ECONOMETRIC EVALUATION OF PUBLIC DEBT ON INFLATION: EVIDENCE FROM KOSOVO AND NORTH MACEDONIA

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Abstract: *The nexus between public debt and inflation has been continuously investigated, but after the pandemic, it has returned to the center of researchers' courtesy. Consequently, this research examines the influences of public debt, interest rates, trade openness, GDP growth, and foreign direct investments on inflation. The study employs secondary data from 2008 to 2021 and incorporates a mixed econometric technique such as the Ordinary Least Squares (OLS) and Arrellano-Bover/Blundell-Bond approach. The study's findings argue that public debt, interest rates, and trade openness significantly influence inflation, whereas GDP growth has a significantly negative impact. Because of the limited number of observations in the context of the research, we have not been able to evaluate the impact in the long term. The uniqueness and relevance of this research stem from its use of a combined approach, and in recent months, a continuous increase in inflation has been recorded throughout the world. The current findings and arguments inspire a productive discourse among academics, scholars, and policy-making entities.*

Keywords: *Public Debt; Inflation; Time Series Models*

INTRODUCTION

The treatment of the inflation phenomenon and the drivers that cause pressures on the growth of inflation have always been a focus of researchers and academics, and it continues to be so nowadays. The fundamental objective of public policy in the country is to promote sustainable economic growth by trying to keep inflation (INF) at a low level. Nevertheless, in most developing countries, the governance structures are forced to accept public debts to overcome these challenges, even though this growth in public liabilities may lead to inflationary pressures, as the alternative perspective may harm the economy. This issue becomes even more complicated considering the current scenario caused by the Covid-19 pandemic, as well as the circumstances of the ongoing conflict in Europe, where central banks are often forced to choose between price stability and their responsibility as the government's last creditor (Fiedler, Gern, and Stolzenburg 2020). Based on this argument, an essential question is necessarily presented

that has continuously attracted the attention of many researchers to investigate whether public debt causes inflation (Sargent and Wallace 1981).

Therefore, it is worthwhile to note that there is a substantial divergence in the causes of INF from this point. Conferring to proponents of the monetarist hypothesis, INF is a monetary issue, with the premise that a monetary expansion will boost actual output and prices in the short term but would only increase prices eventually (Friedman 1968). Conversely, recent research has shown that inflation is caused not only by monetary characteristics but also by fiscal issues that may arise from the fiscal deficit or public debt (Lin and Chu 2013; Nastansky and Strohe 2015). In addition to the contradiction to the monetarist view that only monetary aggregates drive INF, Kwon *et al.* (2006) argue that the fiscal theory of price levels identifies the wealth effect of public debt as an additional channel of fiscal pressure on inflation. He stresses the significance of fiscal policy in the inflation process, claiming that the money supply alone may not be sufficient to determine the length of the INF. Conferring to scientific findings, public debt can have a neutral impact, which is equivalent to the Ricardian hypothesis. Barro (1989) and Aimola and Odhiambo (2021) have established such an argument.

Considering the relevance of inflation, particularly the rising trend in 2021 and the tremendous predictions for 2022, there is an extra reason to explore the interaction between several macroeconomic determinants, emphasizing public debt and inflation. Because considering the above arguments, there is no agreement on the influence that public debt can have on inflation; therefore, in our research context, it is unquestionably crucial to analyze the following research question (RQ):

RQ1: Does the increase in public debt positively affect the increase in inflation in the case of Kosovo and North Macedonia?

The research to accomplish the stated objective comprises panel data (two groups) from 2008 to 2021, with the combined econometric technique used to resolve the dilemma expressed in the research question. The overarching objective of the research, particularly the econometric results, is to contribute to various areas. First, it extends to the empirical work by employing current data to analyze the link between public debt, macroeconomic factors, and inflation. Second, in terms of novelty and academic contribution, it offers econometric evidence based on panel data using a mixture of OLS Regression and Arrellano-Bover/Blundell-Bond. Third, based on the research, this is the first investigation that deals with this matter, including only these economies.

Finally, by addressing the policy suggestions, the study intends to facilitate these institutions in explicitly understanding the triggers that cause inflation pressures on the one hand and in the redesign of normative acts to prevent the growth of public debt on the other. The research structure is organized as follows: the second part contains a review (background) of the literature, the third part contains the methodology and data, the fourth part contains the results and their discussion, and the fifth part contains the conclusions and policy implications.

THEORETICAL BACKGROUND AND DEVELOPMENT OF HYPOTHESES

The starting point regarding measuring the influence of PD on macroeconomic phenomena, and in our instance, the impact of PD on inflation, is to understand the mechanisms through which the primary macroeconomic factors can be influenced. The government's mechanisms are primarily directed through fiscal policies with the only intention of influencing aggregate demand to accomplish economic objectives, with a specific emphasis on generating price stability, the quality of employment, economic growth, and ensuring low inflation. The monetarist concept dominates from a theoretical standpoint, arguing that inflation is a monetary phenomenon and that its oversight should be solely the responsibility of monetary authorities. The consistency of this assumption is that an expansionary monetary policy will immediately affect the rise in output. Still, it will also influence the overall price increase in the short run, while only the price level will increase in the long term (Friedman 1968).

Nonetheless, it should be emphasized that there are differing perspectives on the interaction of monetary and fiscal policy and its implications for this phenomenon. Based on the Ricardian philosophy, the classical perspective argues that the demand for liquid assets and progressive growth over time determine the path of influencing prices (Javid *et al.* 2008). In a quiet circumstance, fiscal policy is described as a passive policy, with the argument that sovereign bonds are not net assets, and interest rates in cost determination direct the function of monetary policy. Additionally, according to Barro (1989), Ricardian equivalence has established that the budget deficit or public debt has no significant impact on determining the price, concluding that sovereign bonds cannot be classified as net assets. On the other hand, proponents of modern theory explicitly believe that inflation is impacted not only by monetary factors but also by fiscal matters. Throughout the latest period, opponents of the Ricardian philosophy have argued that under an active fiscal system, changes in the quantity of public debt can produce variations or volatility in inflation, even if monetary policy is unrelated (Marzieh 2015). Studies that support a constant positive association between PD and inflation have been conducted by Musgrave (1949), Phelps (1973), continuing Romero and Marin (2017), and Afonso and Ibraimo (2018). Nevertheless, considering these views, our research presents the hypothesis as follows:

Ho: Public debt has a significant positive impact on inflation in the economies of Kosovo and North Macedonia.

EMPIRICAL EVIDENCE

The following section will explicitly explore the research undertaken from the early perspective, emphasizing the applied determinants while establishing a connection between the research question and validating the presented hypothesis. Several authors have conducted studies analyzing economies using various techniques and econometric models, notably a panel of countries, developed economies, and emerging economies. Nevertheless, it is worth mentioning that there is no consistency among the scholars arguing diverse linkages between public debt (PD) and inflation.

Generally, there are opposing views on the consequences of PD on inflation. Karakaplan (2009) empirically tested whether the external PD was less inflationary in countries with sophisticated financial markets and if the implications of inflation drivers differed across countries. The study used unbalanced secondary data via the GMM method on a sample of 121 economies separated into industrialized and non-industrialized countries from 1960 to 2004. Empirical evidence revealed a negative connection between the two categories, with the supplementary argument that economies with established financial markets are less impacted by PD. Reinhart and Rogoff (2010) investigated the correlation between PD and inflation using time series from 1946 to 2009 in a sample of 20 advanced and 24 developing economies. Their observations claim that high PD levels are not statistically associated with inflation in developed countries, but high levels of public debt harm inflation in developing economies. Thahara and Washima (2019) reached the same conclusion that public debt has a significant adverse effect on the Sri Lankan economy by using the Error Correction Model (ECM) and various methodologies to quantify the effect in the short and long run.

On the other hand, numerous studies offer empirical evidence that public debt has a negligible influence on inflation. Janssen, Nolan, and Thomas (2003) investigated how monetary and fiscal policy factors affected price determination in the United Kingdom. The valuation framework (VAR) approaches were employed throughout the different sampling periods to conduct this research, focusing on the interactions between the public debt, the budget deficit, and the price level. The outcomes of this research indicated that public debt is insignificant in predicting the inflationary process in the United Kingdom. Furthermore, Kwon, McFarlane, and Robinson (2009) used a mixed empirical approach through OLS and the VAR to test the relationship between public debt via inflation in 23 advanced economies, 48 developing economies, 9 Asian countries, 6 Middle Eastern countries, and 5 European countries from 1963 to 2004. The research demonstrates no significant association between these two components in advanced economies. However, the relationship between public debt and inflation is solid and consistent in countries with high public debt. Finally, emerging economies have a consistently positive relationship, whereas countries with a high level of public debt have a weaker association. Similarly, the study by Aimola and Odhiambo (2022), using an advanced technique via the autoregressive distributed lag (ARDL) methodology, examined the influence of public debt on inflation in Nigeria from 1983 to 2018. The study's conclusions are consistent with the previous research, which demonstrated that public debt does not influence inflation.

The joint research contends that public debt and inflation positively correlate. The above argument's defenders consist of (Van Bon 2015; Lopes Da Veiga, Ferreira-Lopes, and Sequeira 2015; Romero and Marin 2017; Durguti, Kryeziu, and Gashi 2020; Duarte Urquhart 2021; and Amiola and Odhiambo 2022). To obtain this conclusion, Van Bon (2015) examined 60 economies in the development cycle (22 Asian countries, 11 Latin American countries, and 27 African countries) from 1990 to 2014, demonstrating that public debt positively influenced inflation. Considering this assumption, Lopes Da Veiga *et al.* (2015) examined 52 African economies using the database and technique used by Reinhart and Rogoff (2010). They concluded that a high level of public debt encourages higher inflation. Similarly, Romero and Marin (2017) investigated the link between public debt and inflation using panel data from 52 countries and the VAR approach.

According to this research, the countries with high public debt and continued rises have resulted in inflationary economies. Additionally, the econometric findings of this study reveal that increasing the ratio of public debt to GDP has a considerable beneficial influence on inflation in developing countries. Nevertheless, the influence on industrialized countries was insignificant.

Based on the empirical evidence in the Western Balkans, insufficient research has been performed to examine the degree of association between public debt and inflation. Durguti *et al.* (2020) analyzed the panel economies of the Western Balkans using the vector error correction model (VECM) technique from 2001 to 2017. The study analyzed the variables of the budget deficit, government debt, interest rate, and unemployment. The findings confirm that an increase in public debt strongly influences inflation in the economies studied. The trajectory of public debt, inflation, and the fiscal theory of price level (FTPL) in emerging markets, specifically the economy of Paraguay, was treated by Duarte Urquhart (2021), who studied the association between these two indicators while considering account FTPL, employing quarterly data from 1993 to 2019. The conclusions of this study emphasize the necessity of monetary policy differentiation, where it is stated that active fiscal policy can increase public debt, which causes inflationary pressures.

Finally, Amiola and Odhiambo (2022) discovered an asymmetric interaction between public debt and inflation by employing the nonlinear autoregressive distributed lag (NARDL) method. Those parameters demonstrate a significant positive association in the short term but eventually have a negative relationship. Additionally, this study included other explanatory parameters such as economic growth, private investment, and trade openness. Interest rates play a vital role in monetary policy in all economies; hence, their influence on inflation is included in the research. Fazlollahi and Ebrahimijam (2022) explored the correlation between interest and inflation rates to justify the Canadian government's inflation-targeting policy. Empirical explanations are supported by evidence that interest rates converged in their long-term equilibrium with a constant of 0.031 units of macroeconomic determinants in the Canadian economy. According to this study, there is a positive association between interest rates and inflation. Trade openness and GDP growth are strongly intertwined when studying macroeconomic issues, particularly the occurrence of inflation. Therefore, the authors support the argument that trade openness and GDP growth are stable to inflation (Durguti and Malaj 2022; Afari *et al.* 2021; Aimola and Odhiambo 2021; Roncaglia de Carvalho *et al.* 2018).

## METHODOLOGY AND DATA

Data Sources

This study includes a sample of two countries (Kosovo and North Macedonia) to examine the impact of public debt and other determinants on inflation. The data were mainly extracted from the World Bank database and the International Monetary Fund, including from 2008 to 2021. The selection of these two countries was made based on the availability of the data and the typical specifications they have. The other argument for selecting data as the starting year is 2008, which is that Kosovo has become independent. The applied data are time series firmly

balanced with 24 observation periods, classifying them into two categories: inflation is the dependent variable, while the explanatory variables are public debt, interest rate, trade openness, GDP, and foreign direct investments. The data used are data according to the official format defined and are considered among the most credible data and, as such, used by global researchers. In this context, Table 1 presents the variables with their acronyms and the sources where they are used.

Table 1: Variable Descriptions and Data Sources (Source: Author's selection)

Variable	Denominations	Acronyms	Data Sources
Dependent Variable	Inflation	INF	World Bank Indicators
Explanatory Variables	Public Debt	PD	World Bank Indicators
	Interest Rate	IR	International Monetary Fund
	Trade Openness	TO	World Bank Indicators
	Gross Domestic Product	GDP	World Bank Indicators
	Foreign Direct Investment	FDI	World Bank Indicators

Regarding study variables, specific consideration was given after an examination of the literature in the scientific context, and the formulation and design of the variables were based on the studies conducted by Durguti *et al.* (2021) and Aimola and Odhiambo (2021). The study also contains two unique factors, which add value equally in terms of extending the literature and analyzing their effect on inflation.
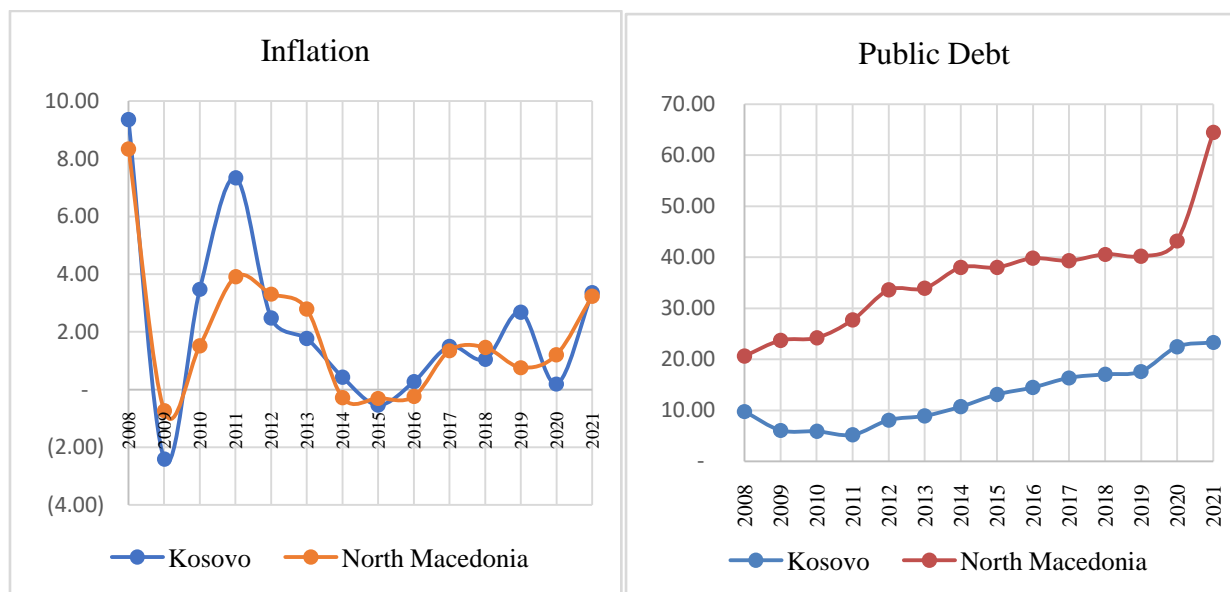
**Graph 1: Inflation and Public Debt Trends during Observation
(Source: Authors' calculations)**

Graph 1 exhibits the pattern of inflation movement throughout the whole study stretch, and it can be seen that in 2011, Kosovo had 7.33 percent inflation compared to North

Macedonia's 3.91 percent. While in other periods, an insignificant difference is observed between these two states. Nevertheless, the metric used to evaluate whether inflation affects inflation varies significantly amongst the studied economies. During the observed period, North Macedonia had almost three times the most extensive public debt compared to Kosovo. It should be underlined that North Macedonia achieved the peak level of public debt in 2021, at 64.43 percent of GDP, which is within the Maastricht agreement's threshold. The part that includes statistical descriptions will thoroughly examine these factors and other applicable factors.

Specifications of the Econometric Model

The study employs the combined OLS and Arrellano-Bover/Blundell-Bond technique to explore the effects of macroeconomic factors (PD, IR, TO, GDP, and FDI) on Kosovo and North Macedonia inflation. Data annually, spanning the period 2008-2021, were employed to calculate their interrelationship. The study modified the model used by Nguyen (2015) and Durguti *et al.* (2021). Thus, through this perspective, the OLS model in this scenario looks like equation 1.

$$INF_{it} = \alpha + \beta_1(PD_{it}) + \beta_2(IR_{it}) + \beta_3(TO_{it}) + \beta_4(GDP_{it}) + \beta_5(FDI_{it}) + \varepsilon_{it} \dots\dots\dots\dots\dots(1)$$

The predictor constraint is represented by, INF_{it} whereas the control variables are, $PD_{it}, IR_{it}, TO_{it}, GDP_{it,}$ and FDI_{it}. The predictive constant is α, and the error term is ε_{it}. The model requires that the constants of the control variables be matched across components (i) and periods (t). In contrast to the basic model, the component of ordinary least square error ε_{it} that is unique to each remark unit, is included in the random error ε_{it} according to the conjunction of time series and comparison statistics. In the following paragraphs, we will present the dynamic GMM equation as a given formula in our concrete scenario and then extend the equivalence in the first difference to identify the effects of determinants on inflation using this approach. Beyond that, we will run the dynamic GMM model as a generalized equation in our concrete scenario and then develop the argument in the first difference to examine the effect of variables on inflation using this method.

$$INF_{it} = +\alpha_{it} + \beta_o(INF_{it-1}) + \beta_1(PD_{it}) + \beta_2(IR_{it}) + \beta_3(TO_{it}) + \beta_4(GDP_{it}) + \beta_5(FDI_{it}) + \mu_i + \varepsilon_{it} \dots\dots\dots\dots\dots(2)$$

$$\Delta INF_{it} = +\alpha_{it} + \beta_o(INF_{it-1}) + \beta_1(PD_{it}) + \beta_2(IR_{it}) + \beta_3(TO_{it}) + \beta_4(GDP_{it}) + \beta_5(FDI_{it}) + \mu_i + \varepsilon_{it} \dots\dots\dots\dots\dots(3)$$

where, μ_i is an unobserved time-invariant, country-specific effect, and ε_{it} is an observation-specific error term.

For the empirical equations (1) and (2), the presence of the lagged dependent factor produces autocorrelation. It can make OLS inconsistency and estimate bias for short-time dimensions (small T) (Judson and Owen 1999). Therefore, we decided to use the Arellano-Bond (1991) difference GMM estimator first proposed by Holtz-Eakin *et al.* (1988). The Arellano-Bond estimator was designed for dynamic "small-T and large-N" panels (Roodman 2006).

In the standard GMM procedure, it is essential to distinguish instrumented parameters and instruments. Endogenous parameters are placed in the group of instrumented variables by lags of these variables (Judson and Owen 1999). Strictly exogenous regressors and extra instruments are placed in the group of instrument variables and included in the standard IV procedure. For exogenous variables, their level and lags are suitable instruments (Judson and Owen 1999) and (Arellano and Bover 1995).

Sargan statistics are used to test the reliability of the instruments in the GMM estimator. The Sargan assessment with null premise H_0: the instrument is entirely exogenous, meaning it has no association with errors. Consequently, the p-value of the Sargan statistic is as high as possible. The Arellano-Bond test is used to determine autocorrelation in the first difference errors. Hence, the screening test of the first autocorrelation of errors, $AR_{(1)}$, is neglected. In contrast, the second autocorrelation of errors, $AR_{(2)}$, is tested on the first difference series of errors to discover the phenomenon of the first autocorrelation of errors.

Descriptive Statistical Analysis

This section presents the empirical evidence of descriptive statistics, which are reported in Table 2. The first metric shown is inflation, which ranges from -2.41 percent to 9.35 percent, indicating the lowest and greatest rates reported in the sample context, while the mean value of inflation for the observed period is 2.04 percent with a standard deviation of 2.69 percent. The mean value of public debt in our scenario is 24.51 percent of the value of GDP, while the minimum reported value is 5.21 percent of GDP, and the maximum is 64.43 percent of GDP, achieved by North Macedonia in 2021. Another variable examined in this research was the interest rate (IR), which has a mean value of 5.92 percent, the lowest value of 3.23 percent, and a highest of 10.67 percent. Kosovo has the highest interest rate in this scenario. The range between the smallest and highest values for the trade openness variable is 74.02 percent, respectively 147.80 percent. At the same time, the mean value is 99.32 percent. During the period under study, the lowest value of economic growth was recorded in Kosovo in 2008 at 6.11 percent. However, the maximum value of economic growth was recorded in Kosovo at 9.12 percent, with a standard deviation of 3.24 percent.

Table 2: Summary of descriptive statistics (Source: Author's calculation)

Variables	INF	PD	IR	TO	GDP	FDI
Minimal	-2.410	5.210	3.228	74.020	-6.110	0.535
Maximal	9.350	64.431	10.670	147.80	9.127	10.401
Mean	2.043	24.513	5.922	99.318	3.235	4.873
Std.Dev	2.698	14.715	2.518	22.255	3.242	2.128
Skewness	1.185	0.635	0.790	0.547	-1.354	0.814
Kurtosis	4.227	2.947	2.133	2.098	5.199	3.705
Obs	24	24	24	24	24	24

The study's last variable is foreign direct investment, with a mean value of 4.87 percent of GDP. The statistics dispersion during the observation period, as shown in Table 2, has no

value considerably greater than zero (0), indicating that the data exhibit a stable symmetrical connection (Bulmer 2003). Kurtosis outcomes, on the other hand, demonstrate positive values because of the correlation of the factors used. According to authors MacGillivray and Balanda (1988), an increase in kurtosis is connected to the movement of the probability measure from the sides of the dispersion to the centers with its axis.

Diagnostic Tests for Multicollinearity

We performed the two most suitable techniques, correlation breakdown and vector inflation factor, to capture if the data had problems with multicollinearity. Table 3 summarizes the empirical evidence of this evaluation. According to the outcomes, inflation positively correlates with interest rates, trade openness, GDP, and FDI. At the same time, there has been proof of an adverse association between inflation and public debt. The observed information proves that inflation has a weak association with all the factors tested except for foreign direct investments. FDI has a constant of 0.552, considered a modest positive association (Pallant 2017).

Table 3: Correlation Analysis and VIF (Source: Author's calculation)

	INF	PD	IR	TO	GDP	FDI
INF	1.0000					
PD	-0.1693	1.0000				
IR	0.2118	-0.7871	1.000			
TO	0.2947	-0.3549	0.3695	1.000		
GDP	0.0263	0.3119	-0.4004	-0.2233	1.000	
FDI	0.5552	-0.4498	0.2730	0.3670	-0.2682	1.000

This evidence also suggests that if the constants between the dependent and independent factors are more than 0.7 (coefficient >0.7), the data do not have a problem with multicollinearity. We used the VIF analysis to reinforce the outcomes of the correlation breakdown, and the outcomes indicate that the mean VIF is 1.45, which is less than the significant value of an estimated α = 0.05.

RESULTS AND DISCUSSION

Combined regression analysis was performed to investigate the relationship between the explanatory and predictor variables. Estimates according to the static OLS approach and the dynamic approach through Arrellano-Bover/Blundell-Bond were used to evaluate the study's hypothesis that public debt has a significant positive impact on inflation. Table 4 presents the results of the research in the context of Kosovo and North Macedonia. Based on the findings, the constant alpha R^2 is 0.4726, indicating that the OLS model explains 47.26% of the variability of inflation, while the remaining part is described by other parameters that are not part of the

research. Adjusted R^2 is 0.2842 or 28.42 percent, which explains the variation of the variables included in the research.

The F statistic value is 2.51 (ρ -value = 0.0002), which is compared to a significant value of 5 percent, which means that the premise of a significant direct association between the predicted and explanatory factors is accepted. To test whether the data have any concern with heteroscedasticity, the Breusch-Pagan test is performed. Based on the empirical evidence, if the p-value is less than α ≤ 0.05, the null hypothesis should be rejected. In the context of our investigation, the results show that ρ ≥ 0.05, respectively = 0.8962, and considering this evidence, we conclude that the data do not have any concern or problem with heteroskedasticity.

The second estimation was carried out using the Arrellano-Bover/Blundell-Bond, and the $AR_{(2)}$ test was applied to analyze if the data had autocorrelation between them. To evaluate the suitability and validity of the instruments in the first difference and serial autocorrelation of residuals, we have performed the Sargan J-test (see the result of Wald $chi2_{(1)}$ = 3.36 with ρ = 0.0067. The Sargan J test was used to examine the over-identification of limitations in a statistical model. Thus, based on the test results, ρ = 0.5054 shows no concern with the reliability of the dynamic estimation according to Arrellano-Bover/Blundell-Bond (Sargan 1958) and (Kitamura 2006).

Table 4: Estimation Results (Source: Author's calculation)

	Model 1		Model 2	
	Coefficient	P>|z|	Coefficient	P>|z|
_constant	0.5875	0.079	1.7027	0.000
PD	0.4911	0.036	0.4325	0.067
IR	0.2242	0.092	0.0208	0.044
TO	0.0784	0.065	0.0442	0.000
GDP	-0.1343	0.297	-0.3557	0.000
FDI	0.2176	0.169	0.1980	0.269
Observation number	24	-"-	24	-"-
Diagnostic tests				
R^2- squared	0.4726	-"-	-"-	-"-
Adj R^2- squared	0.2842	-"-	-"-	-"-
F-test	F(5,14) 2.51	*ρ =0.0002*	-"-	-"-
χ-heteroscedasticity	Chi2 (1)	*ρ =0.8962*	-"-	-"-
Mean VIF	1.45	-"-	-"-	-"-
AR (2) test	-"-	-"-	Wald chi2(1) 3.36	*ρ = 0.0067*
Sargan Ɉ test	-"-	-"-	Chi2 =27.237	*ρ = 0.5054*

Note: Significant at 1, 5, and 10 percent. Model 1 is an OLS, and Model 2 is Arellano-Bover/Blundell-Bond estimation.

The results obtained are summarized in Table 4. Initially, our regression results (in both the OLS and Arellano-Bover/Blundell-Bond techniques) reveal that PD growth has a significant and persistent positive influence on inflation in Kosovo and North Macedonia. The coefficient

for PD is β = 0.4911 with ρ = 0.036 (according to OLS) and β = 0.4325 with ρ = 0.067 (according to Arellano-Bover/Blundell-Bond). This signifies that growth of 1 percent of the PD increases by 0.4911, respectively 0.4325 percentage points of inflation. PD constants were significant at 5% and 10 percent. Our econometric evidence supports (H_o) the stated hypothesis that there is a positive association between PD and inflation. The results follow earlier academic research that has explored the association between PD and inflation and has argued for a confident association between the various methodologies used. Gomez-Gonzalez (2021) empirically investigated the determinants of cross-country heterogeneity between PD and inflation for developed and emerging economies from 1995 to 2017. The study's findings claim a steady positive association between these two variables, with the critical verdict arguing that economies with high inflation substantially impact public debt. Considering these outcomes, Akingbade and Odhiambo (2022) discovered a substantial positive link between PD and inflation using the ARDL bounds testing approach. Additionally, the outcomes of this study suggest a good correlation in both the short- and long-term.

An interest rate (IR) based on the outcomes of β = 0.2242 with ρ = 0.092 according to OLS and β = 0.0208 with ρ = 0.044 according to GMM has resulted in a positive consequence on inflation in the circumstance of Kosovo and North Macedonia with a confidence level of 5 and 10 percent. This signifies that every 1 percent rise in IR directly influences the inflation of 0.22 or 0.02 percentage points. This conclusion contradicts Fisher's hypothesis, which states that the predicted result adversely influences these two variables. The previously observed discoveries by Kandel *et al*. (1996) oppose Fisher's premise, stating that the nominal value of the IR incorporates an associated risk of inflation that is positively linked. Durguti *et al*. (2020) provide similar empirical facts by examining the drivers of inflation in Western Balkan economies using the Vector Error Correction Model (VECM) and unit root tests. The panel's discoveries indicate that the budget deficit, PD, and IR are statistically positive concerning inflation.

An additional determinant included in the study as an explanatory variable is trade openness (TO), which, based on the reliability β coefficients, indicates a more pronounced difference between the models used. The OLS model proved to be significant at the 10 percent confidence level since the p-value is ρ = 0.065, while according to Arellano-Bover/Blundell-Bond, it is statistically significant at the 1 percent confidence level since the p-value is ρ = 0.000. These findings mean that each increase in TO by 1 percent affects an increase of 0.07, respectively 0.04 percentage points inflation. At this point, there is a substantial difference between the studies in which the various conclusions are discussed, and it is important to keep in mind that the author Romer (1993) proposed the hypothesis that economies with a high level of TO have lower inflationary pressures. Our conclusions reject this premise, arguing that there is a positive link involving TO and inflation in our observed scenario.

Additionally, Ahmad *et al*. (2012) evaluated the (Romer 1993) hypothesis by examining developed and developing economies. Their results support a positive association between TO and inflation, which is consistent with our findings. Afari *et al*. (2021) reported a positive association between TO and inflation after researching 25 Sub-Saharan African countries. Furthermore, recent research employing panel data for Southern and Western European countries performed by Durguti and Malaj (2022) reveals a positive association between them.

The final determinant that has had a substantial influence on inflation is economic progress, measured by GDP growth. Thus, according to Arellano-Bover/Blundell-Bond, the coefficient is β = -0.3557, with ρ = 0.000. Our findings reveal that the GDP growth coefficient has an adverse sign and is statically important at the 1% reliability interval. Based on this, we infer that GDP growth in our scenario (for the countries of Kosovo and North Macedonia) harms inflation. These observations agree with the predictions of Aimola and Odhiambo (2021), who identified a negative association between these categories. Roncaglia de Carvalho *et al*. (2018) obtained the same finding after using the feasible-GLS technique to explore the link between economic development and inflation in 65 undeveloped countries. The study demonstrates a slight adverse correlation relating economic development and inflation.

CONCLUSION

The overall aim of this study was to explore the link between public debt and inflation, and the findings revealed a significant positive association between them. The data used is a panel of two countries from 2008 to 2021. Although several studies have been conducted on the relationship between public debt and inflation, very few studies have been conducted on the economy of Kosovo or North Macedonia. Therefore, this study brings added value both in the theoretical and empirical aspects, especially for the countries included in the analysis. The research's novelty and significance stem from selecting a critical macroeconomic issue. However, the emphasis is on public debt and inflation, a concern for every government worldwide. We discovered that public debt, interest rate, trade openness, and GDP had a significant influence on inflation using panel data for two economies using the combined OLS and Arellano-Bover/Blundell-Bond technique. Meanwhile, foreign direct investments have shown insignificant results.

The study performed diagnostic tests on data distribution, heteroskedasticity, multicollinearity, AR (2) for autocorrelation, and the Sergan J-test for the feasibility of the GMM technique before performing the regression analysis. During the empirical analysis of public debt for the analyzed period, statistical data disclosed that Kosovo has a low rate of public debt. Still, in the last two years, a significant increase has been observed, reflecting a completely different picture compared to North Macedonia, which in 2021 reached the highest rate and that of 64.43 of GDP. Furthermore, the study sheds light on the complexities of inflationary incentives in the economies under consideration. Its importance can be conceptualized from two perspectives. First is the empirical literature on the determinants that affect inflation, which recently has been surprisingly ignored by almost all structures, beginning with researchers, academics, and policymakers. Second, the governing structures' misunderstanding of empirical evidence has been repeatedly highlighted, with underdeveloped countries seeing the most extensive inflation levels compared with sophisticated economies.

Finally, it is worth mentioning that the research is not only an examination of the link between public debt and inflation. As such, it cannot be considered unique for all economies but may be applied to economies with similar characteristics. Without a doubt, multiple techniques and methodologies can be used in this discipline, and they can be improved, strengthened, or even challenged by incorporating additional, more particular factors. Given the complexity of

the research, for future research, curiosity is added to the expansion of time series, states to be included in the analysis, other more specific drivers, and their evaluation in the short- and long-term aspects.

Implications

In terms of policy outlook, the governments of the respective economies must perform harmonized monetary and fiscal policies to adapt to the legislative aspects of emerging economies. Research may significantly improve policy-making frameworks through reforming macroeconomic guidelines, particularly monetary policies that supervise the macro-fiscal system and related segments. This signifies that the administration shall run the economy constructed on inflation directing (focused on a certain level of inflation), and public debt should be maintained at a certain level to build sustainable economic progress and avoid a public debt crisis in the future.

COMPLIANCE WITH ETHICAL STANDARDS

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REFERENCES

1. Afari, F.O., Son, J.C. & Haligah, H.Y. (2021). Empirical analysis of the relationship between openness and inflation: a case study of sub-Saharan Africa. *SN Business & Economics*. 1, 72. https://doi.org/10.1007/s43546-021-00081-6

2. Afonso, António and Ibraimo, Yasfir, (2018). The Macroeconomic Effects of Public Debt: An Empirical Analysis of Mozambique. *REM Working Paper 029-2018*, Available at SSRN: https://ssrn.com/abstract=3128469

3. Ahmad Jafari Samimi, Saman Ghaderi, Ramezan Hosseinzadeh, and Younes Nademi,. (2012). Openness and inflation: New empirical panel data evidence, *Economics Letters*, Volume 117, Issue 3, https://doi.org/10.1016/j.econlet.2012.07.028

4. Aimola Akingbade U. & Odhiambo Nicholas M. (2021). Public debt and inflation nexus in Nigeria: An ARDL bounds test approach, *Cogent Economics & Finance*, 9:1, https://doi.org/10.1080/23322039.2021.1921905

5. Aimola Akingbade U. & Odhiambo Nicholas M. (2022). Is the effect of public debt on inflation symmetric or asymmetric? Evidence from the Gambia. *Croatian Review of Economic, Business and Social Statistics*, 8 (1), 41-57. https://doi.org/10.2478/crebss-2022-0004

6. Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2), 277–297. https://doi.org/10.2307/2297968

7. Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error components models. *Journal of Econometrics*, 68(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

8. Barro, R. J. (1989). The Ricardian Approach to Budget Deficits. *Journal of Economic Perspectives*, 3(2), 37–54. https://doi.org/10.1257/jep.3.2.37

9. Bulmer, M.G. (2003). Principles of Statistics. *Dover Publications Inc*. (17 March 2003). New York, United States. New Edition. ISBN13 9780486637600.

10. Duarte Urquhart, Magaly. (2021). Public debt, inflation, and the Fiscal Theory of Price Level in emerging markets: the case of Paraguay, *Macroeconomics, and Finance in Emerging Market Economies*, 15, pp. 1-28. https://doi.org/10.1080/17520843.2021.1927128

11. Durguti Esat, Tmava Qazim, Demiri-Kunoviku Filloreta & Krasniqi Enver. (2021). Panel estimating effects of macroeconomic determinants on inflation: Evidence of Western Balkan, *Cogent Economics & Finance*, 9:1, https://doi.org/10.1080/23322039.2021.1942601

12. Durguti, E and Malaj, A. (2022). A Dynamic Panel Gravity Model Application on Trade Openness Determinants: Evidence from Southern and Western European Countries. *Journal of Global Business and Technology*. Volume 18, (22). https://gbata.org/journal-of-global-business-and-technology-jgbat/publications/

13. Durguti, E. A., Kryeziu, N., and Gashi, E. (2020). How Does the Budget Deficit Affect Inflation Rate – Evidence from Western Balkans Countries. *IJFBS* (2147-4486), 9(1), 01–10. https://doi.org/10.20525/ijfbs.v9i1.526

14. Fazlollahi, N., Ebrahimijam, S. (2022). The Relationship Between Interest Rates and Inflation: Time Series Evidence from Canada. *New Dynamics in Banking and Finance. Springer Proceedings in Business and Economics*. https://doi.org/10.1007/978-3-030-93725-6_11

15. Fiedler, S., K.J. Gern, and U. Stolzenburg. (2020). Blurred boundaries between monetary and fiscal policy. Briefing paper requested by the European Parliament's Committee on Economic and Monetary Affairs. Accessed: (13.07.2022): https://www.europarl.europa.eu/committees/en/econ/econ-policies/monetary-dialogue

16. Friedman, M. (1968). Dollars and deficits: Inflation, Monetary Policy and the Balance of Payments. *Prentice Hall, International*.

17. Gomez-Gonzalez, P. (2021). Drivers of inflation-linked public debt: an empirical investigation. *International Economics and Economic Policy*. 18, 223–244. https://doi.org/10.1007/s10368-020-00485-z

18. Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, 56(6), 1371–1395. https://doi.org/10.2307/1913103

19. Janssen, N., Nolan, C., Thomas, R. (2003). Money, Debt and Prices in the United Kingdom, 1705–1996. *Economica*, 69 (275), 461–479. https://doi.org/10.1111/1468-0335.00294

20. Javid, A. Y., Arif, U., and Sattar, A. (2008). Testing the Fiscal Theory of Price Level in the Case of Pakistan. *The Pakistan Development Review*, 47(4), 763–778. http://www.jstor.org/stable/41261252

21. Judson, R.A. and Owen, A.L. (1999). Estimating Dynamic Panel Data Models: A Guide for Macroeconomists. *Economics Letters*, 65, 9-15. https://doi.org/10.1016/S0165-1765(99)00130-5

22. Kandel, S., Ofer, A. R., & Sarig, O. (1996). Real Interest Rates and Inflation: An Ex-Ante Empirical Analysis. *The Journal of Finance*, 51(1), 205–225. https://doi.org/10.2307/2329307

23. Karakaplan, M. U. (2009). THE CONDITIONAL EFFECTS OF EXTERNAL DEBT ON INFLATION. *Sosyal Ekonomik Araştırmalar Dergisi*, 9 (17), 203-217. Retrieved from https://dergipark.org.tr/en/pub/susead/issue/28418/302586

24. Kitamura, Yuichi (2006). "Specification Tests with Instrumental Variable and Rank Deficiency". Econometric Theory and Practice: *Frontiers of Analysis and Applied Research*. New York: Cambridge University Press. pp. 59–124. ISBN 0-521-80723-9.

25. Kwon, G., L. McFarlane, and W. Robinson. (2009). Public debt, money supply, and inflation: A cross-country study. *IMF Staff Papers* 56, no. 3: 476–515. https://doi.org/10.1057/imfsp.2008.26

26. Kwon, G., McFarlane, L., & Robinson, W. (2006). Public Debt, Money Supply, and Inflation: A Cross-Country Study and its Application to Jamaica. *International Monetary Fund Working Paper*, WP/06/121.

27. Lin, H. Y., & Chu, H. P. (2013). Are Fiscal Deficits Inflationary? *Journal of International Money and Finance*, 32(c), 214–233. https://doi.org/10.1016/j. jimonfin.2012.04.006

28. Lopes da Veiga, J., Ferreira-Lopes, A., Sequeira, T. (2016). Public Debt, Economic Growth, and Inflation in African Economies. *South African Journal of Economics*, 84 (2), 294–322. https://doi.org/10.1111/saje.12104

29. MacGillivray H.L, and Balanda K.P. (1988). The Relationship Between Skewness and Kurtosis. *Australian Journal of Statistics*. 30 (3), 319-337. https://doi.org/10.1111/j.1467-842X.1988.tb00626.x

30. Marzieh, A. (2015). Monetary and Fiscal Policy Interactions: National and International Empirical Evidence. Ph.D. *Thesis. University of Glasgow Digital Repository*. Accessed 15 July 2022. https://theses.gla.ac.uk/6796/

31. Musgrave, R. A. (1949). Debt Management and Inflation. *The Review of Economics and Statistics*, 31(1), 25–29. https://doi.org/10.2307/1927190

32. Nastansky, A., & Strohe, H.G. (2015). Public Debt, Money and Consumer Prices: a Vector Error Correction Model for Germany. *Econometrics*. 1(47). https://www.dbc.wroc.pl/dlibra/publication/32216/edition/28970/content

33. Nguyen Van Bon, (2015). The Relationship Between Public Debt and Inflation in Developing Countries: Empirical Evidence Based on Difference Panel GMM, *Asian Journal of Empirical Research, Asian Economic and Social Society*, vol. 5(9), pages 128-142.

34. Pallant, J. (2017). SPSS priručnik za preživljavanje. Beograd: Mikro knjiga.

35. Phelps, E. S. (1973). Inflation in the Theory of Public Finance. *The Scandinavian Journal of Economics.* 75 (1): 67–82.

36. Reinhart, C.M., Rogoff, K.S. (2010). Growth in a Time of Debt. *American Economic Review*, *American Economic Association*, 100 (2), 573–578. https://doi.org/10.1257/aer.100.2.573

37. Romer David, (1993). Openness and Inflation: Theory and Evidence, *The Quarterly Journal of Economics*, Volume 108, Issue 4, November 1993, Pages 869–903, https://doi.org/10.2307/2118453

38. Romero, J,P,B and Marín, K.L. (2017). Inflation and Public Debt, *Monetaria, Centro de Estudios Monetarios Latinoamericanos*, CEMLA, vol. 0(1), pages 39-94.

39. Roncaglia de Carvalho André, Ribeiro Rafael S. M. & Marques André M. (2018). Economic development and inflation: a theoretical and empirical analysis, *International Review of Applied Economics*, 32:4, 546-565, https://doi.org/10.1080/02692171.2017.1351531

40. Roodman, D. (2009). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *The Stata Journal*, 9 (1), 86–136. https://doi.org/10.1177/1536867X0900900106

41. Sargan, J. D. (1958). The Estimation of Economic Relationships Using Instrumental Variables. *Econometrica*, 26(3), 393–415. https://doi.org/10.2307/1907619

42. Sargent, T.J., and N. Wallace. (1981). Some unpleasant monetarist arithmetic. *Federal Reserve Bank of Minneapolis Quarterly Review*. 5, no. 3: 1–17.

43. Thahara, A. F., and Washima, M. N. F. (2019). The impact of public debt on inflation: a case study of Sri Lanka, *E-Repository - South Eastern University of Sri Lanka*, ISBN: 978-955-627-189-8, pp.1192–1196. http://ir.lib.seu.ac.lk/handle/123456789/4073

44. Van Bon, Nguyen. (2015). Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia, Journal of Economics, Finance and Administrative Science, Vol. 20, Iss. 38, pp. 49-53, https://doi.org/10.1016/j.jefas.2015.01.002