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EFFECTS OF THE IMPLEMENTATION OF THE INFLATION TARGETING REGIME ON ECONOMIC GROWTH

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This research study is focused on the examination of the influence of the introduction and implementation of the monetary Inflation Targeting (IT) regime: the level of the inflation rate and the Gross Domestic Product (GDP) growth rate, as well as inflation and the GDP volatility. Conditional variance is calculated by fitting an empirical Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to an annualized quarterly date for the period from 1993Q1 to 2020Q3, all in order to assess volatility. The results of the regression model showed that there was a positive statistical significance between the instability of inflation and the instability of the growth rate of the GDP in the three analyzed countries (namely in Albania, Turkey and the Republic of Serbia). The result of introducing the IT regime when the GDP growth rate volatility is concerned is statistically significant in Serbia and Turkey and led to reduction in the GDP volatility and stabilization. However, the applied regression model indicated that, in the case of Albania and Romania, the introduction of the IT regime did not have a statistically significant impact on the GDP growth rate volatility.

Keywords: inflation targeting, economic growth, GARCH, regression model

JEL Classification: C32, E47, O11, O42

INTRODUCTION

During the 1990s, major changes took place in the way the monetary policy was being conducted. In developed economies, numerous innovative ideas emerged. One of these ideas is the concept of the Inflation Targeting (IT) which was first established as the monetary policy regime in New Zealand in 1990. This concept then spread to Canada, the United Kingdom, Australia, and many other countries (Bernanke & Mishkin, 1997; Svensson, 1999). At first, the concept began to be applied only by developed countries, then later by developing and transition countries as well. S. Stevanović and I. Milenković (2020) highlight the positive effects of the IT as a monetary strategy on economic growth and financial

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stability in Canada and New Zealand. During the analyzed period (2008-2017), the target (1-3%) was not achieved only in the period marked by the financial crisis of 2008-2011. The ultimate goal of the IT as a monetary strategy is to ensure price stability. This monetary policy regime implies that inflation rates are adjusted to a predefined target, which solves the problem of time inconsistencies in the monetary policy. The set monetary target is determined either in the target interval form or in the target value form. The target is most often presented as the Consumer Price Index (CPI) or certain variants of the same, with the exclusion of certain variables.

The implementation of the IT as a monetary strategy is complex and requires commitment from monetary policymakers in creating certain preconditions for its implementation. Therefore, the question of examining its effectiveness arises.

This article is aimed at assessing the effects of the application of the IT monetary regime in the Republic of Serbia, Turkey, Albania and Romania in the period from 1993 to 2020.

The National Bank of Serbia (NBS) adopted the IT regime at the beginning of 2009. The practice of the implementation of the aforementioned monetary policy strategy began in August 2006, based on the Memorandum on the New Monetary Policy Framework. The target inflation rate was determined based on annual changes in the CPI. The aim pursued by the NBS was not to undermine the stability of the financial system and the achievement of the target rate of inflation (NBS, 2008).

The Central Bank of Turkey (Türkiye Cumhuriyet Merkez Bankasi, TCMB) successfully implemented the disinflation process in the period from 2002 to 2005, so all the preconditions were created for the introduction of a new monetary regime, the so-called IT regime, in 2006. Intended to eliminate the consequences caused by the global crisis (2008), the TCMB revised its IT regime by introducing an asymmetric and broader range of multi-instrument corridors to the existing regime, as well as a flexible framework based on the active liquidity policy. Through this revision, the TCMB introduced an asymmetric and broader range of multi-instrument corridors to the current regime, as well as a flexible framework based on the active liquidity policy. The TCMB has been applying explicit full-fledged IT since 2021. The defined medium-term inflation target of 5% was retained (TCMB, 2022).

Following the period of the previous financial crisis, the Bank of Albania (BA) introduced a new monetary regime in order to target the inflation in 2009, after having targeted monetary aggregates. That year, it also submitted a request to join the European Union. In order to meet the inflation-related Maastricht criterion, the BA set the inflation rate at 3% with a ± 1% deviation. The inflation achieved in this range is considered to be supportive of price stability and economic growth. The preservation of price stability became the main goal of the monetary policy of the BA. Through low and stable inflation rates, it is possible to achieve long-term effects in the field of resource allocation in the economy and imitate financial stability (IMF, 2011).

A. Niculina and M. Catalina (2009) state that the Central Bank of Romania (NBR) has abandoned the monetary regime of the exchange rate targeting and has introduced direct IT. Analyzing broadly the monetary policy, takes into consideration the case of Romania, noticing that there are essentially two types of comments:

- The one in which the monetary policy was criticized for a too slow (too meagre and/or too late) increase in reference rates as compared to inflation, which largely was the case prior to the outbreak of the 2008 global financial crisis.
- The second type of comments referred to criticizing the overly slow reduction in the monetary policy rate, not taking into account the fact that several episodes of the abrupt fall in inflation were due to favorable supply-side shocks, which largely was the case after the global crisis had hit Romania, starting in the second part of 2008.

The impact of the introduction of the IT regime on the level of inflation rates, the level of the GDP growth rates, the inflation rate and GDP growth rate

volatility are examined in this paper. The main goal of the research study is to examine the impact of the introduction of IT on the economic growth of the selected countries.

The subject matter of the research is the examination of the effectiveness of IT and its impact on economic growth.

The research is aimed at examining the impact of IT as a monetary strategy on economic growth and a comparison of the results achieved between the selected developing countries.

The research is based on the following hypotheses:

H1: There is a positive impact of the inflation rate from the previous period on the current inflation rate movement.

H2: The IT regime had a positive impact on the GDP growth rate movement.

H3: Inflation volatility increases the uncertainty of the GDP growth rate.

H4: The IT regime decreases the GDP growth rate volatility.

Using the GARCH model, inflation volatility and the GDP volatility series were created. The analysis of the impact of the introduction of IT and inflation volatility on the GDP growth rate was carried out using a regression model. Quarterly data were used due to a larger number of observations. The analysis pertains to the period from 1993Q1 to 2020Q3 for Serbia, Turkey, Albania and Romania, which all introduced IT as a monetary strategy during 2009, 2006, 2009 and 2005, respectively.

The paper is interesting from the aspect of comparing the effects of the application of the monetary regime of IT in selected developing countries.

The paper is organized into four parts. First, a literature review is given. Second, the description of the variables and methodological research framework is presented. In the third part of the paper, the results of the econometric analysis are presented, and in the fourth part the concluding considerations are given.

LITERATURE REVIEW

Ever since the concept of IT and its impact on inflation volatility came to life as a monetary policy regime more than thirty years ago, it has been the subject matter of analysis made by numerous scientists.

In this part of the paper, a literature review prepared by the authors who were engaged in researching the impact of IT as a monetary strategy on inflation volatility and the GDP volatility is presented using one of the versions of the GARCH model.

A. Kontonikas (2004) used the GARCH-M model to examine the relationship between the previous inflation rate and inflation uncertainty in the United Kingdom using quarterly data for the period from 1972 to 2002. The results indicate that there is a positive statistical relationship between the previous inflation rate and the current inflation uncertainty. Adopting explicit IT eliminates inflation persistence and reduces long-term uncertainty.

The research study conducted by the authors N. Ç. Yavuz and B. Güriş (2004) was based on the GARCH model. They examined the impact of shocks on the GDP volatility in the long run and in the short run. They used quarterly data on a data sample from Turkey, and the period covered by the analysis was from 1987 to 2003. The results show that, although there were shocks in the analyzed period (economic and political events and the earthquake shock), they have no effect on the real GDP growth rate uncertainty in the long run, but they caused breaks in the short run instead.

J. E. Payne (2009) studied the influence of IT on inflation uncertainty in Thailand from 1965 to 2007 using the ARIMA-GARCH model and yearly data. The conclusions indicate that IT has an effect on reducing inflation volatility in the analyzed period from 2000 to 2007 and also that an increase in the inflation rate affects an increase in inflation uncertainty as well.

B. K. O. Tas (2012) analyzed the impact of IT on inflation uncertainty for the period from 1957 to 2008 by using the monthly data of six developed and 13 developing countries with the help of the PARCH

and GARCH models. The results show that a country applying IT as a monetary regime has significantly lower inflation variability after the introduction of this regime. The developing countries that have experienced hyperinflation periods benefit more from the introduction of IT. Also, the level of inflation and its volatility demonstrate the presence of a strong positive statistical relationship.

W. L. Kumo (2015) investigates the impact of IT as a monetary policy measure on economic growth in South Africa using the GARCH model. Its results show that the period preceding the introduction of this monetary policy measure (1960Q1-1998Q4) was characterized by high and more volatile inflation, which had a statistically relevant negative effect on the economy. The results of the analysis indicate that, during the period when the IT regime was being applied (2000Q1-2013Q3), inflation volatility did not have a statistically significant impact on economic growth in South Africa. The results of this research indicate that a low and stable growth of the general price level has been achieved in South Africa since 2000 with the adoption of the IT monetary regime, which on its part has created a stimulating environment for economic growth. W. L. Kumo (2015) proposes urgent structural reforms in order to ensure greater flexibility in the disinflation regime for achieving greater economic growth.

In their research study, the authors H. G. A. Valera, M. J. Holmes and G. M. Hassan (2017) analyzed the impact of the introduction of IT on the movement of the inflation level and its volatility. For the purpose of their analysis, they applied the Novel Panel GARCH model for the period from 1987 to 2013 on a sample of eight Asian countries. The results of this analysis indicate that the introduction of IT as a monetary strategy led to a reduction in the inflation level and its volatility in the case of the Philippines and South Korea.

S. Kyaw, T. Kyaw and C. Nimanussornkul (2016) used the ARIMA GARCH model to study the correlation between inflation volatility and economic growth in the Alliance of the Republic of Myanmar using the annual data from 1980 to 2014. The results indicate that there is a positive statistical relationship between inflation and inflation volatility. The findings show that higher and lower inflation has a negative impact on economic growth as measured by the GDP growth. There is also a long-term cause-and-effect relationship between inflation variables, dummy inflation, inflation volatility and economic growth.

Using the GARCH model and the Panel Vector Autoregressive (PVAR) technique, the authors S. T. Nene, D. I. Kehinde and S. Mashapa (2022) examined the volatility of inflation in order to determine the impact of IT on economic growth in the selected African and European countries. Their research confirms the advantages of the introduction of IT policy in the European countries in relation to the African countries, and as a potential explanation they conclude that the European countries have better economic conditions compared to the African countries. The authors S. T. Nene, D. I. Kehinde and S. Mashapa (2022) state that the effect of the IT monetary regime on inflation uncertainty and economic growth is different for the observed countries. Therefore, the monetary authorities should examine the state of the economy in more detail before introducing any regime or any new policy.

THE DESCRIPTION OF THE VARIABLES AND THE METHODOLOGICAL FRAMEWORK OF THE RESEARCH

This analysis examines:

- The impact of the inflation rate of the prior period on the current inflation rate movement.
- The impact of inflation volatility on the volatility (instability) of the GDP growth rate as the main indicator of economic growth.
- The impact of the introduction of IT on the GDP growth rate.

In order to generate a greater number of observations, this research study is based on quarterly data. The analysis period is the period from 1993Q1 to 2020Q3, for Serbia, Turkey, Albania and Romania, which all

introduced IT as a monetary strategy during the years 2009, 2006, 2009 and 2005, respectively.

The data used in the analysis were retrieved from the website of the International Monetary Fund's International Financial Statistics (IFS). The variables used in the research are shown in Table 1.

As the data on inflation and the GDP used in the paper are quarterly due to a larger number of observations, seasonal adjustment was performed using the Census X-11 method (McKenzie, 1984; Den Butter, Coenen & Van de Gevel, 1985) based on the principle of moving averages.

It is shown in the Table 2 that the descriptive measures for the inflation rate and the real GDP growth rate (the mean and the standard deviation) for Serbia, Turkey, Albania and Romania for the period from 1993Q1 to 2020Q3. In the analyzed countries, a cross-section of the period was made, indicating the period before and the period after the implementation of IT as a monetary strategy.

After the implementation of the monetary IT regime, it is clear that the analyzed countries faced lower average inflation rates and lower inflation volatility measured by the standard deviation, which is especially noticeable in Serbia, Romania and Turkey, the countries facing high inflation rates (periods of hyperinflation).

The volatility of the GDP growth rate decreased in all four analyzed countries after the introduction of inflation targeting, in particular this difference in the volatility of the GDP growth rate being applied in Albania and Serbia. In Serbia, the GDP growth rate fell after the introduction of the monetary strategy of IT in relation to the period before it. Also, in Turkey, a slight decline in the GDP growth rate is noticeable after the introduction of IT. Only in Albania is there a slight increase in the GDP growth rate from 2.820% before and 3.075% after the introduction of the mentioned monetary regime. Figure 1 shows the movement of the inflation rate and the real GDP growth rate in the period from 1993Q1 to 2020Q3 Serbia, Albania, Turkey and Romania.

High oscillations of inflation were observed in the first 30 observed quarters in Serbia, whereas the mentioned oscillations decreased after that. It can also be noticed that the trend of the real GDP rate had more oscillations in the first 30 observed quarters (until around the second quarter of 1997). The GDP rates expressed on a quarterly basis were negative, with the lowest negative GDP rate recorded in the

Table 1 The overview of the research variables

Variable	Abbreviation	Source
The quarterly growth rate of the gross domestic product	GDP	International Financial Statistics
The consumer price index	CPI	International Financial Statistics
Inflation	INF	Calculated from CPI - the quarterly growth rate
GDP volatility	GDP_VOL	Modeled by the GARCH model
Inflation volatility	INF_VOL	Modeled by the GARCH model
High inflation*	DHIGH	The dummy variable
Inflation targeting **	IT	The dummy variable

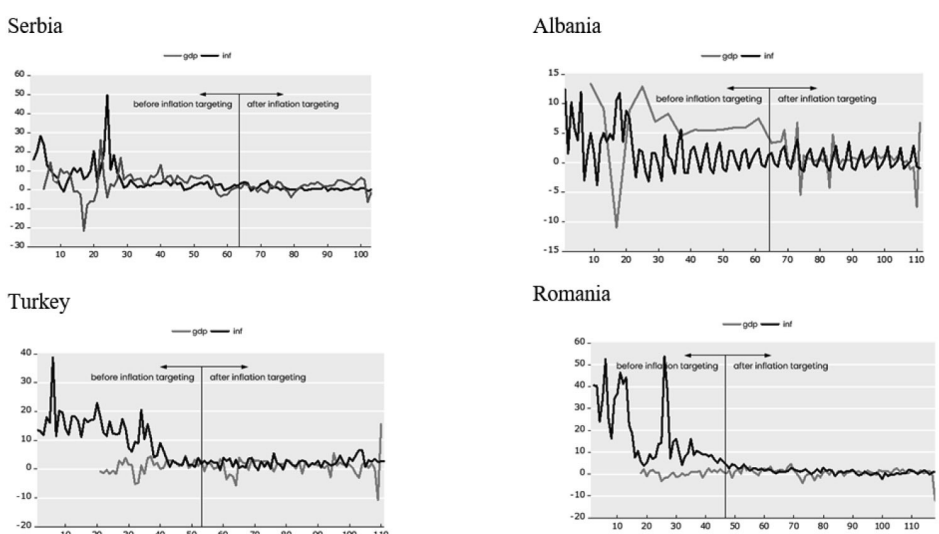
Note: * The dummy variable denoting high inflation (DHIGH) takes the value 1 when the inflation rate is over 10% and if it is lower than 10%, it takes the value 0. ** The dummy variable denoting the period of the implementation of the monetary regime of inflation targeting (IT) occupies the value 1, denoting the period after the introduction, and the value of 0 before the introduction of the said regime.

Source: Authors

Table 2 The descriptive statistics of the inflation rate and the GDP rate for the target countries

The total period of analysis				
Countries	The GDP growth rate		The inflation rate	
	Mean	Std.Dev	Mean	Std.Dev
Serbia	3.06	4.71	4.57	0.72
Turkey	4.61	4.59	5.85	0.59
Albania	2.92	7.94	1.1	0.26
Romania	1.95	5.61	4.16	0.71
The period before the introduction of the IT regime				
	The GDP growth rate		The inflation rate	
	Mean	Std.Dev	Mean	Std.Dev
Serbia	4.03	6.07	7.54	1.17
Turkey	4.61	5.06	10.03	0.96
Albania	2.82	10.28	1.68	0.46
Romania	20.23	6.55	9.39	1.53
The period after the introduction of the IT regime				
	The GDP growth rate		The inflation rate	
	Mean	Std.Dev	Mean	Std.Dev
Serbia	1.90	1.97	1.04	0.19
Turkey	4.59	4.12	2.34	0.21
Albania	3.08	1.71	0.52	0.21
Romania	3.67	4.01	0.97	0.12

Source: Authors



Notes: The X coordinate: the period in quarters; the Y coordinate: the percentage (%).

Figure 1 The movement of the inflation rate and the real GDP growth rate for the period from 1993Q1 to 2020Q3 in the selected countries

Source: Authors

first quarter of 1999 at -21.5%. The highest inflation rate in the analyzed period was recorded in the fourth quarter of 1993, amounting to 372.6%.

In Turkey in the analyzed period (1993Q1-2020Q3), there were high fluctuations in the inflation rate and low growth rates of the real GDP in the first 40 quarters. The maximum inflation rate in the second quarter of 1994 was over 38%. The stabilization of inflation is observed after the 40 quarters, the quarterly rate being in the range of about 1-3%. Mild fluctuations in the real GDP growth rate were recorded between the 60^{th} and 70^{th} quarters (the periods before and after the financial crisis) and larger oscillations were perceived at the end of the observed period (the period after the second financial crisis).

Albania passed through a large transition process which resulted in the high oscillations of inflation rates and especially the GDP rates. The mentioned categories of significant oscillations were especially present in the first 20 quarters of the analysis. After this period, there were still uniform oscillations of the inflation rate and uneven GDP rates. After the period of the first financial crisis, the Central Bank of Albania introduced a new monetary regime of inflation in 2009, having targeted monetary aggregates. The stabilization of the inflation rate has clearly been noticed since 2009, while the growth rate of the GDP is still characterized by unstable movement. Especially large GDP fluctuations are noticed at the end of the analyzed period (Q1, Q2, Q3, 2020).

The movement of the quarterly inflation rate and the real GDP rate was shown in the previous graph. There was a high oscillation of the inflation rate in the first 40 quarters, i.e. in the first 10 observed years. The real GDP growth rates of this period were also low. The growth rate of the GDP had mild oscillations during the observed period. The end of the analyzed period has a tendency to decline. Expressed in the CPI, inflation was confirmed in the first years of the analysis. In the first quarter of 1993, it was 34.51%, so in the first quarter of 1994 this rate increased to 44.29%. Until the second quarter of 1997, inflation was around 10% on average, so this rate rose to 53.86%. The stabilization of inflation has been evident since 1998, and quarterly inflation rates have fluctuated around 2% since 2005.

In order to investigate whether the introduction of the monetary strategy of IT leads to a reduction in inflation and GDP volatility, a regression model was used in this research. The regression model is applied for this purpose. The series of inflation and GDP volatility was determined on the basis of the GARCH model (Fang & Miller, 2009; Syed, Bushra, Christian & Nawazish, 2014). Prior to the evaluation of the GARCH model (Bollerslev, 1986; Engle, 2001), the stationarity of the series had been tested and the ARCH-LM test (Engle, 1982) had been conducted so as to assess the adequacy of the application of the GARCH model in modeling inflation volatility. Checking the stationarity of the inflation rate and the GDP series was performed using the following three tests: the Augmented Dickey-Fuller - ADF test, the Philips - Peron test and the KPSS test.

The results of the econometric analysis

The results of the GARCH (1,1) analysis

In order to model the inflation rate and the GDP rate series using the GARCH model, it is necessary to check whether the mentioned series are stationary or not. The verification of the stationarity of the analyzed series in the selected countries was performed using the following three tests: the Augmented Dickey-Fuller - ADF test, the Philips - Peron test and the KPSS test (Liew, Lau & Ling, 2005). The test results are accounted for in Table 3.

In the case where only the constant was used as a deterministic component, all the tests showed the series stationarity, except in the case of the Kwiatkowski-Philips-Schimdt-Shin test on the GDP series in Romania. When the trend is included in the deterministic component, only the Kwiatkowski-Philips-Schimdt-Shin test indicated the presence of the unit root in the case of the inflation rate series for Serbia and Romania, so that the final conclusion can be made that the series are stationary and they will be used as such in further analysis.

Table 3 The stationarity of the inflation rate and the GDP rate in the selected countries

Country	Variable	ADF test		Philips-Perron test		Kwiatkowski-Philips-Schimdt-Shin test	
		Constant, no trend	Constant, trend	Constant, no trend	Constant, trend	Constant, no trend	Constant, trend
Serbia	INF	-3.598*	-6.006*	-4.706*	-6.074*	0.906*	0.116
	GDP	-3.539*	-3.545**	-6.643*	-6.669*	0.481**	0.161**
Turkey	INF	-2.953**	-4.146***	-3.644*	-6.845*	0.915*	0.285*
	GDP	-11.332*	-11.320*	-11.549*	-11.547*	0.219**	0.129**
Albania	INF	-4.584*	-4.669*	-8.732*	-9.453*	0.722**	0.168**
	GDP	-3.157**	-3.654*	-3.975**	-4.396*	0.783*	0.256**
Romania	INF	-3.818*	-4.942*	-3.553*	-4.843*	1.102*	0.252
	GDP	-4.773*	-4.644*	-4.685*	-4.546*	0.115	0.156**

Notes: * statistical significance at 1%, ** statistical significance at 5%, and *** statistical significance at 10%

Source: Authors

Prior to evaluating the GARCH model, it is necessary to conduct the ARCH-LM test in order to assess the adequacy of the application of the GARCH model. The results of the ARCH-LM test are shown in Table 4.

Table 4 The ARCH-LM test results

	Serbia	Turkey	Albania	Romania
Inflation rate series				
F-test	20.531	27.560	8.389	19.346
P-value	0.000	0.000	0.005	0.000
GDP series				
F-test	49.842	57.596	29.319	33.459
P-value	0.000	0.000	0.000	0.000

Source: Authors

The ARCH-LM test confirmed the justification for modeling the inflation and GDP series in the selected countries using the GARCH model at a significance level of 1%.

The results of the GARCH (1,1) analysis for a series of inflation rates in the analyzed countries

In Table 5, the results of the GARCH (1,1) estimation of the model for the inflation rate series using the EViews econometric software are shown. The assessment was performed using the maximum likelihood method.

The obtained mean equation shows that the lagged value of the inflation rate is statistically significant at the level of 1% in the case of Serbia, Turkey and Romania. A conclusion can be drawn that there is a statistically significant positive impact of the inflation rate from the previous period on the movement of the current inflation rate, except in the case of Albania. So, in the case of Albania, the previous movement in the inflation rate did not have an impact on future movements. The results of the evaluation of the GARCH (1,1) model for the inflation in the observed period indicate the presence of GARCH effects in the time series.

Based on the GARCH model, the inflation volatility series were created. These series of inflation volatility in the selected countries are shown in Figure 2.

Table 5 The GARCH (1,1) model for the inflation rate series

Variables	Serbia	Turkey	Albania	Romania
Mean equation				
C	0.574*	0.951*	0.517*	0.448*
INF(-1)	0.571*	0.666*	0.051	0.622*
Equation of variance				
C	8.775*	-0.072***	0.051	0.159
RESID(-1)^2	0.950*	-0.055*	-0.108***	1.006*
GARCH(-1)	-0.113**	1.029*	1.087*	0.416*

Notes: * statistical significance at 1%, ** statistical significance at 5%, *** statistical significance at 10%

Source: Authors

Table 6 The GARCH model for the real GDP growth rate series

Variables	Serbia	Turkey	Albania	Romania
Mean equation				
C	0.924**	0.959*	0.037	0.317*
GDP(-1)	0.613*	0.232*	0.005*	0.324*
Equation of variance				
C	-1.071**	5.778*	-0.001	1.688**
RESID(-1)^2	0.519**	0.555*	2.937*	-0.200*
GARCH(-1)	1.053*	-0.402*	0.195*	0.588*
IT	-1.036**	-2.545**	0.0001	0.404*

Source: Authors

The results of the GARCH (1,1) analysis for the gross domestic product growth rate series in the analyzed countries

In the GARCH model, an additional regressor (the IT dummy variable) is included in order to determine the impact of IT on the movement of the GDP growth rate. Table 6 shows the GARCH model for the series of the real GDP growth rates in Serbia, Turkey, Albania and Romania.

In Serbia, Turkey and Romania, the presented model indicates the statistical significance of all parameters, so there is a statistically significant impact of both the ARCH and GARCH parameters, as well as the IT-regime-related dummy variables. In Albania, there are statistically significant parameters at the risk level of 1% with the ARCH and GARCH components, except for the parameter with the IT dummy variable, which is not statistically significant. It can be concluded that the introduction of inflation targeting had a negative impact on the GDP growth in the observed period in the cases of Serbia and Turkey. In the case of Romania, that impact was positive and statistically significant, whereas in case of Albania the model showed no statistically significant positive impact. Based on the GARCH model, the GDP volatility series was determined (Figure 3).

The influence of IT and inflation volatility on the GDP volatility - the results of the analysis

Table 7 below shows the stationarity of the inflation volatility and GDP volatility series, which is necessary in order to successfully analyze the impact of the introduction of IT as a monetary strategy and the impact of inflation volatility on the GDP volatility.

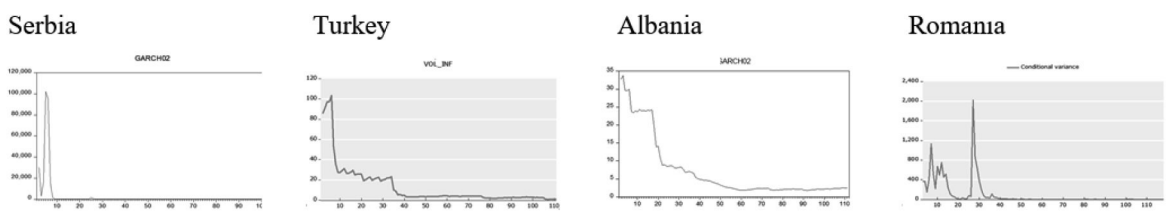


Figure 2 Inflation volatility in the selected countries in the period from 1993 to 2020

Source: Authors

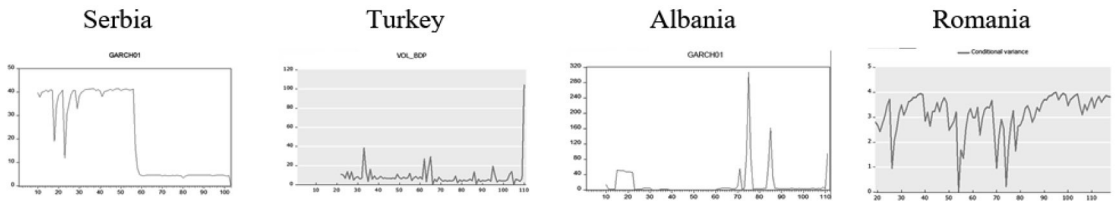


Figure 3 The GDP volatility in the selected countries in the period from 1993 to 2020

Source: Authors

According to the results of the stationarity tests, both series (INF_VOL, GDP_VOL) are stationary at the level in the selected countries.

Since it could be concluded after the stationarity tests that both series were stationary at the level, a further analysis of the impact of inflation volatility and the selected dummy variables (IT, DHIGH) on the GDP volatility could be performed using a regression model. The created regression model is shown in Table 8.

The diagnostic test shows that the residuals are not serially correlated. The residuals are homeoskedastic and normally distributed.

It can be concluded that, in Turkey and Serbia, all the parameters are statistically significant at the risk level of 1% and have an impact on the movement of the real GDP volatility, except for the DHIGH dummy variable that refers to high inflation in Turkey. Based on the presented regression model for Albania, a conclusion can be made that inflation volatility and the DHIGH

Table 7 The stationarity of the inflation volatility and GDP volatility series

Variable	Inflation volatility					
	At the level					
	ADF test		Philips-Perron test		Kwiatkowski-Philips-Schimdt-Shin test	
Inf. Vol.	Constant, no trend	Constant, trend	Constant, no trend	Constant, trend	Constant, no trend	Constant, Trend
Serbia	-5.153*	-5.367*	-5.214*	-5.387*	0.354***	0.139***
Turkey	-3.627*	-3.700**	-5.978*	-5.115*	0.470**	0.160**
Albania	-3.690*	-4.939*	-2.997**	-4.279*	0.833*	0.269*
Romania	-5.568*	-6.462*	-5.584*	-6.513*	0.785*	0.168**
Variable	GDP volatility					
	ADF test		Philips-Perron test		Kwiatkowski-Philips-Schimdt-Shin test	
GDP Vol.	Constant, no trend	Constant, trend	Constant, no trend	Constant, trend	Constant, no trend	Constant, Trend
	At level					
Serbia	-3,517*	-4,011*	-3,598*	-4,146*	0,576***	0,156**
Turkey	-4.961*	-5.110*	-5.099*	-4.949*	0.392***	0.153**
Albania	-6.085*	-6.059*	-5.778*	-5.754*	0.147**	0.166**
Romania	-5.109*	-5.413*	-4.957*	-5.305*	0.361***	0.152**

Notes: * statistical significance at 1%, ** statistical significance at 5%, *** statistical significance at 10%

Source: Authors

Table 8 The regression model - the influence of IT and inflation volatility on the GDP volatility

Variables	Coefficient (Standard error)			
	Serbia	Turkey	Albania	Romania
C	20.113* (4.775)	7.921* (2.852)	5.258 (9.591)	5.183* (0.185)
INF_VOL	0.139* (0.024)	0.766* (0.241)	0.781* (0.247)	-0.001 (0.000)
IT	-14.135** (6.466)	-5.929* (1.943)	-4.163 (12.996)	0.019 (0.290)
DHIGH	60.965* (9.574)	-4.495 (5.637)	100.444* (33.023)	0.569 (0.569)
R^2	0.610	0.355	0.203	0.017
F-test	51.243	9.958	8.987	0.554
P-value	0.000	0.000	0.000	0.646

Diagnostic test	Serbia	Turkey	Albania	Romania
Breusche-Goldfrey serial correlation LM test (p value)	0.859874 (0.256641)	0.256447 (0.7744)	3.54678 (0.165548)	0.957456 (0.21897)
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.425655 (0.745632)	0.310435 (0.8178)	0.715399 (0.5451)	0.296901 (0.8278)
Jarque-Bera Normality test	3.987882 (0.137526)	3.145567 (0.15455)	0.491071 (0.782288)	1.596474 (0.45678)

Notes: * Statistical significance at 1% ** Statistical significance at 5%

Source: Authors

dummy variable have a statistically significant impact on the movement of the real GDP volatility. In the case of Romania, the model did not prove to be statistically significant, and the observed variables do not have a statistically significant impact on the GDP volatility.

CONCLUSION

The GARCH model was used in the paper in order to find the effect of the previous inflation rate on the current inflation rate. It can be concluded that H1 reading that there is a positive impact of the inflation rate from the previous period on the movement of the current inflation rate in Serbia, Turkey and Romania cannot be rejected. On the other hand, this hypothesis is rejected in the case of Albania. The descriptive statistics of the inflation rate and the GDP rate before and after the introduction of IT show that the analyzed countries faced lower average inflation rates and lower inflation volatility. J. E. Payne (2009) has also come to similar results using the ARIMA-GARCH model in Thailand for the period from 1965 to 2007 and B. K. O. Tas (2012) for the period from 1957 to 2008, using the PARCH and GARCH models on the monthly data of six developed and 13 developing countries.

In order to examine the hypothesis that the introduction of the monetary strategy of IT had a

positive effect on the movement of the GDP growth rate, the IT dummy variable (indicating the period of the application of IT) was added to the GARCH model as an additional regressor.

Our findings reveal that, in the case of Serbia and Turkey, the implementation of IT had a negative and statistically significant impact on the GDP growth during the period under observation, a positive statistically significant result in the case of Romania, whereas in the case of Albania, the model showed a positive, but not statistically significant influence. It follows that, in the case of Albania, Serbia and Turkey, the hypothesis H2 reading that the introduction of the IT regime has a positive impact on the movement of the GDP growth rate is rejected, whereas in the case of Romania the given hypothesis cannot be rejected.

Based on the results obtained using the regression model, it can be concluded that the hypothesis H3 reading that inflation volatility had a positive impact on the GDP growth rate volatility cannot be rejected in the case of Serbia, Turkey and Albania. In the case of Romania, however, inflation volatility had a negative impact on the growth rate volatility. Yet, this impact is not statistically significant. On a sample in South Africa, W. L. Kumo (2015) also came to the conclusion that inflation volatility did not have a statistically significant impact on real economic growth. The authors differently interpret how inflation volatility affects economic growth. In this context, M. Friedman (1977) states that inflation volatility has the potential to lead to a reduction in economic growth. Thus, inflation volatility can have a negative impact on economic growth.

In order to test the H4 hypothesis reading that the introduction of the IT regime affects a reduction in the GDP growth rate volatility in Serbia, Turkey, Albania and Romania for the period from 1993 to 2020, the regression model was applied by each country individually. The results of the analysis in Serbia indicate that the introduction of the monetary regime of IT (2009) has a negative impact on the GDP volatility. It is clear that the DHIGH dummy variable has a positive impact on the growth rate of the real GDP and its volatility, and the IT dummy variable has a negative impact. The results of the analysis in Turkey indicate that inflation volatility and the IT dummy variable have an impact on the movement of the real GDP growth rate volatility. In Albania, the results of the analysis indicate that inflation volatility and the DHIGH dummy variable are statistically significant for the movement of the real GDP volatility. The IT dummy variable IT has a negative but not statistically significant influence on the GDP volatility movement and its stabilization, whereas the variable indicating high inflation is statistically significant for the movement of the GDP volatility. Also, in the case of Romania, the observed variables have no statistically significant impact on the movement of the GDP volatility.

Since its inception, the IT regime has shown a statistically significant negative influence on the movement of the GDP growth rate in the case in Serbia and Turkey, so the hypothesis H4 cannot be rejected in the case of these two countries. The statistics show that, in Albania, where the IT regime was introduced in that period, the GDP still has unstable movement, whereas in Romania, it had the tendency to grow during the analyzed period. Certainly, as one of the reasons for different influences, the strategy for Serbia, Romania, Turkey and Albania can indicate various economic conditions, which is also pointed to in the research studies by S. T. Nene, D. I. Kehinde and S. Mashapa (2022). The results of this study show that there are different influences of the IT regime in terms of its influence on the GDP growth rate that are in line with the results obtained by S. T. Nene, D. I. Kehinde and S. Mashapa (2022) in their research done in the selected European and African countries.

This research study confirms the fact that the introduction of the IT monetary regime contributes to the reduction of inflation volatility and the volatility of the GDP growth rates, which ultimately leads to higher economic growth. However, the effects of IT as a monetary regime are different in the selected developing countries. One of the reasons for that lies in the fact that the positive effects of the mentioned monetary strategy are more obvious when the same is applied for a longer period of time. In order for the IT monetary regime to be successful, it is necessary that

all the preconditions for its implementation should be met. One of the limitations of this research study reflects in the fact that the period of the application of the mentioned regime in the analyzed countries is quite short.

The directions for further research are aimed at comparing the achieved economic performance of the countries that apply the monetary regime of IT (targetars) and the countries that apply other alternative monetary regimes (non-targetars). Also, future research will be directed towards comparing this regime in developing countries with that in developed countries, which will further examine the effectiveness of applying IT as a monetary strategy as opposed to the central bank's other monetary policy strategies.

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