to reach the wrong conclusions due to the period of hyperinflation, we excluded the years when inflation rates were over 50% from the observation. Since this is a general problem of research on the movement of inflation in many developing countries, many authors, such as Gonclaves and Salles (2008), Brito and Bysted (2010), and Amira Mouldi and Feridun (2013), have similarly solved this problem in their research.

Goncalves and Sales (2008) state that in the traditional DID methodology, the initial and final periods are the same for the control and treatment groups. Although the application of this method is somewhat random, calculating the average date of the introduction of the IT regime introduces a certain symmetry into the analysis. Also, they ran the same regressions using 1997 and 1999 as the years demarcating the initial period, but these changes in the analysis did not substantially affect their results.

RESULTS

Fall in Inflation as a Dependent Variable

When we used the inflation rate as a dependent variable in the model, we used three samples. All three mentioned samples include a group of IT countries (Czech Republic, Poland, Hungary, Albania, Romania, Serbia, Turkey, and Moldova) and a group of non-IT countries (Bulgaria, Croatia, Estonia, Latvia, Lithuania, Slovakia, Slovenia, Bosnia and Herzegovina, Montenegro, North Macedonia, and Belarus). Russia and Ukraine have only recently introduced an inflation-targeting regime,

so due to the short period of the application of this regime and the possi-bility of obtaining wrong results and interpretations, we excluded them from the analysis.

The first sample includes changes in average inflation rates, where the initial period is 1990 and the final period is 2020. In this sample, we calculated the decline in inflation for the entire period of analysis using the arithmetic mean. The drop in inflation is noticeable in both of the ob-served groups, even though the average drop in inflation is slightly higher in countries that apply inflation targeting.

In the second sample, we used the initial period of analysis differ-ently for the observed groups of countries. For target countries, it is the date of adoption of inflation targeting, and for non-target countries, we use the average date of introduction of IT for target countries (2005). The drop in inflation in this sample is on average higher in the target countries compared to the non-target group. What we can conclude is that the final inflation before the introduction of the monetary inflation targeting re-gime in the target countries was almost twice as high on average com-pared to non-target countries (using 2005 as a hypothetical year).

In the third sample, we analysed the period after the introduction of inflation targeting. The initial period is the year after the introduction of inflation targeting as a monetary strategy. Based on the calculated aver-ages, we obtained a result that indicates that the average drop in inflation in the group of IT countries is slightly higher than in non-IT countries.

Table 2. IT countries – Fall in inflation

Country (IT)	Year of IT adoption	Sample 1 (1990-2020)	Sample 2 (Before IT)	Sample 3 (After IT)
Czech Republic	1998	-7,93	-3,3	-7,54
Poland	1999	-42,73	-34,5	-3,78
Hungary	2001	-25,04	-18,57	-5,79
Albania	2009	-20,95	-19,21	-0,61
Romania	2005	-29,61	-20,37	-6,38
Serbia	2009	-21,73	-10,9	-6,54
Turkey	2006	-32,68	-36,78	+2,68
Moldova	1998	-26,10	-29,93	-3,71
Mean	2005	-25,85	-21,70	-3,96

Source: Author's calculation

The previous table (Table 2) shows the decline in the inflation rate in the target countries – countries that apply the IT monetary regime, for the three analysed periods. The first sample refers to the complete period of analysis, the second sample refers to the period before IT, and the third simple refers to the period after the introduction of IT.

In the first sample, the largest drop in the inflation rate was recorded in Poland (-42.73%), and the lowest in the Czech Republic (-7.93%). The Czech Republic and Poland are the first developing countries to introduce the IT regime, and the first countries in the CESEE region. In the Czech Republic, inflation hovered around 10% until 1998, then recorded a decline and hovered around 2% until the end of the analysed period. Poland had periods of hyperinflation in the 1990s, and the recorded inflation in 1990 was as much as 568%.

In order not to get inflated results and illogical conclusions from the analysis, we excluded this period (1990–1992) from the analysis. After the introduction of the IT monetary regime, the biggest drop in inflation was recorded in the Czech Republic (-7.54%), followed by Serbia (-6.54%). Serbia also had a long period of hyperinflation (1990–2001); the inflation rate has dropped to around 2% as recently as 2014. Considering that Serbia introduced the IT monetary regime in 2009, these results of the IT regime proved to be effective. Turkey also had a long period of hyperinflation (1990–2001); inflation rates were over 50%, and in 1994 they were 105%. After the implementation of the new IT monetary regime in 2009, there was a slight increase in the inflation rate amounting to 2.68%. It is also the only target country in the CESEE region where inflation increased in the period after the introduction of IT (2006–2020). However, it is specific to Turkey which had the largest drop in the inflation rate before the introduction of the IT regime (-36.78 %). In this sample of IT countries, in addition to the mentioned IT countries, the countries that had a period of hyperinflation in the 1990s are Albania (e.g., 226%, 1992), Romania (e.g., 231%, 1991), and Moldova (e.g., 1,614%, 1993).

Table 3. Non-IT countries – Fall in inflation

Country (Non-IT)	Year of IT adoption (hypothetical year)	Sample 1 (1990-2020)	Sample 2 (Before IT)	Sample 3 (After IT)
Bulgaria	2005	-22,13	-12,52	-3,37
Croatia	2005	-3,18	-1,89	-2,55
Estonia	2005	-48,09	-44,6	-4,52
Latvia	2005	-35,70	-29,73	-6,53
Lithuania	2005	-38,45	-38,49	-1,46
Slovakia	2005	-7,95	-2,34	-0,77
Slovenia	2005	-31,81	-28,17	-2,5
Bosnia and Herzegovina	2005	-6,78	-5,45	-4,63
Montenegro	2005	-30,12	-26,76	-3,71
North Macedonia	2005	-15,17	-16,82	+0,67
Belarus	2005	-36,99	-24,44	-4,79
Mean	-	-25,12	-21,02	-3,11

Source: Author's calculation

Table 3 shows the decline in inflation rates in non-IT countries, where we determined the year of IT introduction to be the arithmetic mean of the years of IT introduction in countries (2005), as was done by the authors Ball and Sheridan (2005) and Gonclaves and Salles. (2008). Based on this and the specific hypothetical date of the introduction of IT in the non-IT countries, in the first sample, the largest drop in inflation was recorded in Estonia (-48.09%), and the lowest in Croatia (-3.18%). In the period between 1990 and 2005 (second sample), the largest drop in inflation was recorded in Lithuania (-38.49%) and the lowest in Croatia (-1.89%). In the period between 2005 and 2020, in 2008, the largest drop in the inflation rate was recorded in Latvia (-6.53%), and the lowest drop, i.e., an increase in the inflation rate, was recorded in North Macedonia (at 0.67%). In this sample of non-target countries, a period of hyperinflation was present in the following countries: Bulgaria (e.g., 1,058%, 1997), Croatia (e.g., 500%, 1990), Estonia (e.g., 90%, 1993), Latvia (e.g., 952%, 1992), Lithuania (e.g., 1021%, 1992), Slovenia (e.g., 552%, 1990), North Macedonia (e.g., 127%, 1994), and Belarus (e.g., 2,221%, 1994).

Based on the results presented in Tables 2 and 3, determined by the arithmetic mean of targeters and non-targeters in the first sample (1990–2020), a greater drop in the inflation rate was recorded in the group of target countries. In the second sample (1990–IT introduction period), a greater drop in the inflation rate was also recorded among the target audience, as was the case in the third sample (IT–2020 introduction period). Therefore, the results indicate that the drop in the inflation rate in all three of the analysed samples is greater in the target countries, emphasising the period after the introduction of the IT monetary regime, where the drop in the inflation rate is greater in the target countries compared to the non-target group. The difference in the fall in the inflation rate between the observed groups of countries is minimal, but it is present.

In this part of the paper, we wanted to determine whether excessively high inflation in the past led to huge drops in inflation from the initial to the final period in the observed countries, that is, whether the significance of the IT dummy variable was 'artificially' inflated.

According to the evaluated models (1) and (2) (Table 4), it can be observed that the dummy variable IT is not statistically significant in model 2, which was evaluated on the first sample. Estimated models that include the initial value of inflation indicate that this variable has a statistical impact on the decline in the value of inflation in all observed samples, and that the significance of the inflation targeting regime is inflated.

Table 4. Inflation regressions

Dependent variable:	Equation 1			Equation 2		
Fall in inflation	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
IT dummy	0,7217	0,5747	0,8533	-2,7435**	-3,17419	-1,2575
Infpre				0,93335*	13897219***	0,5492**
Adjusted R²	0,0579	0,058	0,0313	0,9659	0,864728	0,2020

Notes: * statistical significance at 1% ** statistical significance at 5%
*** statistical significance at 10%
Source: Author's calculation

Inflation Volatility and GDP Volatility as Dependent Variables

In the following analysis, we evaluated inflation volatility and GDP volatility using two initial periods, 1990 and 1996, to see if we would get different results in the direction of the effectiveness of inflation targeting in reducing inflation and GDP volatility. Inflation volatility and GDP volatility were calculated as standard deviations, according to Ball and Sheridan (2005) and Goncalves and Salles (2008).

Table 5. IT countries – Inflation volatility

Country (IT)	Sample 1 (1990-2020)	Sample 2 (1996-2020)
Czech Republic	-2,45	+1.30
Poland	-10,02	-1.67
Hungary	-5,39	-3.27
Albania	-9,17	-9.06
Romania	-10,14	-11.70
Serbia	-7,63	-8.76
Turkey	-14,30	-12.81
Moldova	-8,73	-8.33
Mean	-8,48	-6.79

Source: Author's calculation

We chose two initial periods in the analysis of inflation volatility in the target countries in order to obtain different results and be able to compare them with each other. When we took 1990 as the initial year in the analysis, the biggest reduction in inflation volatility was recorded in Romania, and when we took 1996 as the initial year, this reduction was recorded in Turkey. In the Czech Republic, inflation volatility increased in the second sample (1996–2020) compared to the first sample (1990–2020). If we compare samples 1 and 2, there is little difference in the average reduction in inflation volatility. In the second sample, the average

reduction in inflation volatility in the target countries is -6.79, while the volatility reduction is greater than -8.48 in the first sample.

Table 6. Countries non-IT – Inflation volatility

Country (Non-IT)	Sample 1 (1990-2020)	Sample 2 (1996-2020)
Bulgaria	-2,05	-2.54
Croatia	+0,36	+0.28
Estonia	-11,68	-3.76
Latvia	-6,98	-0.68
Lithuania	-10,68	-5.32
Slovakia	-3,36	-1.03
Slovenia	-6,36	-0.39
Bosnia and Herzegovina	+0,28	+0.63
Montenegro	-8,84	-7.43
North Macedonia	-2,92	-0.32
Belarus	-7,64	-5.35
Mean	-5,44	-2.35

Source: Author's calculation

As for the non-IT countries, the largest decrease in inflation volatility in the first sample (1990-2020) is present in Estonia (-11.68), while the lowest is in the case of Croatia and Bosnia and Herzegovina, where there was even an increase in volatility in the final period compared to the initial period of analysis. In the second sample (1996–2020), the greatest reduction in inflation volatility is present in Croatia (-7.43), and the lowest in Bosnia and Herzegovina and Croatia (these countries experienced an increase in inflation volatility in the final period compared to the initial period of the analysis). Therefore, by changing the initial period, we reached similar results in terms of inflation volatility. What is clear is that there was a double decrease in inflation volatility in the second sample compared to the first sample. As for Bosnia and Herzegovina and Croatia, it is clear that inflation volatility did not decrease in the mentioned countries even after 1996, and until the end of the analysis.

If we compare the results of the inflation volatility of the groups of IT countries and non-IT countries (Tables 5 and 6), we can conclude that there was a drop in the volatility of inflation in both of the observed groups. What can be pointed out is that the drop in inflation volatility in both samples is greater in the IT countries.

Table 7. IT Countries – GDP volatility

Countries (IT)	Sample 1 (1990-2020)	Sample 2 (1996-2020)
Czech Republic	-2,71	-0.26
Poland	-3,50	+0.15
Hungary	+0,82	+1.38
Albania	-8,19	-3.50
Romania	-2,25	-0.96
Serbia	-2,14	-2.54
Turkey	-1,15	-1.28
Moldova	-7,39	-1.14
Mean	-3,31	-1.02

Source: Author's calculation

In the same way, we analysed GDP volatility using two initial periods of analysis (1990 and 1996). The largest drop in volatility in the first sample of GDP is present in Albania, and the smallest (even an increase) in volatility is in Hungary. In the second sample, the largest drop in GDP volatility was recorded in Serbia, while the increase in GDP volatility was the largest in Hungary (as in the first sample). By changing the initial period of the analysis, we came to different average results for reducing GDP volatility. A larger drop in volatility was observed in the first sample (Table 7).

Table 8. Non-IT Countries – GDP volatility

Countries (Non-IT)	Sample 1 (1990-2020)	Sample 2 (1996-2020)
Bulgaria	-3,58	-4.04
Croatia	+1,75	+1.71
Estonia	+1,75	+2.29
Latvia	+0,73	+4.18
Lithuania	+2,24	+2.03
Slovakia	+2,00	+1.94
Slovenia	+3,07	+3.13
Bosnia and Herzegovina	-22,94	-7.02
Montenegro	+0,93	+0.78
North Macedonia	-1,54	+0.27
Belarus	-3,56	+1.35
Mean	-1,74	+0.60

Source: Author's calculation

In the group of non-IT, the largest drop in GDP volatility is present in Bosnia and Herzegovina in both the first and second sample. What can be highlighted is that almost all IT countries in both of the observed samples experienced an increase in GDP volatility. In addition to Bosnia and

Herzegovina, there was also a drop in GDP volatility in Bulgaria in both of the observed samples. When we compare the groups of IT and non-IT countries, it is clear that the drop in GDP volatility is greater in IT countries (with two initial periods of analysis). In the case of the non-IT countries, there was a smaller average decrease in GDP volatility in the first sample (Table 7), but there was an average increase in GDP volatility in the second sample (Table 8).

Table 9. Regressions of inflation volatility

Dependent variable:	Equation 1		Equation 2	
Fall in inflation volatility	Model 1 (1990)	Model 2 (1996)	Model 1 (1990)	Model 2 (1996)
IT dummy	3,0360	5,3360**	0,6249	2,4554
Volinfpre			0,9009*	0,71956*
Adjusted R²	0,0901	0,2761	0,95389	0,63009

Notes: * statistical significance at 1% **statistical significance at 5%
Source: Author's calculation

Similar conclusions can be drawn from Tables 9 and 10, where we analysed inflation volatility and GDP volatility. For all models, the initial value of inflation is statistically significant, which points to the conclusion that high initial values were of crucial importance for the drop in the volatility of the observed variables. The variable IT has a statistically significant influence in the model in which the drop in GDP volatility is analysed.

Table 10. Regressions of GDP volatility

Dependent variable:	Equation 1		Equation 2	
Fall in GDP volatility	Model 1 (1990)	Model 2 (1996)	Model 1 (1990)	Model 2 (1996)
IT dummy	1,5728	1,458095	1,3451**	1,5193**
Volgdppre			1,0366*	1,071535***
Adjusted R²	0,0393	0,0144	0,9653	0,832849

Notes: * statistical significance at 1% **statistical significance at 5%
*** statistical significance at 10%
Source: Author's calculation

The dummy variable IT has a statistical significance of 5% on the decline in inflation volatility in Model 1, where we took 1996 as the starting year of the analysis (Table 9). However, in Model 2, where the independent variables are IT and Volinfpre (pre-IT inflation volatility), it is clear that the impact of the IT dummy variable does not affect the fall in inflation volatility, but only the pre-IT inflation movement. Furthermore, the dummy variable IT affects the drop in GDP volatility with a statistical significance level of 5% in the second equation and in Model 1, where we took 1990 as the initial year, and in Model 2, where the initial year of analysis is 1996.

DISCUSSION

Using the DID statistical method, we examined the impact of the IT monetary regime on the movement of inflation, inflation volatility, and GDP volatility. We compared the realised effects of IT on the economic performance of IT countries, using them as a 'treatment group,' and non-IT countries, using them as a 'control group.'

The hypothesis H0, which states that the application of the IT monetary strategy leads to a decrease in the level of inflation, a decrease in the volatility of inflation and the volatility of GDP, which leads to the stabilisation of the GDP growth rate, and thus to the stabilisation of economic growth, has been partially proven. Although there was a significant drop in inflation rates during the analysed period, and especially after the introduction of the IT regime, after the inflation regression was performed, the evaluated models (1 and 2) (Table 9) showed that the IT dummy variable has an 'artificially' inflated significance. The decline in inflation according to the estimated models that include the initial value of inflation (INFpre) points to the conclusion that this variable has a statistical impact on the decline in inflation rates in all of the observed samples, and that the statistical significance of the IT regime is inflated. Furthermore, we evaluated the volatility of inflation and the volatility of GDP. According to the obtained results, we can conclude that there was a drop in the volatility of inflation in both of the observed groups of countries (Tables 5 and 6). Only Bosnia and Herzegovina and Croatia did not decrease the volatility of inflation in any sample. Using the two initial periods of analysis (1990 and 1996) and examining the volatility of inflation, we also examined the volatility of GDP. In both of the observed groups, there was a decrease in GDP volatility, and thus a stabilisation of economic growth. Then we evaluated the volatility of inflation and GDP, and concluded that the IT dummy had a statistical impact on the drop in the volatility of GDP in both of the observed groups (Table 10).

The obtained results partially confirm hypothesis H1, which states that IT leads to a decrease in the level of inflation, volatility of inflation and volatility of GDP in the target countries – it was not proven that the IT dummy variable has a statistical impact on the drop in the level of inflation.

Hypothesis H2, which states that the positive effects of IT on the economic performance of IT countries are greater than the positive effects of other (alternative) monetary regimes in non-IT countries, has been proven. Based on Tables 2 and 3, we conclude that there was a drop in inflation in both of the observed groups of countries, with a slightly larger drop recorded in the countries that use IT as a monetary regime. Nevertheless, it is indicated in Table 4 that the IT dummy variable has an inflated statistical significance on the impact of the reduction of the inflation level, and that the INFpre variable had a greater statistical significance on

the reduction of the inflation level. As for the drop in inflation volatility (Tables 5 and 6), there was a drop in both of the observed groups of countries, but a greater drop in inflation volatility was recorded in the countries that use inflation targeting. Also, the results are similar in the analysis of the drop in GDP volatility, where there was a drop in GDP volatility (statistical significance 5%), but only in the groups of countries that use inflation targeting. In the case of non-IT, there was even a slight increase in the volatility of inflation. Therefore, when we compare the impact of the IT regime on economic performance, the positive effects are greater in the countries that use IT monetary regimes.

The limitation related to this research was hyperinflation, which was addressed by introducing an artificial variable into the analysis, neglecting all inflation rates above 50%. Additionally, some limitations are associated with the specificity of the sample countries included in the analysis. Countries that have implemented inflation targeting are at different levels of economic development, and at different stages and/or statuses where membership in the European Union and the European Monetary Union is concerned. However, the authors aimed to demonstrate whether there are differences in achieved economic performances by comparing the group of countries implementing inflation targeting with the group of countries applying other monetary strategies. Although the results showed slightly better economic performances in countries implementing inflation targeting, it is necessary to conduct an individual analysis for each country covering the period between the moment of introducing inflation targeting and the present moment. This way, a better picture of the effectiveness of inflation targeting as a monetary strategy and its impact on economic growth would be provided.

CONCLUSION

Based on the obtained results of the analysis done using the DID methodology, we came to the following conclusions. The IT monetary regime has not proven to be effective in reducing inflation rates in the observed group of countries (CESEE), which is its main objective. However, the IT regime has proven to be effective in reducing inflation volatility and GDP volatility. Comparing the achieved effects of the IT monetary regime, it is clear that there are greater positive effects on economic performance and the stabilisation of economic growth in countries that apply this monetary regime (targeters) compared to the group of countries that do not apply it. The limiting factor of this research is certainly the specific sample of countries in the CESEE region, since most countries had periods of hyperinflation during the 90s (except for the Czech Republic, Hungary, Slovakia, Bosnia and Herzegovina, and Montenegro). Then, some of the IT countries have a shorter period of application of the IT

monetary regime, and a longer period should pass for its successful effects. Excluding all limiting factors to obtain results as realistic as possible, we proved that the IT monetary regime is more efficient than other monetary regimes. Although the differences in the positive effects on economic growth are small, they still exist. For the IT monetary regime to be effective in achieving its goals, it is of great importance to provide the necessary preconditions for its implementation. In economically developed countries, the positive results of the introduction of the IT monetary regime are proven and more visible, and in developing countries, the effects of this monetary regime will only intensify over a longer period of application.

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ЦИЉАЊЕ ИНФЛАЦИЈЕ И ПРИВРЕДНИ РАСТ У ЗЕМЉАМА ЦЕНТРАЛНЕ, ИСТОЧНЕ И ЈУГОИСТОЧНЕ ЕВРОПЕ

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Резиме

Монетарна стратегија циљања инфлације је представљала револуционарну идеју која је првенствено „изнедрена" у привредно развијеним земљама. Индустријски развијене земље су након дугогодишњег периода хиперинфлације (пример Латинске Америке) успешно успоставиле контролу над нивоом инфлације и свеле је на једноцифрен ниво. Касније, примена овог концепта је доживела експанзију од просперитетнијих, развијених земаља ка земљама у развоју и земљама у транзицији. У овом раду бавили смо се ефикасности монетарног режима циљања инфлације на економске перформансе, кроз макроеконмске варијабле: инфлацију, волатилност инфлације, бруто домаћи производ и волатиност бруто домаћег производа. Изабрали смо за узорак земље Централне, Источне И Југоисточне Европе (ЦЕССЕ). Разлог избора овог узорка лежи у различитом привредном развоју ових земаља као и различитости у смислу стратегија монетарне политике које оне примењују. Узорак се састоји од укупно 19 земаља (Русија и Украјина су искључене из узорка због кратког периода примене циљања инфлације), 8 земаља таргетара и 11 земаља нетаргетара. Анализа се врши са годишњим подацима за период између 1990. и 2020. године. Пад инфлације према оцењеним моделима који укључују иницијалну вредност инфлације (ИНФпре) упућује на закључак да ова варијабла има статистички утицај на пад стопа инфлације у свим посматраним узорцима и да је статистички значај монетарног режима циљања инфлације надуван. Према добијеним резултатима, можемо закључити да је дошло до пада волатилности инфлације код обе посматране групе земаља, као и до смањења волатилности БДП, а тиме и до стабилизације привредног раста. Затим смо извршили оцену волатилности инфлације и БДП и закључили да је ИТ вештачка варијабла имала статистички утицај на пад волатилности БДП у обе посматране групе. Такође, слични су резултати и код извршене анализе пада волатилности БДП, где је дошло до пада волатилности БДП (статистичка значајност 5%), али само код група земаља таргетара. Код нетаргетара дошло је чак до благог раста волатилности инфлације. Дакле, кад упоредимо утицај монетарног режима циљања инфлације на економске перформансе, већи су позитивни ефекти код земаља таргетара.