

The effect of the inflation rate on gross domestic product: an economic analysis for the Western Balkans countries

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Abstract

Background: One of the key indicators of a country's macroeconomic stability is certainly inflation. During the past year, there has been a general increase in inflation in Europe. The question arises as to how inflation affects other relevant indicators of the stability of a country. One of the most important indicators is gross domestic product.

Purpose: This paper analyses the effect of the inflation rate on gross domestic product in the countries of the Western Balkans for the period 2006-2021, which includes the initial period of the emerging health crisis.

Study design/methodology/approach: Official data from the World Bank was used to review the analysis of the state of inflation and gross domestic product. The same data was transformed into appropriate logarithms for proper econometric modelling. The methodology used to determine the effect of the inflation rate on the gross domestic product is multiple regression analysis with the ordinary least squares estimation method.

Findings/conclusions: The results of the analysis indicate a positive effect of the gross domestic product deflator on economic growth in the sample countries, while the impact of inflation measured according to the consumer price index is not significant.

Limitations/future research: Recommendations for decision-makers about inflation targeting, and further methodological approaches are given as part of the research conclusions.

Keywords

GDP deflator, consumer prices, consumer basket, countries in transition, Balkans, monetary policy, ANOVA, logarithmic values

Introduction

The main goal of macroeconomic policy is to maintain the level of economic growth while maintaining a low inflation rate, particularly in transition (Pollin & Zhu, 2006, p. 5) and developing countries (Sabir, Rafique & Abbas, 2019). According to the classical economic theory, whose main representative is Adam Smith, it is necessary to conserve a balance between supply and demand, as well as it is necessary to encourage the population to save and invest so that the country's economy can tend to grow.

The monetarist framework or Keynesian theory, which is led by the AD-AS model, contributes to a more comprehensive linking of the

inflation rate with the rate of economic growth. In this regard, the aggregate supply – aggregate demand theory dictates that monetary growth plays a key role in determining inflation and that inflation growth and economic growth move together (Kremer, Bick & Nautz, 2013; Pollin & Zhu, 2006). In other words, according to this theory, inflation affects economic growth. Conversely, a very high inflation rate contributes to a decline in economic growth, both in highly developed and in small open inflation-targeting economies (Nasir, Huynh & Vo, 2020).

On the other hand, newer economic theories, such as the neoclassical theory (whose main exponents are Solow and Swan), explain the impact of inflation on economic growth by taking

into account the parameters of capital accumulation and investment (Najeb, 2014). Investments as well as capital accumulation are key elements of economic growth. Solow was the first economist to include technological progress as a determinant of economic growth.

According to classical theory, inflation is the result of the process of monetary emission due to public deficits, which increases demand and leads to an increase in prices. Therefore, to suppress inflation effectively, the emission of currency must be stopped, which can only be achieved by withdrawing demand, either in the private sector, by increasing taxes, in the public sector, or by reducing national (public) spending. In other words, suppression of inflation is achieved through recessionary policy (Li, Tang & Xiang, 2020).

Differently, and according to Keynesian and neoclassical theory, inflation is not the result of excess demand caused by monetary emissions. Instead, monetary emission is the result of inflation, not its cause. Therefore, inflation could be suppressed without a recessionary policy, but by freezing wages and prices.

Inflation is defined as a monetary phenomenon that is a consequence of excessive monetary expansion, i.e. an increase in the general price level. The country's economic growth is represented as GDP, which is the sum of goods and services produced in one year. The value of production of foreign companies in the domestic country is included in this total, while the value of production of domestic companies in foreign countries is excluded. In other words, GDP represents the total domestic income of a country.

In the countries of the Western Balkans, the level of GDP has fluctuated in the last twenty years, since the transition process began in these economies. In the period 2000-2010, the GDP of these countries grew on average, while inflation was moderate and under control. In this period, the economy of Serbia had the highest growth in both GDP and inflation (Tošković, 2015, pp. 94-104).

The Western Balkans is a group of countries consisting of Serbia, Slovenia, North Macedonia, Croatia, Montenegro, Bosnia and Herzegovina, and Albania. Of this group of countries, two are members of the European Union (Slovenia and Croatia). According to the classification of countries by income, only Slovenia and Croatia belong to the high-income countries group. The other four economies are classified as middle-income countries in transition (IWA, 2021). A large number of research and economic studies

have been carried out for the group of countries of the Western Balkans (e.g. Despotović, Cvetanović & Nedić, 2014; Gabrisch, 2015; Pere, 2015; Tošković, 2015; Fetai, Koku, Chaushi & Fetai, 2016; Zdraveski, Janeska & Taleska, 2016; Đurović-Todorović, Đorđević & Tomić, 2016; Jusufi & Bellaqa, 2019; Vladi & Hysa, 2019; Rehman, Çela, Morina, & Sulçaj-Gura, 2019; Mansi, Hysa, Panait, & Voica, 2020; Nedić, Despotović, Cvetanović, Djukić & Petrović, 2020; Perić & Stanišić, 2020; Karadžić & Pejović, 2021), which, in addition to political and geographical characteristics, makes it economically relevant as well. Therefore, the selection of this group of countries for the present analysis is additionally relevant.

In the next part of this paper, the theoretical framework related to the relationship between inflation and economic growth, along with the research hypotheses, is presented. In the third part of this paper, explanation of the methodology used to measure the effect of the inflation rate on GDP growth is presented. The fourth part of this research presents the results and discussion of the results. In the fifth and the last part of this research, conclusions were drawn and recommendations were formulated for future research and decision-makers.

1. Measures of inflation: GDP deflator versus CPI

GDP is the sum of the gross value added of all resident producers in the economy and all taxes on products minus all subsidies that are not included in the value of products. According to the methodology of the World Bank, it is calculated without subtracting the depreciation value of factory assets and without the degrading natural resources.

The implicit GDP deflator is the ratio of GDP in current local currency to GDP in constant local currency:

$$GDP\ deflator\ (p) = \frac{GDP\ in\ current\ prices}{GDP\ in\ base\ year\ prices} * 100 \quad (1)$$

Similarly, a GDP deflator is a ratio of nominal and real GDP:

$$GDP\ deflator = \frac{nominal\ GDP}{real\ GDP} \quad (2)$$

The consumer price index and consumer price inflation rate are generally calculated using the

Laspeyres formula:

$$L = \frac{\sum_{j=1}^J q_{kj} p_{ij}}{\sum_{j=1}^J q_{kj} p_{kj}} \quad (3)$$

According to the Laspeyres formula, J is the base region, i is every other region, j are all items in the consumer basket, k is quantity and p are prices (Pearson, 2019). According to Đurović-Todorović et al. (2016, p. 58), the general formula of the consumer price index is:

$$CPI = \frac{\text{current price level}}{\text{price level according to base period}} * 100 \quad (4)$$

The logic of this formula is compatible with the GDP deflator equation, while the general inflation rate formula is:

$$\% \text{ inflation} = \frac{p(t) - p(t-1)}{p(t-1)} * 100 \quad (5)$$

where t represents the time period, p the price level, and $t - 1$ the previous time period.

Although the difference between deflator GDP and CPI may appear to be non-existent or very small, in essence, there is a significant difference.

Taking into account the difference between these two indicators can point out significant dissimilarities in income and consumption (Dinterman & Katchova, 2020). Based on those dissimilarities, strategic steps to reduce consumption and increase income can be taken when it comes to the national economy. The key difference is that the GDP deflator reflects the prices of all goods and services produced in a given country, and uses the prices of currently produced goods and services, while the CPI reflects the prices of a consumer basket of goods and services whose buyers are producers, and uses fixed prices (due to taking into account fixed goods and services). Similarly, Turner, Lauer, Tran, Teerawattananon and Jit, (2019) point out the importance of the methodologies used for adjusting costs (for inflation) that are obtained from different periods.

2. The relationship between inflation and economic growth

The importance of the relationship between inflation and economic growth is comparable to the relationship between health/disease and the human body. Good health has a positive impact on the

human body, so healthy (balanced) inflation is a warranty for a country's economic growth. Otherwise, unhealthy (unbalanced) inflation can ruin a country's economy, like a virus. Reasonably, in many countries and for decades there has been constant research on the impact of inflation on GDP (e.g. Rehman, Ali & Shahzad, 2020; Chen, Dolado & Gonzalo, 2021).

Recent studies have demonstrated the importance of measuring the impact of inflation-targeting on macroeconomic indicators. For example, Das & Ghate (2022) claim that inflation contributes in financing government debt, but only under the flexible inflation-targeting policy, while Ullah, Apergis, Usman and Chishti (2020) claim that inflation instability and GDP growth volatility can have both positive and negative impacts on the economy in terms of pollution emissions.

This paper provides an overview of the literature on the relationship between inflation and economic growth, as shown in Table 1.

Table 1 Inflation rate and GDP level: empirical research

Research	Aim and methodology	Results
Armsh, Salarzahi, Yaghoobim & Heydari (2010)	Impact of inflation on GDP in Iran for the period 1961-2005 using OLS regression	GDP has a negative and statistically significant impact on the inflation rate
Arsić, Mladenović & Nojković (2022)	Impact of inflation targeting in European and Asian emerging economies for the period 1997-2019 using regression	Inflation targeting reduces GDP volatility, inflation rate, and inflation volatility, although not affecting inflation persistence or economic growth
Barro (2013)	Impact of inflation on GDP in over 100 countries for the period 1960-1990 using OLS regression	Increasing inflation has a negative and statistically significant impact on GDP
Chien, Chau, Sadiq & Hsu (2022)	Impact of economic and non-economic determinants on the natural resources commodity prices volatility in China for the period 1986-2019 using regression	Inflation and GDP growth have positive impact on natural resources commodity prices
Fetai et al. (2016)	Analysis of the impact of macroeconomic indicators on GDP in the countries of the Western Balkans for the period 1994-2015 using OLS regression	Inflation has a negative and statistically significant impact on GDP
Kasidi & Mwakane-mela (2013)	Impact of inflation on GDP in Tanzania for the period 1990-2011 using OLS regression	Inflation has a negative impact on GDP growth, which is statistically significant in the short term,

		while there is no evidence of statistical significance in the longer term
Koulakiotis, Lyrودي & Papasyriopoulous (2012)	The relationship between inflation and GDP in 14 developed European countries for the period 1961-2008 using OLS regression	The relationship between inflation and GDP is positive. Inflation affects GDP and vice versa
Kryeziu & Durguti (2019)	Impact of inflation on GDP in 17 Euro-zone countries for the period 1997-2017 using OLS regression	Inflation has a positive and statistically significant impact on GDP
Mandeya & Ho (2021)	Impact of inflation and inflation uncertainty on economic growth in South Africa for the period Q1 1961 – Q4 2019 using regression	Inflation has a negative impact on economic growth in both the short- and long-run
Obradović, Šapić, Furtula & Lojanica (2017)	The relationship between inflation and GDP in Serbia for the period Q1 2007 - Q3 2014 using OLS regression	Inflation has a positive effect on GDP in a short period, while other variations of the influence have not been determined
Umaru & Zubairu (2012)	Impact of inflation on GDP growth in Nigeria for the period 1970-2010 using OLS regression	GDP and GDP per capita affect inflation while inflation does not affect GDP except through productivity enhancement
Xiao (2009)	The relationship between inflation and GDP in China for the period 1978-2007 using OLS regression	Inflation and GDP are in a positive relationship for a long period of time, while the impact of GDP on inflation depends on the amount of investments in a short period

Source: the author

Armash et al. (2010) found that there is a negative and statistically significant relationship between inflation and GDP. On the other hand, Kasidi and Mwanemela (2013) found that inflation growth has a negative effect on GDP growth. As far as the analysis for Serbia is concerned, it was established that there is a direct causality of inflation concerning GDP, but that there is no direct causality of GDP in relation to inflation (Obradović et al., 2017).

Xiao (2009) found that the relationship between inflation and GDP is positive when the level of investment is controlled. In this sense, the relationship between inflation and GDP will not be negative as long as investments do not grow rapidly, especially in a short period (Xiao, 2009; Barro, 2013). Similarly, inflation has a positive impact on GDP growth (Kryeziu & Durguti, 2019) when the level of production and productivity are

boosted in an economy (Umaru & Zubairu, 2012).

Barro (2013) analyzed the impact of inflation in 117 countries for the period 1960-1970, 122 countries for the period 1970-1980, and 119 countries for the period 1980-1990. This sample of countries also includes the countries of former Yugoslavia. Using data from the World Bank and applying regression models, the results of Barro's research showed that an increase in the average level of inflation by 10% per year affects the decrease in the growth rate of real GDP per capita by an average of 0.25% per year. In addition, this level of increase in inflation has the effect of reducing the ratio of GDP to investments by an average of 0.5% per year. Similar results were found in the analysis of Fetai et al. (2016), where these authors found a negative relationship between inflation and GDP. Namely, all four regression models (Pooled OLS, Fixed Effects, Random Effects, and Hausman Taylor) indicated a negative (statistically significant) impact of the inflation rate on economic growth in the countries of the Western Balkans.

Additionally, inflation can respond to GDP growth shocks, as GDP can respond to inflation shocks. As for Apostolakis and Papadopoulos (2019), using the regression estimation on the data for the period 1999–2016 in 19 advanced economies, an inflation shock has a negative impact on GDP growth.

Moreover, Ehigiamusoe, Guptan and Narayanan (2021) found that the level of inflation rate (measured in CPI) impacts the relationship between financial development and GDP. Their analysis encompassed a sample of 125 countries, both developed and developing. These authors argue that the outcome of their analysis applies mostly to middle-income countries.

As a whole, these studies indicated a binary relationship between inflation and GDP, that is, that inflation can affect GDP both positively and negatively (Musarat, Alaloul, & Liew, 2021) as well as that GDP can affect inflation, positively or negatively. Koulakiotis et al. (2012) argue that inflation affects GDP just as GDP affects inflation. In this regard, it can be argued that the level and nature of the impact depend on several macroeconomic indicators, the time period taken into account for the analysis (state of stability or crisis period), as well as the level of development of the country.

Based on the review of the literature, it can be argued that the level of the inflation rate can have both a positive and a negative impact on the GDP

of countries, which depends on the movement of other macroeconomic indicators. In any case, there is no consensus in the professional and scientific literature about the impact of inflation on economic growth (Pollin & Zhu, 2006, p. 2). Certainly, a three-digit number, and often a two-digit number of the inflation rate (hyperinflation) does not contribute to economic growth.

In addition to the above, the lack of empirical research on the impact of inflation on GDP in the countries of the Western Balkans from the point of view of the regression approach, especially since the beginning of the pandemic caused by the new coronavirus, was determined as well. An additional incentive for conducting this research is the emerging threat of an increase in the rate of inflation, which can drastically affect the slowdown of the economic growth of these countries, especially countries in transition.

Although relevant research has been published, the research about the inflation impact on GDP (while differentiating GDP deflator and inflation based on CPI) for the Western Balkan countries during the COVID-19 crises and the war in Ukraine, and after the inflation overtook many European countries, has not been published, to the knowledge of the author of this paper. Therefore, this paper is about to cover the mentioned gap in the literature.

The null hypothesis is that GDP deflator has negative and statistically significant impact on GDP in the Western Balkan countries, while the alternative hypothesis is that this impact is significantly positive.

In the following part of this paper, the data and methodology used to measure the impact of the inflation rate on GDP in the countries of the Western Balkans are presented.

3. Research methodology

In this research, an appropriate econometric model based on theoretical foundations is used to determine the level of influence of inflation on GDP in the countries of the Western Balkans.

This part of the paper is divided in two sections. In section 3.1, the data and sample used for modelling is described. The assessment method and the model used in this research is presented in the section 3.2.

3.1. Data and sample

The analysis uses annual data collected from the World Bank database (World Bank, 2022). The variables used for the analysis are consumer price

index (CPI), inflation, deflator, and % change in GDP level. The definition of the variables is presented in Table 2.

Table 2 Definition of data and indicators for analysis

Name / Label	Description	Source
GDP growth / GDP%	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in US dollars.	Calculation according to data on national accounts of the World Bank and OECD.
Inflation, GDP deflator / INFL_DEFL%	Inflation measured using the annual growth rate of the implicit GDP deflator shows the rate of change of prices in the overall economy.	Calculation according to data on national accounts of the World Bank and OECD.
Inflation, consumer prices / INFL_CPI%	Inflation measured using the consumer price index represents the percentage change in the costs of the average consumer for the purchase of a basket of goods and services that can be fixed or can change over a certain period of time, here annually.	Calculation according to the International Monetary Fund, according to the data of the International Financial Statistics.
Consumer price index / CPI	Consumer price index indicates changes in the costs of the average consumer for the purchase of a basket of goods and services that can be fixed or can change in a certain period of time, here yearly.	Calculation according to the International Monetary Fund, according to the data of the International Financial Statistics.

Source: the author

The unit of measure for GDP growth, GDP deflator, and inflation is in percentage (%) on the annual basis, while CPI is an index, period average, yearly (2010=100).

3.2. Assessment method and the model Section

Regression analysis, which includes statistical operations and mathematical models, is one of the most appropriate econometric analyzes that shows the relationship between variables numerically, based on which their relationship is described in real environments. For the regression analysis to make sense, all variables must at least theoretically be related to each other (Perić & Filipović, 2021, p. 250). The main goal of conducting regression analysis is to estimate the values of unknown variables based on those values that are known. In this research, ordinary least squares (OLS) estimates of all regression parameters, namely coefficients, standard errors, t-values, and

probability values, are estimated. In addition, summary statistics (R-squared, adjusted R-squared, regression standard error, and residual sum of squares) is designed with the aim of diagnosing possible deviations from the original hypotheses.

The specification of the model relies on general rules from the field of econometrics. It relies on the examples of similar models that were taken into account with the specification and description of the model in this research according to Rangarajan (2012), Barro (2013) and Perić and Filipović (2021), as well. The general specification of the model is:

$$\ln Y_{it} = \beta_0 + \beta_1 + \sum_i \ln \beta_{it} + \varepsilon_{it} \quad (6)$$

where:

$\ln Y_{it}$ represents the logarithmic value of the dependent variable in the country i and in year t , *i.e.* the estimated value of the dependent variable, β_0 represents the intercept of the model and the estimated value of the dependent variable when the coefficients are equal to zero, the sum $\ln \beta_{it}$ represents the logarithmic value of the independent variables for country i in year t , *i.e.* the logarithmic value of the regression coefficients, ε_{it} represents the standard error of the model prediction.

The specific specification of the model is:

$$\ln GDP\%_{it} = \beta_0 + \ln INFL_DEFL\%_{it} + \ln INFL_CPI\%_{it} + \ln CPI_{it} + \varepsilon_{it} \quad (7)$$

where:

$\ln GDP\%_{it}$ represents the logarithmic value of GDP in the country i and in year t and the value of the dependent variable,

$\ln INFL_DEFL\%_{it}$ represents the logarithmic value of the GDP deflator in the country i and in year t , *i.e.* independent variable of the model,

$\ln INFL_CPI\%_{it}$ represents the logarithmic value of inflation calculated according to the consumer price index in the country i and in year t , *i.e.* independent variable of the model,

$\ln CPI_{it}$ represents the logarithmic value of the consumer price index in the country i and in year t , *i.e.* independent variable of the model.

The data were transformed into the natural logarithm due to the normalization of the data distribution: $N = (0, \sigma^2)$. In the event of a 1% change in one independent variable, a change in the dependent variable is expected in the value of the coefficient of that independent variable, while the other independent variables of the model remain constant. H_0 is that the regression coefficients $\ln GDP\%_{it}$, $\ln INFL_DEFL\%_{it}$, and $\ln INFL_CPI\%_{it}$ negatively affect $\ln GDP\%_{it}$. H_1 is that the regression coefficients have a positive effect on GDP growth. In the next part of the paper, the results of the models applied are presented.

4. Results and discussion

In this paper, the presentation of the statistical description of the data precedes the regression analysis (Table 3).

Table 3 Descriptive statistics

	N / Range	Min	Max	Mean	Std. Dev.	Variance
Year	112 / 15	2006	2021	2013.5 (0.438)	4.63	21.44
INFL_ DEFL %	112 / 17.07	-1.03	16.04	2.908 (0.262)	2.776	7.71
INFL_ CPI%	112 / 14	-1.58	12.41	2.419 (0.249)	2.638	6.96
CPI	112 / 79.38	72.86	152.2 4	106.97 (1.25)	13.28	174.9
GDP%	112 / 27.74	-15.3	12.43	2.375 (0.375)	3.966	15.73
lnINFL _DEFL %	89 / 2.77	0	2.78	1.05 (0.07)	0.661	0.44
lnINFL _CPI%	83 / 2.49	0.03	2.52	1.009 (0.065)	0.588	0.35
lnCPI	112 / 0.74	4.29	5.03	4.665 (0.011)	0.121	0.02
lnGDP %	83 / 2.52	0	2.52	1.299 (0.056)	0.513	0.26

Source: the author

Descriptive statistics is a summary of the data set used in this paper and serves to better understand the data and analysis itself. Hereinafter, the term "inflation" is used for consumer price index (CPI) inflation, while the term "GDP deflator" remains the same.

According to Pollin and Zhu (2006, p. 2), an adequate level of inflation is between 3 and 5%, while Frattini and Crosta (2006, p. 55) believe that inflation should be around 2%, with which Kremer et al. (2013) agree but when it comes to developed countries (p. 8). The state of inflation and GDP in the countries of the Western Balkans in the period

2006-2021, which is interpreted according to the official data of the World Bank (World Bank, 2022), is summarized below.

The highest drop in GDP was documented in Montenegro (-15.31%) in 2020 compared to the previous year. In that period, the GDP deflator was -0.18% and inflation was -0.26%. In this country, negative economic growth was recorded in 2009 and 2012 (-5.8% and -2.72% respectively), compared to the previous year (7.22% in 2008 and 3.23% in 2011) when inflation had a positive sign and a low single-digit value. The highest level of inflation in this country was in 2007 (GDP deflator = 16.4%) and 2008 (inflation = 8.76%). These data are consistent with the theory of economic decline and inflation growth during the period of the financial crisis.

When it comes to the COVID-19 period in the countries of the Western Balkans, overall economy was affected, such as GDP, inflation, the ways of doing business (e.g. Szeiner, Kovács, Zsigmond & Poór, 2021), foreign direct investments (Milovanović & Marković, 2022) etc., while the new business models were developed (Erceg & Zoranović, 2022). The highest GDP growth (12.43%) was recorded in Montenegro in 2021, as well as the growth of GDP deflator and inflation (4.37% and 2.41% respectively). In terms of GDP growth, Croatia is behind Montenegro with a GDP growth of 10.45% (GDP deflator = 3.25%, inflation = 2.55%) in the same year.

In the most developed country from the sample, Slovenia, the state of GDP and inflation is slightly different than in the countries discussed above. The highest decline in GDP growth was documented in 2009 (-7.55%), which was followed by a decline in both inflation indicators. On the other hand, GDP growth in this country was also negative in 2020 (-4.23%) with inflation rates of 1.23% (GDP deflator) and -0.05%, while a sharp increase in GDP (8.11%) followed by an increase in the GDP deflator and inflation (2.55% and 1.92% respectively) was verified in 2021.

Analogous to Slovenia, inflation in Bosnia and Herzegovina was negative (-1.05%), and the GDP deflator was positive (0.18%) in 2020, followed by negative GDP growth (-3.12%), while during the next year all indicators recorded growth, namely GDP growth (7.10%), GDP deflator (1.74%) and inflation (1.98%). Excluding 2020, the lowest GDP growth rate in this country was recorded in 2009 (-3%) with inflation rates of 0.19% (GDP deflator) and -0.38%. On the other hand, the highest GDP growth rate in this country was 5.86% (BDP

deflator = 6.20%, inflation = 1.50%) in 2007, followed by a decline in the inflation rate (BDP deflator₂₀₀₆ = 7.80 %, inflation according to CPI₂₀₀₆ = 6.13%).

As for inflation in the period 2020-2021, no negative inflation was recorded in Serbia, North Macedonia, and Albania. Namely, in Serbia, a negative GDP growth of -0.94% (GDP deflator = 2.45%, inflation = 1.58%) was noted in 2020, and a positive GDP growth of 7.39% and inflation (4.09% and GDP deflator = 6.09%) in 2021. In Albania, on the other hand, GDP growth was negative (-3.48%) and inflation was positive (GDP deflator = 0.68%, 1.62%) in 2020, while 2021 saw GDP growth of 8.54% as well as a GDP deflator (5.92%) and inflation (2.04%). Similarly, North Macedonia recorded negative GDP growth (-6.11%) in 2020 (GDP deflator = 0.86%, inflation = 1.20%), and positive growth of the GDP indicator, GDP deflator, and inflation one year later, *i.e.* 3.96%, 6.06%, and 3.23% respectively.

Based on this review of indicators, inflation growth and GDP growth have generally gone *pari passu*, but not always. Therefore, their causality cannot be claimed. Causality of this kind is the subject of the analysis below.

The results of the regression analysis are presented in the following equation:

$$\ln GDP_{it} = 3.331 + 0.428\% - 0.216\% - 0.472 \quad (8)$$

	(const.)	(INLF DEFL%)	(INFL CPI%)	(CPI)
std.error	(2.149)	(0.141)	(0.146)	(0.448)
t	(1,550)	(3,029)	(-1,478)	(-1,054)
p (<0.05)	(0.127)	(0.004)	(0.145)	(0.297)
VIF	(2.263)	(2.210)	(1.261)	
R-squared	= 0.213			

Given the statistically significant model ($p < 0.05$), the null hypothesis is rejected because it is proven that there is a positive impact of the GDP deflator on economic growth.

When observing the results of the econometric analysis according to the above model, it was determined that the variable $\ln INFL_DEFL\%$ is statistically significant with a positive sign and with a confidence level of 21.3%. Therefore, the GDP deflator has a positive effect on the rate of economic growth. If the GDP deflator increases by 1%, it will cause variability or GDP growth of 0.428%. ($p = 0.004$, $t = 3.029$, $VIF = 2.263$) while other coefficients will remain constant. This change value represents the mean positive change value for the countries i and the period t . The influence of other independent variables is

negative but not statistically significant. These results are consistent with the theoretical assumptions and empirical research of Koulakiotis et al. (2012), Kryeziu and Durguti (2019), and Obradović et al. (2017), who also found that there is a positive impact of inflation on GDP growth. On the other hand, the outcome of this analysis contradicts the research of Barro (2013). Barro measured the impact of inflation on GDP for the period 1960-1990, and it can be assumed that the time period of the research, which does not include either the global financial crisis or the emerging health crisis, affects the outcome of his analysis and the difference with the outcome of this research. In addition, this author used a sample of over a hundred countries, and it is assumed that the difference in the sample size contributes to the difference in the outcome of the regression analysis, to be precise, that the increase in inflation has a negative and statistically significant impact on GDP.

Conclusion

This research aimed to measure the impact of inflation on GDP in the countries of the Western Balkans for the period 2006-2021. The results showed that the GDP deflator has a positive effect on GDP and this outcome is statistically significant. Therefore, the main contribution of this paper is that the question of how much inflation affects GDP in the sample countries has been largely answered empirically. In addition, the results of this research have implications for the monetary policy of these countries if it is taken into account that both the level of GDP and the level of inflation varied significantly, especially during the period of the emergence of the global health crisis caused by the COVID-19 virus. In this sense, the main recommendations refer to the central banks of the Western Balkan countries to set the target inflation framework under other relevant macroeconomic indicators (e.g. employment) and monitor them on a continuous level.

The implementation of the monetary policy of the central banks of the countries of the Western Balkans, especially those in transition, should have as one of its main goals the determination of inflationary expectations for the sake of controlling inflation for a long-term period (inflation targeting). Also, these banks must manage public spending and investments in a controlled manner. To achieve this goal, central banks must provide a higher level of transparency, because in this way they will gain a higher level of credibility within

the framework of monetary policy. In this way, inflation can be kept under control without limiting economic progress and GDP growth.

Recommendations for further research from the methodological aspect are as follows. Based on the same series of data used for analysis in this paper, the impact of inflation on GDP can be analyzed including random effects. Given that only fixed effects were used in this research, random effects could also be incorporated employing a linear mixed model, and with the same estimation method (OLS). In addition, to analyze the impact of inflation on GDP in each country of the Western Balkans individually, seven separate models can be constructed. Every single model would indicate the level of impact of inflation on GDP in each of the countries. Finally, from the econometric aspect of the analysis, a comparative analysis can be conducted between the model with untransformed data into natural logarithms and the model used for analysis in this paper.

References

- Apostolakis, G., & Papadopoulos, A. P. (2019). Financial stability, monetary stability and growth: a PVAR analysis. *Open Economies Review*, 30(1), 157-178. <https://doi.org/10.1007/s11079-018-9507-y>
- Armeh, H., Salarzahi, H., Yaghoobi, N., & Heydari, A. (2010). Causes of inflation in the Iranian economy. *International Review of Business Research Papers*, 6(3), 30-44. Retrieved July 6, 2022, from https://www.researchgate.net/profile/Habibollah-Salarzahi/publication/229053633_Causes_of_Inflation_in_the_Iranian_Economy/links/5627fe8b08ae04c2aead821d/Causes-of-Inflation-in-the-Iranian-Economy.pdf
- Arsić, M., Mladenović, Z., & Nojković, A. (2022). Macroeconomic performance of inflation targeting in European and Asian emerging economies. *Journal of Policy Modeling*, 44(3), 675-700. <https://doi.org/10.1016/j.jpmod.2022.06.002>
- Barro, R. J. (2013). Inflation and economic growth. *Annals of Economics & Finance*, 14(1), 85-109. Retrieved June 24, 2022, from <http://aefweb.net/AefArticles/aef140106Barro.pdf>
- Chen, L., Dolado, J. J., & Gonzalo, J. (2021). Quantile factor models. *Econometrica*, 89(2), 875-910. <https://doi.org/10.3982/ECTA15746>
- Chien, F., Chau, K. Y., Sadiq, M., & Hsu, C. C. (2022). The impact of economic and non-economic determinants on the natural resources commodity prices volatility in China. *Resources Policy*, 78, 102863. <https://doi.org/10.1016/j.resourpol.2022.102863>
- Das, P., & Ghate, C. (2022). Debt decomposition and the role of inflation: a security level analysis for India. *Economic Modelling*, 113, 105855. <https://doi.org/10.1016/j.econmod.2022.105855>
- Despotović, D., Cvetanović, S., & Nedić, V. (2014). Innovativeness and competitiveness of the Western Balkan countries and selected EU member states. *Industrija*, 42(1), 27-45. <https://doi.org/10.5937/industrija42-4602>

- Dinterman, R., & Katchova, A. L. (2020). Property tax incidence on cropland cash rent. *Applied Economic Perspectives and Policy*, 42(4), 739-758. <https://doi.org/10.1093/aep/pz004>
- Đurović-Todorović, J. Đ., Đorđević, M., & Tomić, Z. (2016). Analysis of the dynamics of inflation in Serbia. *Strategic Management*, 21(3), 56-61. Retrieved June 20, 2022, from <http://scindeks-clanci.ceon.rs/data/pdf/1821-3448/2016/1821-34481603056D.pdf>
- Ehigiamusoe, K. U., Guptan, V., & Narayanan, S. (2021). Rethinking the impact of GDP on financial development: evidence from heterogeneous panels. *African Development Review*, 33(1), 1-13. <https://doi.org/10.1111/1467-8268.12469>
- Erceg, V., & Zoranović, T. (2022). Knowledge management and digital business transformation. *Strategic Management*, 27(2), 57-63. <https://doi.org/10.5937/StraMan2200007E>
- Fetai, B., Koku, P. S., Chaushi, A., & Fetai, A. (2016). The relationship between exchange rate and inflation: the case of Western Balkans countries. *Journal of Business, Economics and Finance*, 5(4), 360-364. <https://doi.org/10.17261/Pressacademia.2017.358>
- Frattoni, P., & Crosta, G. B. (2006). Assessment of the acceptability of landslide risk and cost-benefit analysis / Valutazione dell'accettabilità del rischio da frana e analisi costi-benefici. *Giornale di Geologia Applicata*, 4, 49-56. <https://doi.org/10.1474/GGA.2006-04.0-06.0134>
- Gabrish, H. (2015). Net capital flows to and the real exchange rate of Western Balkan countries. *Economic Annals*, 60, 31-52. <https://doi.org/10.2298/EKA1505031G>
- IWA. (2021). *Country Classification*. Retrieved July 5, 2022, from <https://iwa-network.org/wp-content/uploads/2015/12/2021-Country-Classification-Update.pdf>
- Jusufović, G., & Bellaqa, B. (2019) Trade barriers and exports between Western Balkan countries. *Naše gospodarstvo*, 65(4), 72-80. <https://doi.org/10.2478/ngoe-2019-0021>
- Karadžić, V., & Pejović, B. (2021). Inflation forecasting in the Western Balkans and EU: a comparison of Holt-Winters, ARIMA and NNAR Models. *Amfiteatru Economic*, 23(57), 517-532. <https://doi.org/10.24818/EA/2021/57/517>
- Kasidi, F., & Mwakanemela, K. (2013). Impact of inflation on economic growth: a case study of Tanzania. *Asian Journal of Empirical Research*, 3(4), 363-380. Retrieved July 10, 2022, from <https://ideas.repec.org/a/asi/ajoe/rjv3y2013i4p363-380id3366.html>
- Koulakiotis, A., Lyroudi, K., & Papasyriopoulos, N. (2012). Inflation, GDP and causality for European countries. *International Advances in Economic Research*, 18(1), 53-62. <https://doi.org/10.1007/s11294-011-9340-1>
- Kremer, S., Bick, A., & Nautz, D. (2013). Inflation and growth: new evidence from a dynamic panel threshold analysis. *Empirical Economics*, 44(2), 861-878. <https://doi.org/10.1007/s00181-012-0553-9>
- Kryeziu, N., & Durguti, E. A. (2019). The impact of inflation on economic growth: the case of Eurozone. *International Journal of Finance & Banking Studies*, 8(1), 01-09. <https://doi.org/10.20525/ijfbs.v8i1.297>
- Li, L., Tang, Y., & Xiang, J. (2020). Measuring China's monetary policy uncertainty and its impact on the real economy. *Emerging Markets Review*, 44, 100714. <https://doi.org/10.1016/j.ememar.2020.100714>
- Mandeya, S. M. T., & Ho, S. Y. (2021). Inflation, inflation uncertainty and the economic growth nexus: an impact study of South Africa. *MethodsX*, 8, 101501. <https://doi.org/10.1016/j.mex.2021.101501>
- Mansi, E., Hysa, E., Panait, M., & Voica, M.C. (2020). Poverty - a challenge for economic development? Evidence from Western Balkan countries and the European Union. *Sustainability*, 12(18), 7754. <https://doi.org/10.3390/su12187754>
- Milovanović, D., & Marković, N. (2022). Strategic decision making and influence of economic freedoms on foreign direct investment (FDI) in Bosnia and Herzegovina. *Strategic Management*, 27(2), 44-56. <https://doi.org/10.5937/StraMan2200011M>
- Musarat, M. A., Alaloul, W. S., & Liew, M. S. (2021). Impact of inflation rate on construction projects budget: a review. *Ain Shams Engineering Journal*, 12(1), 407-414. <https://doi.org/10.1016/j.asej.2020.04.009>
- Najeb, M. (2014). A contribution to the theory of economic growth: Old and New. *Journal of Economics and International Finance*, 6(3), 47-61. <https://doi.org/10.5897/JEIF2013.0518>
- Nasir, M. A., Huynh, T. L. D., & Vo, X. V. (2020). Exchange rate pass-through & management of inflation expectations in a small open inflation targeting economy. *International Review of Economics & Finance*, 69, 178-188. <https://doi.org/10.1016/j.iref.2020.04.010>
- Nedić, V., Despotović, D., Cvetanović, S., Djukić, T., & Petrović, D. (2020). Institutional reforms for economic growth in the Western Balkan countries. *Journal of Policy Modeling*, 42(5), 933-952. <https://doi.org/10.1016/j.jpolmod.2020.04.002>
- Obradović, S., Šapić, S., Furtula, S., & Lojanica, N. (2017). Linkages between inflation and economic growth in Serbia: an ARDL bounds testing approach. *Engineering Economics*, 28(4), 401-410. <https://doi.org/10.5755/j01.ee.28.4.14003>
- Pearson, T. (2019). *IARIW-World Bank*. Retrieved June 30, 2022, from <http://old.iariw.org/washington/Nakamura-paper.pdf>
- Pere, E. (2015). The impact of good governance in the economic development of Western Balkan countries. *European Journal of Government and Economics*, 14(1), 25-45. <https://doi.org/10.17979/ejge.2015.4.1.4305>
- Perić, M., & Filipović, S. (2021). Foreign direct investments and labour force indicators in transition economies: linear mixed-effects models impact analysis. *Sociológia-Slovak Sociological Review*, 53(3), 238-265. <https://doi.org/10.31577/sociologia.2021.53.3.9>
- Perić, M., & Stanišić, N. (2020). FDI inflow effects on Western Balkan area's labour markets. *The European Journal of Applied Economics*, 17(2), 147-160. <https://doi.org/10.5937/EJAE17-25663>
- Pollin, R., & Zhu, A. (2006). Inflation and economic growth: a cross-country nonlinear analysis. *Journal of post Keynesian economics*, 28(4), 593-614. <https://doi.org/10.2753/PKE0160-3477280404>
- Rangarajan, C. (2012). Dynamics of Inflation. *The Indian Economic Journal*, 60(1), 3-22. <https://doi.org/10.1177/0019466220120102>

- Rehman, M. U., Ali, S., & Shahzad, S. J. H. (2020). Asymmetric nonlinear impact of oil prices and inflation on residential property prices: a case of US, UK and Canada. *The Journal of Real Estate Finance and Economics*, 61(1), 39-54. <https://doi.org/10.1007/s11146-019-09706-y>
- Rehman, N. U., Čela, A., Morina, F., & Sulčaj Gura, K. (2019). Barriers to growth of SMEs in Western Balkan countries. *Journal of Management Development*, 38(1), 2-24. <https://doi.org/10.1108/JMD-09-2018-0273>
- Sabir, S., Rafique, A., & Abbas, K. (2019). Institutions and FDI: evidence from developed and developing countries. *Financial Innovation*, 5(1), 1-20. <https://doi.org/10.1186/s40854-019-0123-7>
- Szeiner, Z, Kovács, A., Zsigmond, T., & Poór, J. (2021). Consulting during the coronavirus in the light of an empirical survey in Hungary. *Strategic Management*, 26(4), 4-14. <https://doi.org/10.5937/StraMan2104004S>
- Tošković, J. (2015). *Preispitivanje neoliberalnog koncepta ekonomije u zemljama Zapadnog Balkana*. Neobjavljena doktorska disertacija.: Univerzitet Educons Sremska Kamenica.
- Turner, H. C., Lauer, J. A., Tran, B. X., Teerawattananon, Y., & Jit, M. (2019). Adjusting for inflation and currency changes within health economic studies. *Value in Health*, 22(9), 1026-1032. <https://doi.org/10.1016/j.jval.2019.03.021>
- Ullah, S., Apergis, N., Usman, A., & Chishti, M. Z. (2020). Asymmetric effects of inflation instability and GDP growth volatility on environmental quality in Pakistan. *Environmental Science and Pollution Research*, 27(25), 31892-31904. <https://doi.org/10.1007/s11356-020-09258-2>
- Umaru, A., & Zubairu, J. (2012). The effect of inflation on the growth and development of the Nigerian economy: an empirical analysis. *International Journal of Business and Social Science*, 3(10), 183-191. Retrieved June 28, 2022, from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1084.5719&rep=rep1&type=pdf>
- Vladi, E., & Hysa, E. (2019). The impact of macroeconomic indicators on unemployment rate: Western Balkans countries. In H. Chandan, & B. Christiansen (eds.), *International firms' economic nationalism and trade policies in the globalization era*, 158-181. IGI Global. <https://doi.org/doi:10.4018/978-1-5225-7561-0.ch009>
- World Bank. (2022). *Open data*. Retrieved June 15, 2022, from <https://data.worldbank.org/?iframe=true>
- Xiao, J. (2009). *The Relationship between Inflation and Economic Growth of China: Empirical Study from 1978-2007*. Master theses. Sweden: Lund University.
- Zdraveski, D., Janeska, M., & Taleska, S. (2016). A statistical analysis of the labor demand of the ICT sector in the R. of Macedonia. *Strategic Management*, 21(1), 23-29. Retrieved August 3, 2022, from <https://www.smjournal.rs/index.php/home/article/view/89/66>

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