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Article

Panel estimating effects of macroeconomic determinants on inflation: Evidence of Western Balkan

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Panel estimating effects of macroeconomic determinants on inflation: Evidence of Western Balkan

Esat Durguti¹, Qazim Tmava^{2*}, Filloreta Demiri-Kunoviku² and Enver Krasniqi²

Abstract: This study analyzes the relationship between macroeconomic variables that influence inflation. Through our research, we will analyze the influence of GDP growth, remittances, level of exports, level of imports, and foreign direct investments on the inflation rate for the Western Balkan. The research has applied panel data using dynamic approaches such as fixed effects, and Arellano–Bover/Blundell–Bond estimation to determine relationships between variables and their impact on inflation. The research used annual series data from 2003 to 2019 provided by the World Bank and the International Monetary Fund. Likewise, to test a stationary of data was applied three estimations for the unit root test and Johansen cointegration. The research results reveal that in the short run, all variables influence the inflation rate, except for foreign direct investment, which has insignificant influence. Moreover, the analyses through the Arellano–Bover/Blundell–Bond estimation reveal that GDP growth, imports, and foreign direct investments have a positive influence on the inflation rate, while, working remittances and exports have

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PUBLIC INTEREST STATEMENT

This article aims at an in-depth analysis of macroeconomic determinants which affect the inflation rate for the Western Balkans countries. The study confronts some of the key macroeconomic indicators, which can potentially have an effect on the inflation rate, and then any increase in this rate directly affects the reduction of customer consumption. What is different about this article compared to previous studies is that we have applied panel countries with a dynamic approach, to test the specifics of a certain determinant of the inflation rate. According to Arellano/Bond estimation, economic growth, imports, and FDI have a positive impact, while remittances and exports have a negative impact. And that, the end of the study offers a new approach as an added value in this field and an opportunity for debate between researchers, policymakers, and government in general.

a negative influence on the inflation rate. These conclusions provide sufficient information for future debates and examination on macroeconomic variables that potentially affect inflation.

Subjects: Regression Analysis and Multivariate Statistics; Economics; Macroeconomics

Keywords: Macroeconomic variables; economic growth; panel data

JEL Classifications: O11; O47; C23

1. Introduction

This research analyses the effect of determinants that impact the inflation rate for the countries included in the analysis. In a wide sense of the term, inflation means an important as well as a perpetual rise in the common scale of prices over an extended time. After a long-stretched theoretical debate among the '70s till '90s, the academic literature on inflation has reached a reasonable range of compromise (Goodfriend & King, 1997). Despite some dissent regarding the particular reasons and channels through which inflation is worked out into the system, it is generally accepted that inflation is affected by three essential sources: (a) excess aggregate demand surplus is a typical feature of overheated economies at full-employment of productive resources; (b) the cost-push effect that possibly results from rising deviations in the market power enjoyed by oligopolistic domestic companies, rising unit labor cost, increased prices of imported intermediate inputs, and one-time or systematic shortages of productive resources on general-due to deficiencies, conflicts; (c) lastly, a self-feeding component by way of an autoregressive mechanism imbued in distributional conflicts among social groups; persisting conflict is probable to take shape in economic institutions practices such as indexation and other systematic reconsiderations of prices, wages, and rents that incorporate random shockwaves into inflation trends. Alternatively, there is no universally acceptable definition of inflation (Dwivedi, 2010). High inflation is constantly related to inferior growth and financial crises (Blanchard et al., 2010; Mishkin, 2008). Rising price levels are further linked to weaker investor confidence, undercut incentives to save, and erode financial and public sector balance sheets. As well, the damage to high inflation can fall disproportionately on the poor since poorer households are more reliant on wage income, have less access to interest-bearing accounts, and are unlikely to have a significant holding of financial or real assets apart from cash.

For these reasons, low and stable inflation has been linked with healthier growth and development effects, financial stability, and poverty reduction (Ha et al., 2019).¹ Based on the importance of inflation for the economic progress of each country through this research, we will try analyzing the relationship between some macroeconomic variables and inflation. Then, this research investigates the connection among determinants of inflation for the Western Balkan economies. The countries that are included in the analysis are *Albania, Bosnia and Herzegovina, Kosovo**,² *North Macedonia, Montenegro, and Serbia*. It is worth noting that all these countries have identical macroeconomic specifics on their treatment, as they all aspire to be part of the European Union and are members of the International Monetary Fund, and, as such, have the same characteristics on the treatment of inflation rate. Another additional motivation for analyzing these countries has been that all of these countries were been an integral part of the former Yugoslavia as well as to analyze the impact of determinants on the inflation rate, as they have gone through a difficult period during the transition period. This research, as specified previously, has applied the dynamic approach analysis to test whether the selected parameters impact the inflation rate for the countries highlighted. The data provided are from credible institutions, prepared and presented according to the format defined by the International Monetary Fund. The data analyzed in the research are from Western Balkans countries, which have derived from the collapse of Yugoslavia.³ Those countries have many things in common—ethnic diversity, social, political, and economic systems. The endmost differences concerning these countries are a result of their status during the Yugoslavia existence, unequal time of declaring their independence, embargoes during the Balkans wars. Therefore, the purpose of this evaluation is to confront the applied parameters and to test whether the results agree with the expected results, and at the same time to provide an analysis with innovations in the macroeconomics field.

This research has limitations in providing data quarterly, which would provide us with the most approximate results of the degree of impact, but even data annually will be an important contribution in this area. Based on the fact that little research has been conducted in these countries. The novelty and original contribution in this research are that a dynamic approach has been applied, such as the fixed-effect model, and Arellano-Bover/Blundell-Bond, which we have not encountered in any research dedicated to these countries. The study is considered in the following sections and subsections: introduction, a review of the literature in theoretical and empirical terms, methodology and analysis of data, a summary of general statistics, test on unit roots, empirical results and discussion, and finally the conclusions of the study.

2. Literature review

The review of the macroeconomic field has consistently been a challenging field for researchers and policymakers in both unindustrialized and industrialized countries. Several authors have conducted research applying econometric models to conclude what correlations these variables have between them. It is worth noting that there is a great diversity of these studies regarding their effect on inflation at the worldwide level, but a smaller number of studies exist for the eurozone countries and in particular for the Western Balkans economies. Certainly, there exist various findings regarding macroeconomic signs who affect the inflation rate, then in the following, a detailed analysis will be conducted in the analysis of the literature in the empirical aspect.

2.1. Empirical review of literature

Inflation analysis has consistently absorbed the courtesy of many researchers and economists around the world, analyzing states as a specific, group of states, developing and developed countries, OECD countries, Western Balkan, etc. However, what is worth is to emphasize regarding the influence of inflation on economic growth, all these studies have not reached common conclusions, but the results are divergent. Three opinions prevail on this phenomenon in the academic and empirical literature. Sidaruski (1967) in his research has found that inflation has an insignificant influence on economic growth, similarly, Cameron et al. (1996) using data for countries (Canada, United States, United Kingdom, and West Germany) their results from the co-integration test and other applied tests did not show significant consequences between these constraints. The authors who support the opinion that there is an adverse correlation between inflation and economic growth remain, Fischer (1993); (Ghosh & Phillips, 1998); (Kremer et al., 2013) studies argue that if we have a high rate of double-digit inflation will have a negative (converse) impact on economic growth. In their researchers, they have exhausted cross-sectional and panel data regressions for industrialized and unindustrialized countries. Finally, the group who in their studies have argued that if you have a low or moderate level of inflation, leads to economic growth are (Benhabib & Spiegel, 2009); (Mallik & Chowdhury, 2001).

Particular authors have written about macroeconomic factors that affect inflation, while we will limit ourselves to those who have written about Western Balkan countries (Domec & Elbirt 1998; (Petrovska & Nikolov, 2018); (Milenković et al. (2020). Domec and Elbirt (1998) investigate the behavior and determinants of inflation in Albania employing three approaches. The first approach decomposes inflation into four components (seasonal, cyclical, trend, and random). The second approach relies on the widely employed Granger-causality test by using disaggregated data on both the consumer price index (CPI) and the key economic variables. Finally, the third approach applies co-integration and error-correction techniques to the inflation process. Based on the analysis, they conclude that inflation exhibits strong seasonal patterns associated with agricultural seasonality. They conclude that peaks and troughs of monetary aggregates correspond to those of inflation with a two-month lag. The exchange rate also exhibits a stable seasonality. Petrovska and Nikolov (2018) investigate the determinants of core inflation in North Macedonia and empirical results show that the most important determinants of the cumulative core inflation are underutilization of labor in the form of spontaneous part-time employment and headline unemployment rate.

However Milenković et al. (2020) examine the impact of some macroeconomic indicators on price movements at the general level, measured by the annual rate of inflation, in selected West Balkan countries. They used a model where inflation is the dependent variable, while the gross domestic product, unemployment, the real interest rate, savings, government expenditures, and value-added tax represent independent variables. The generated results showed that gross domestic product, unemployment, and value-added tax have a statistically significant impact on inflation compared to other explanatory variables.

The crucial component that is straightly related to economic development is working remittance, which positively has a consequence on the economy. Until working remittances rise personal revenue, they directly advance the living standard by receipt remittances, and therefore growing the demand for consumption and thus raise economic activities. As stated by (Cáceres & Saca, 2006) this way remittances tortuously impact inflation. Similarly, the revision piloted by (Goza & Ryabov, 2012) argues that remittances conducted by parents on their children these remittances persist in the main consumer-oriented, and affect inflation. A study conducted by (Ulyses Balderas & Nath, 2008) on the Mexican economy, including the period 1995–2005, shows that remittances take a positive influence on inflation straight and tortuous. While, Narayan et al. (2011) have assessed the influence of remittances on inflation for 54 unindustrialized states using data for the period 1995–2005, applying the GMM approach. Additionally, the results of this examination argue that there is a positive relationship between these two factors. As highlighted earlier, macroeconomic factors are a challenging area for many researchers, and an important study was conducted for the Turkish economy to investigate the determinants of inflation. In this study, the Johansen co-integration technique was used with time series from 1970 to 1995. The results of this study have shown that exchange rates, wages, exports and imports, prices, and money supply are factors that have a significant impact on inflation in the case of the Turkish economy (Papi & Lim, 1997). Also, (Gylfason, 1997) has assessed the impact of exports and several other factors, including inflation. In the framework of this study, cross-sectorial data and econometric techniques were used for 160 countries of the world. Additionally, the results of this study conclude that high inflation tends to be associated with low levels of exports.

Dietmar and Shera (2017) have analyzed six (6) countries that are considered the largest recipients of remittances, using a panel data set (Albania, Bulgaria, North Macedonia, Moldova, Romania, and Bosnia & Herzegovina), covered period 1999 to 2013. These countries, but including also and Kosovo, are presumed by the official records of the World Bank as the largest recipients of remittances. Statistically speaking, remittances represent the foreign sources obtained and account for more than 10% of the GDP of each country included in the analysis. Durguti et al. (2020) in their study evaluation of economic factors for Western Balkan, used the mixed approach, respectively, the OLS, random effect, and fixed-effect model. Including these factors to test the influence of economic growth, working remittance, exports & imports, and foreign direct investment. The results of this study present that they have significant correlations among them.

Dexter et al. (2005) conducted an important study on the prospects of the US economy, they concluded that foreign trade operations have a convincing impact on inflation. Moreover, they have argued that exports are directly correlated with inflation, while imports are inversely correlated. Sahoo and Sethi (2018) have applied the dynamic method to evaluate the level of association among export, import, FDI, and inflation. To evaluate the level of association, they have included the period 1975–2017, employing the Johansen Co-integration test, to find the long-term and short-term correlation between them. The findings of the study offer sufficient indication that exports have a more constant influence, concerning imports and FDI on the inflation rate.

Furthermore, Ferrucci et al. (2010) analyzed the causes of the increase in retail prices in Eurozone countries, and at the same time provided evidence that with a 10% increase in the price of imported goods and if they make up 20% of the sum of spent, domestic inflation can only increase 2%. Additionally, the study by Tuğcu et al. (2019) on the Turkish economy, for the period

1961–2017, using the appropriate co-integration technique. The findings of this study illustrated that inflation in Turkey is essentially rooted in the monetary issue and the level of imports.

The variable FDI, after the “70s, has stayed the focus of empirical analysis by many researchers to test their effect on economic growth, but also with other macroeconomic segments. In this context, in the outline of the analysis, the aim is to assess its effect on inflation. Asiamah and Afful, (2019) study ‘*Analysis of determinants of foreign investment in the Ghana economy*,’ wherever this revision checked the connection among foreign direct investment also a macroeconomic contributing factor in the short-term and long-term using Johansen’s methodology to co-integration in the context of VECM. The conclusions of this revision propose that there is a correlation between foreign direct investment and macroeconomic issues and that a negative correlation has inflation, exchange rate, interest rate but, a positive correlation has GDP and energy generation. (Saini & Singhania, 2018) have observed the interconnectedness of foreign direct investment in industrialized and unindustrialized countries (11 industrialized countries and 9 unindustrialized countries) for the period 2004–2013 using the static and dynamic approach starting from the fixed effect, random effect, and GMM method. The results give different indications for the countries treated in the analysis. In industrialized countries” GDP growth, trade openness, inflation, and freedom index, while in unindustrialized countries gross-fixed capital, trade openness, and efficiency variables have a positive impact on foreign direct investment.

Allard (2007) investigates to what extent the inflation in Poland is determined by global factors and globalization. She empirically analyzes the association between inflation and globalization at the cumulative, macroeconomic level for Central and Eastern European (CEE) with CPI inflation explained by trade openness defined as the ratio of imports of GDP and output gaps derived with Hodrick Prescott filters for GDP. The results offer an indication that the sensitivity of prices to national economic environments in the eight CEE countries has been falling in the wake of higher trade integration. Allard (2007) evaluates the influence of globalization in Poland and discovers that globalization would have lowered domestic prices by between $\frac{1}{2}$ and 1 percentage point per year since the middle of the 1990s, mainly through lower markups on prices. Allard’s model, therefore, offers a strong empirical indication of an adverse association between globalization and inflation.

3. Data and methodology

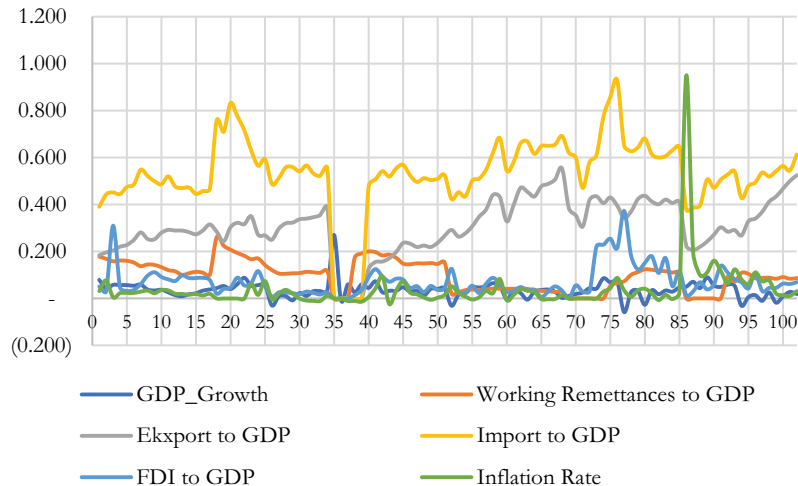
3.1. Data set

The research included six countries from the Western Balkan, consuming panel data with 102 observations, including the period 2003–2019. The reason for determining the observation period from 2003 to 2019 is that the data were available according to the format determined by the IMF, while the next studies will be included the latest data and the countries involved in this research, lies in that there is not enough research in this field, and other issues are that all these countries were part of the single state before the period of 1990, except Albania. In this research, the data provided are in the form of financial indicators, respectively, in coefficient where five (5) of them are controlling factors, which will be investigated how controlling factors affect inflation. The source of information for all variables is taken from the World Bank and World Economic Outlook Database (IMF), and these data are constructed on the format well-defined. The table below shows us the macroeconomic indicators used in the analysis and the expectations from the results [Figure 1](#).

Macroeconomic variables have consistently been the focus and challenging for many researchers and policymakers. In the following, we will present the variables applied in this study and the expected results. One of the variables that have sparked debate among researchers over the years is the *growth of GDP to the inflation rate*. No agreement was reached among the researchers on this relationship. Thus, we devise consistently encountered conflicting opinions and conclusions. Sidaruski (1967) found insignificant consequences between these two variables, while the negative effect supported by Fischer (1993), and the positive impact was stated by (Mallik & Chowdhury, 2001) among GDP growth and inflation rate. A key indicator that is measured for the countries we

Figure 1. The trend of variables applied in the analysis for the six countries.

Source: IMF dataset and author's presentation



take in the investigation is *working remittances*, which by numerous studies is considered a key injection for the country's economy.

However, in the world and Europe, some research has been conducted on the influence of remittances on inflation, then their findings are consistent. The study conducted by Narayan et al. (2011) analyzing the data used for 54 developed countries of the world has found that remittances consume a positive impact on inflation, and the most serious effects are eventually. Dexter et al. (2005) have conducted a fundamental study from the viewpoint of the US economy; they have conducted that international trade takes a convincing impact on inflation. However, the *exports* create a straight correlation with inflation, and *imports* have a converse association with inflation. And finally, the variable that has been the focus of many studies is *FDI* and its influence on economic growth, while our focus with this variable is to analyze what influence it takes on the inflation rate. It is worth mentioning that there is a small amount of research conducted in this regard and it would be of interest to investigate. The expected results of this variable are to impact inflation.

The figure above presents the statistics trend, also from the figure, we can see that the variables that have more pronounced oscillations are *imp_GDP*, *exp_GDP*, while other variables have a constant trend except in 2009 while *inflation* had a greater increase.

3.2. Methodology

The research on the contributing factor of inflation in the countries of the Western Balkans will be based on the above-mentioned treatments, but given the characteristics and specifics of the factors applied in this research. So, the study used panel data trying to apply dynamic techniques to recognize which is more appropriate starting from fixed-effect, and Arellano–Bover/Blundell–Bond. A fixed-effects model is an assessment methodology used after we are handling dynamic panel data set that enables us separately to examine on behalf of a time-invariant undetected particular specification that would be connected through the perceived explanatory factors. Consuming the Arellano–Bover/Blundell–Bond it's encouraging crosswise in that it only evaluates the situations of the implied moment in the AR (1) and effectively reduces heterogeneity. Also, the GMM method sets the additional situations of the moment that possibly will be false. The indicators that will be evaluated in the analysis are the inflation rate, the gross domestic product growth, workers' remittances, the level of export to GDP, the level of import to GDP, and foreign direct investment with GDP. As mentioned earlier to assess the impact of these macroeconomic indicators, we have used specific advanced approaches related to the evaluation of panel data, in which the following we will present their essential equations Table 1.

Table 1. Variable descriptions and expected signs

Variable		Denominations	Acronyms	Sign
Dependent variable	Inflation	Inflation rate	Inf_r	
Explanatory variables	Selected-specific factors	Gross domestic product growth—nominal Working remittances to GDP Export level to GDP Import level to GDP Foreign direct investment to GDP	Gdb_r Wr_gdp Exp_gdp Imp_gdp Fdi_gdp	+ ±- + ±

Source: author’s description

$$Y_{it} = \beta'X_i + \mu_i + \varepsilon_i \text{— Fixed effect regression}$$

$$Y_{it} = \sum_{j=1}^p \alpha_j Y_{i,t-j} + X_{it}\beta_1 + W_{it}\beta_2 + \vartheta_i + \varepsilon_{it} \text{— Arellano–Bover/Blundell–Bond Estimator}$$

K' is a vector, in which the lagged dependent variable is integrated as a covariate.

3.3. General summary statistics

Table 2 presents the explanation of the data that are in the investigation, beginning from the number of observations, smallest value, largest, mean, standard deviation, and variance coefficient. All the existing data are perceived to have no high variation, which is proved by the coefficient of variance, where the highest level of variance has the ratio imp_gdp with .0247 or 2.47%. Inflation reached its minimal, maximal scale in 2009. The minimal inflation rate in Kosovo was -2.47%, while the maximal value reached by Serbia at 12.41%. Also, Table 2 presents in detail the statistics for other factors used in the analysis.

To analyze the relationship between the determinants applied in the analysis, correlation analysis was used. The conclusions drawn from this analysis give us information that only the determinants of GDP growth have a positive relationship with the inflation rate. While the determinants that have a negative relationship with the inflation rate are exports to GDP, imports to GDP, and FDI to GDP as shown in the table below.

4. Unit root tests

To check panel data involve beyond the examination of their stationary, the following examinations were used: The Levin-Lin-Chu-[LLC], Fisher, and Pasaran-Shin test. Table 3 and 4, presented below provides us detailed evidence on the stationary level and their placement from nonstationary to stationary statistics regulated in the second difference [2nd difference].

Additionally, based on these marks regarding indicator stationarity, the assessments applied in the context of this revision recommend we throw away the basic hypothesis and, necessity take the alternate hypothesis at the critical value of 1% and 5%. If a variable has unit-root property, the variable is non-stationary as in the case with time-series data. When the variables have a unit root, the co-integration process is needed to be examined. When variables are non-stationary, estimation using OLS yields misleading and incorrect results. For instance, if the true value of β is zero, but the OLS model yields an estimation of β in other figures apart from zero.

This information distorts the result of the model. Otherwise, the OLS cannot estimate or estimate the model of the association among variables that have unit-roots. It is a false regression

Table 2. Summary of descriptive statistics

	Obs	Smallest	Largest	Mean	Std.Dev	Variance
Inflation	102	-.0242	.1241	.0379	.0989	.0098
GDP_g	102	-.0581	.0863	.0351	.0356	.0013
Wr_gdp	102	.0013	.2003	.0968	.0639	.0041
Exp_gdp	102	.0002	.5002	.3080	.1145	.0131
Imp_gdp	102	.0013	.7751	.5309	.1572	.0247
Fdi_gdp	102	.0011	.2285	.0719	.0642	.0041

Source: author’s calculation using STATA Software

problem. Nevertheless, if the two constraints in question are co-integrated, the false regression can be avoided (Koop, 2008).

To eliminate the doubt about data cointegration, in addition to the Kao test, we have also applied the Johansen test for cointegration, and Table 5 offers the outcomes, that the data are cointegrated in the second rank, according to a critical value of 5%. Evidence on data cointegration is provided according to this technique when the trace statistics coefficient has a value larger than the critical value 1% and 5%, which in this study the model maximum can have two equations of cointegration.

5. Empirical results and discussion

This section discusses the issues highlighted earlier as part of the methodology starting with the applied tests on the adequacy and stability of the applied models. In model 1, R is 0.5262 or 52.62% of the control variables explain the dependent variable [see table no.6], the Durbin–Watson test was also used to test whether the data have a serial correlation. The observation shows that the data do not have a negative or positive serial correlation since the value is 1.577, which proves to us that the model is suitable and fit. Also, F-test was applied, where the value of this test is $F(5.91) = 4.97$; $Prob > 0.0005$, which gives us information that all variables applied in the model have a value less than <10 , and finally, the applied test for heteroscedasticity is the Breusch–Pagan/Cook–Weisberg test and the value generated in this observation is $\chi^2(2) = 10.31$ $Prob > \chi^2 = 0.0672$, which confirms that the data do not have heteroskedasticity. Additionally, model 2, GMM to test if the data are co-integrated Kao test is applied and its results are $Wald \chi^2 = 4.4921$, [$P < 0.001$]. The application of the Arellano–Bover/Blundell–Bond (GMM) method was done according to the criterion one-step results, with the number of the instrument in lags (1) and artest (2). GMM was applied after two important tests (AR2) were performed for autocorrelation and Sargan J-test of overidentifying restrictions. The results presented in Table 6, assure us that the data used in the model have no autocorrelation, and the instruments within the GMM, based on the Sargan test overidentifying restrictions are valid. Additionally, these give us enough assurance that the results of the model are consistent and appropriate.

Table 3. Correlation matrix

	Inflation	GDP_g	Wr_gdp	Exp_gdp	Imp_gdp	Fdi_gdp
Inflation	1.000					
GDP_g	0.066**	1.000				
Wr_gdp	-0.221*	-0.009*	1.000			
Exp_gdp	-0.071**	-0.311**	-0.306	1.000		
Imp_gdp	-0.069**	-0.168**	0.097*	0.756	1.000	
Fdi_gdp	-0.027**	-0.046	0.035	0.188*	0.347	1.000

The association among the variables, *, **, and *** denote statistical significance at 10%, 5%, and 1%.

Source: author’s calculation using STATA Software

Table 4. Unit root tests applied

Variable	Levin-Lin-Chu		Fisher		Pasaran-Shin	
	At level	2 nd difference	At level	2 nd difference	At level	2 nd difference
	Statistic	P-value	Statistic	P-value	Statistic	P-value
Inf_r	-0.6864 0.2462	-4.7701 0.0000	-7.9829 0.0000	-16.4961 0.0000	-4.5522 0.0000	-6.3549 0.0000
GDP_g	1.3742 0.9153	-6.9278 0.0000	-6.5029 0.0000	-16.5789 0.0000	-3.7824 0.0001	-6.4040 0.0000
Wr_gdp	-1.8408 0.0328	-9.8186 0.0000	-1.5918 0.0557	-11.5587 0.0000	-1.2272 0.1099	-5.4966 0.0000
Exp_gdp	-0.2095 0.4170	-10.2677 0.0000	1.5311 0.9371	-11.5382 0.0000	1.5821 0.9432	-5.4629 0.0000
Imp_gdp	-1.9677 0.0246	-6.4037 0.0000	-0.9183 0.1792	-13.6114 0.0000	-1.0633 0.1438	-5.9318 0.0000
Fdi_gdp	-6.0042 0.0060	-12.8663 0.000	-5.0478 0.0000	-13.7466 0.0000	-3.3450 0.0000	-5.8805 0.0000

This table reflects the Levin-Lin-Chu, the Fisher, and Pasaran-Shin test. Observations to verify if the data are stationary since we are applying panel data, notice some parameters at the level are not stationary, then after placing in the second difference all data converted stationary, and in this case, the basic hypothesis is not confirmed, while the alternative hypothesis is accepted at 1% level of significance.

Source: author's calculation using STATA Software.

Table 6 shows the result evaluated through dynamic quantitative analysis and verification of the expected results, which are presented to recognize whether the chosen macroeconomic variables affect inflation for the Western Balkans countries. Moreover, quantitative approaches have been applied through dynamic analysis, to reach the most stable conclusions. All observations from the models regarding the effect of macroeconomic parameters on rising or declining inflation expose important tendencies. In both models, it results that GDP growth, import to GDP, and foreign direct investment take a positive effect on inflation, while negative influence has working remittances and export to GDP. Recognized results, relative to GDP growth on the inflation in both models, turn out to have important positive consequences, at a confidence level of 1%. Based on these marks, we consequently assumed that any economic growth will create an effect on growing inflation for the Western Balkans countries. As distinguished previously in the connection between these dualistic variables, studies proclaim that economic growth creates no influence on inflation, likewise, we have a study that announces that they found a positive link, and the last group, argues an adverse link between themselves. The results of our study agree with the expected results and under the author's Benhabib and Spiegel (2009) conclusion where their findings argue that if we have moderate inflation affects economic growth and underlines the argument that the link between them is nonlinear. (Mallik & Chowdhury, 2001) in their study "Inflation and Economic Growth" for the four countries of South Asia used co-integration analysis and VECM has set up that in the long-run GDP growth takes a confident impact at the inflation rate.

The verified results for working remittances to GDP, according to the fixed effects model and Arellano-Bover/Blundell-Bover have resulted in harm inflation at significance levels of 1%. The results of the analysis are correlated with the findings of the authors Ulyses Balderas and Nath (2008) have argued that through their direct and indirect effects on (aggregate demand) consumption, remittances can impact inflation. Also, Narayan et al. (2011) emphasize that the increase in remittances creates an increase in inflation. However, (Kasteli & Glytsos, 1986) in their study for Greece have found that remittances have a negative relationship with inflation.

The two parameters that should be analyzed in parallel as part of international trade in the open economy are export and import, which in most of the empirical literature have reached conflicting

Table 5. Johansen test for cointegration

Variables:

Lag interval (in second differences):

Unrestricted Co-integration Rank Test (Trace)

Hypothesized

No. of CE(s)	Eigenvalue	Trace statistics	Critical value 0.05
None*	-	217.8936	94.15
At most 1	0.56996	132.6609	68.52
At most 2	0.45643	71.0919	47.21

The outcomes from the Johansen valuation confirm that the data are cointegrated in the second rank, according to the critical value 0.05, as its value is larger than the trace statistic, which proves that in this range the null hypothesis is confirmed. Additionally, in this model, we have a maximum of two cointegration equations. Johansen, S. 1995. *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. Oxford University Press.

Source: author’s calculation using STATA Software.

conclusions and arguments. Then, the results observed in the examination prove that both of these parameters have a significant influence on inflation. The outcomes correspond to the study of the Turkish economy conducted by Papi and Lim (1997) examining the determinants of inflation, through the Johansen co-integration approach including data from 1970 to 1995. The findings of this analysis have shown that the exchange rate, wages, export, import, prices, and money supply are significant parameters that impact inflation. Both constraints in our study are significant *exp_gdp* with negative impact and *imp_gdp* with a positive impact on all three models applied at a reliability level of 1%. While our results are inversely with the findings of Dexter et al. (2005) where their findings are that the level of exports is directly related to inflation, whereas the level of imports is inversely related to inflation. The result generated by the econometric analysis shows that imports have a positive impact on inflation, and is a clear signal to policymakers not to focus only on price stability. Tuğcu et al. (2019) claim that the core source of inflation is monetary and import issues. The ratio of *imp_gdp* according to the fixed effect model has turned out to be insignificant in inflation, and as specified by the GMM, the effects show that *imp_gdp* has a vital influence on inflation. In both simulations, the confirmation of the expected results was verified at the significance level of 1%.

The same conclusion outreached by Asiamah and Afful, (2019) that there is a short- and long-term adverse relative between *imp_gdp* besides inflation by using the Johansen co-integration technique within the VECM examination. Finally, the GMM estimation outcomes show that there is a confident association between these two factors, and a relevant study conducted with the GMM method by the Saini and Singhania (2018) found that real GDP growth, inflation, open trade, exchange rate, and public obligation play a crucial part between *imp_gdp* and inflation.

6. Conclusion

The main purpose of this study was to analyze the relationship between some of the macroeconomic variables and the inflation rate for the Western Balkans. In particular, we have investigated whether these variables impact inflation, applying these indicators GDP growth, working remittances, export, import, and foreign direct investment. To achieve the objectives, we have applied the dynamic approaches using the panel data for the countries specified in the analysis, including the period 2003–2019, which in total are 102 observations. The exclusiveness of this study is that tests were applied for each applied model, to analyze how considerable the dependent variable is explained by the independent variables, tests on serial correlations, heteroskedasticity, AR (2) test, and Kao test for co-integration, all of which have consistent results at a significance level of 1%.

The findings of this study are under the expected results and following the studies conducted earlier by different researchers applying different approaches and models to achieve the most

Table 6. Estimation results fixed effect, ARCH, and GMM Arellano—Bover/Blundell—Bond

Variable	Fixed-Effect Model		Arellano-Bover/Blundell-Bond Estimation	
	Model 1		Model 3 [1 st lag]	
Inf_r	—.—		Inflation rate L1. 0.144***	
Constant	0.033	0.101**	0.057	0.021*
GDP_g	0.061	0.007*	0.039	0.182**
Wr_gdp	0.048	-0.397*	0.000	-0.307***
Exp_gdp	0.000	-0.492***	0.000	-0.239***
Imp_gdp	0.038	0.252**	0.000	0.175***
Fdi_gdp	0.291	0.090	0.000	0.329**
Observation number	102		102	
R-sq Within Between Overall	0.4710 0.4512	0.5262		
The F-test	F(5,91) = 4.97; P > .0005			
log-likelihood test				
AR (2) test			Wald chi2(6) = 108.77 Prob >chi2 = 0.0000	
Durbin-Watson stat	D-stat (6,102) = 1.577			
Breusch-Pagan/Cook-Weisberg test	chi(2) = 10.31 Prob > chi2 = 0.0672			
Kao test for co-integration			Augmented test -4.4921 [P < 0.001]	
Sargan test J-test			Chi2(87) = 95.88 Prob>chi2 = 0.2415	

The significance of the variables, *, **, and *** denote statistical significance at 10%, 5%, and 1%.

Source: author's calculation using STATA Software

accurate results. The component, which has been analyzed by many authors is economic growth, the confirmed results show us that any economic growth in the Western Balkan countries affects the increase in inflation. Moreover, remittances have an inverse influence on the inflation rate. However, the two important components of international trade that are export–import have a negative impact, respectively, positive on the inflation rate. The surprise of this study is the variable foreign direct investment and what impact it has on inflation based on the fact that a few studies have been conducted on this indicator, especially in the countries of the Western Balkans and the European Union. The outputs of this indicator according to the econometric analysis are contradictory by applied models, where according to the fixed effect, there is insignificant impact, and according to the GMM, we have a positive relationship between foreign direct investment and inflation. The scope of this study was limited to the collection of data for macroeconomic indicators, as for some other important indicators we did not have the opportunity to provide data to enrich the study on the one hand, and on the other hand, the inclusion of data is up to 2019. These findings provide a clear path for future research on macroeconomic variables, moreover applying their subcomponents as well as the application of other dynamic models to study their effects in the short and long term.

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Notes

1. Extremely low inflation, however, such as has prevailed at many progressive economies exceeding the past decade, can also be problematic: it may make it difficult for central banks to lower real short-term interest rates sufficiently toward providing the requisite stimulus to demand, given the minor deflation on nominal interest rates; and it may tip into deflation—a sustained decline in prices—which can exacerbate recessionary tendencies (Blanchard et al., 2010).
2. Kosovo*: This designation is without prejudice to positions on status, and in line with UNSCR 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.
3. All countries included in the analysis were part of the former Yugoslavia except Albania.

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