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Economics of corruption: The demand side case of Western Balkan countries

Edmira Cakrani[1*]
Gjergji Shqau[2]
Dimitrios Alexios Karras[3]

[1]*Canadian Institute of Technology, Xhanfize Keko Street 12, Tirana 1004, Albania.*
Email: edmira.cakrani@cit.edu.al
[2]*University "Aleksander Xhuvani" of Elbasan, Ismail Zyma Street, Elbasan 3000, Albania.*
Email: Gjergji.Shqau@uniel.edu.al
[3]*Epoka University, Autostrada Tiranë-Rinas, km. 12, Tirana 1000, Albania.*
Email: dkarras@epoka.edu.al

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(Corresponding Author)*

Abstract

The purpose of this article is to identify some macroeconomic and institutional factors that lead to the demand for corruption in the Western Balkans. Corruption is a very negative phenomenon that distorts markets and harms economic growth. Corruption has its side of supply and demand. Both the supply and demand for corruption are influenced by many factors. Among the different indexes, the Corruption Perception Index and Control of Corruption Index are used in this paper as measures of corruption. To analyze factors that affect the demand for corruption, two econometric models are constructed, where independent variables are real income per capita, inequality gap, unemployment rate, rule of law, and government efficiency. A panel model with data for the period 2012-2022 is used to identify the most important variables affecting corruption in the Western Balkans. The results show that the index used to measure corruption affects the statistical significance of the variables, with the inequality gap and rule of law being significant in both models. The identification of factors can help the governments of these countries design policies and adopt strategies that will reduce the involvement of people in corrupt practices. There are a limited number of papers that have analysed the causes of corruption in the Western Balkans, and this paper will add value to the existing literature on this very important topic.

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1. Introduction

Not only that, corruption cannot be measured directly, but there is not even a single definition for it in the literature. This negative phenomenon has been defined in different ways by different researchers. One of the earliest definitions belongs to Leff (1964) who defines corruption as a practice that people or organizations use to exercise control over public administration decisions. In the same line is the definition given by Huntington (1968) which suggests that corruption can be perceived as a pattern of behavior that deviates from the social norms of society with the aim of achieving personal benefits. In one of the first studies that the World Bank has done on corruption, this institution defines it as abuse of office by civil servants. The goal remains the same: personal gains (World Bank, 1997). This definition only considers corruption in the public sector, underestimating its existence in the private sector. Transparency International offers a more comprehensive definition of corruption as the abuse of authority for personal benefit.

Despite various definitions, it is widely accepted that corruption implies the use of authority for private gain. Researchers have been studying corruption for years. This is because it is widely accepted that corruption has negative effects on the economy. Corruption distorts markets and weakens the role of the government as a market regulator and guarantor of rights. If government regulation can be overcome through corruption, or if property rights become a "market commodity" by the public servant, then markets can fail, investments, especially foreign ones, will fall (Wei, 1997) and there will be negative effects on economic growth (Mauro, 1995). On the other hand, corrupt payments increase business costs (Svensson, 2005) and increase the burden, especially on the poor, who must pay to receive services or to have their rights respected, thus leading to a further deterioration of their economic situation. In addition to the negative impact on the economy, corruption also has a negative impact on democracy. Corruption compromises the effects of government policies as well as undermines public confidence in democratic institutions. It is considered an important indicator of the performance of a political system (Anderson & Tverdova, 2003).

But what is considered corrupt behavior? According to the United Nations Convention Against Corruption UNCAC[1], the most common actions that are considered corrupt are: bribery, embezzlement, and trading in influence.

- Bribery in the public and private sectors, whether briber-initiated or bribe-initiated, is the amount given in a corrupt relationship. The goal is to facilitate arrangements and get things done with less effort. Bribes are usually considered grease money because they enable the bureaucratic apparatus of the state to move faster. This is the case when individuals or businesses evade taxes, when they do not comply with legal restrictions, etc.
- Embezzlement is the theft and misuse of public funds by public officials. However, the private sector also suffers from this form of corruption.
- Trading in influence occurs when a public official is promised or offered a reward in order to exert his influence in the public administration to create advantages for the interested party. This also means access to take advantage of public resources.

The effectiveness of the fight against corruption depends on a number of factors of economic, social, and political nature. The article's goal is to pinpoint several institutional and macroeconomic elements that affect the desire for corrupt behavior. The second section presents different definitions of corruption and the factors that generally affect it in a country. The third section is dedicated to the literature review. The fourth section provides an analysis of the level of corruption and some macroeconomic factors in the Western Balkans, and the analysis of the econometric models, which serve to identify factors that affect the demand for corruption in these countries. The article concludes with recommendations for improving the situation.

2. Corruption: Definition and Determinants

Corruption is not a variable that can be measured directly in the economy. By its very nature, it is not possible to have accurate measurements of it. For this reason, different indexes try to measure the perception of individuals about the degree of corruption in a country. These indexes are built on the basis of questionnaires. Among the various indexes, some that can be mentioned are:

- The International Country Risk Guide (ICRG) Index, which is constructed to measure the likelihood that officials of all levels of public administration will be involved in corrupt practices. Corruption is evidenced when high-ranking officials demand special payments in search of favors, while low-ranking officials demand bribes in exchange for granting special licenses for the exercise of commercial activities, for avoiding tax obligations, for special protection from the police, etc. To construct the ICRG index, 3 sub-indexes are first calculated: the Financial and Economic Risk Indexes, which are evaluated with a maximum of 50 points each, and the Political Risk Index, for which the evaluation can be up to 100 points. The ICRG index is constructed as a weighted average of these 3 sub-indexes. The index takes values from 0 to 100, where values close to 100 mean a low risk of corruption, while values below 50 mean a high risk of corruption.
- The Global Competitiveness Report Corruption Index (GCRCI) aims to give an assessment of corruption by conducting a survey with business managers or experts. The goal is to measure how much the business sector is involved in corrupt practices. Using the Likert scale from 1 to 7, managers assess corruption, considering how many payments or bribes they have made to ensure benefits for their businesses, special licenses, tax avoidance, favorable court decisions, etc. The average evaluation of the managers gives the value of the corruption index for a country, where the value 1 suggests frequent corrupt payments, while the value 7 means no corrupt payments.
- Business International Index is another measure of corruption, from the point of view of business. The index measures the extent to which companies are involved in corrupt practices and bribe payments. The

[1] https://www.unodc.org/documents/brussels/UN_Convention_Against_Corruption.pdf

assessment of corruption is done with points, in the range of 0 to 10. The higher the value, the less widespread corruption is perceived in a country.

- The Corruption Perception Index (CPI) ranks countries by their perceived level of public sector corruption. Data from 13 different datasets is used to calculate the index. For each country, at least three assessments are made with different data in order to calculate the index. The Corruption Perception Index reflects the corruption perceptions of businesspeople and business analysts. Even though there is corruption in the private sector as well, the CPI measures the perception of corruption only in the public sector. Countries are ranked on a scale from 0 (very corrupt) to 100 (very clean).
- The Control of Corruption (CC) measures perceptions of the degree to which public power is used for private benefit, including both small-scale and large-scale corruption, as well as the "capture" of the state by elites and special interests. According to the World Bank definition, corruption is a failure of governance because it frequently results from a lack of respect for the laws that regulate the interactions between the corrupted (usually a public official or politician) and the corrupter (usually a private citizen or firm) (Kaufmann, Kraay, & Mastruzzi, 2010). The values of the index vary from -2.5 to 2.5, where the lowest values indicate a perception of high corruption, while high positive values indicate a perception of low corruption.

Regardless of what index they have used, various researchers have tried to identify the factors that affect the level of corruption in a country. Researchers have identified several factors that directly or indirectly affect it. Among many factors, Kaufmann et al. (2010) identified the following as direct factors:

- Regulations and authorizations: the need to obtain a license or permit to conduct business activity gives the civil servant a kind of monopoly power. These clerks can put pressure on those interested, with the goal of getting bribes for themselves.
- Taxation: when the tax laws are not clear or when the civil servant has discretion over important decisions (the provision of tax incentives, selection of audits, etc.) the possibility for the official to be involved in a corrupted practice increases.
- Spending decisions: investment projects and procurement spending are decisions that government officials often use to secure benefits for themselves. Public projects are often used to favor certain parties in exchange for bribes.

As indirect factors, among others (Tanzi, 1998) identified:

- Quality of the bureaucracy: corrupt acts are committed mainly by public officials. If these officials are not hired and promoted on the basis of merit, that will result in a higher level of corruption in the country (Rauch & Evans, 2000). Employment for political reasons, nepotism, and unclear rules of employment or promotion result in corrupt behavior by the public servant.
- Level of public sector wages: low public sector wages can encourage employees to engage in corrupt acts (Van Rijckeghem & Weder, 2001).
- Penalty systems: the lighter the penalties, the more widespread the corruption.

3. Literature Review

Chaudhry and Shabbir (2007) in a study of 41 developing countries, analyze the determinants of corruption, dividing them into two groups of factors: economic and non-economic. As a measure of corruption, the authors use the CPI. Cross-sectional analysis, with data for 2006, shows that among the economic factors, the level of income and globalization, economic freedom, and the level of education result in influencing the level of corruption, while the distribution of income does not result in this impact. The study reaches the conclusion that non-economic factors, such as freedom of the press, religion, and democracy, have no influence on the level of corruption in these countries. Using panel data analysis for the period 2004-2010 for several developing countries, Gani (2017) concludes that foreign direct investments, the export of natural resources, and the level of economic development are among the most important factors that influence corruption in these countries. The study also suggests that other factors, such as country size, state of democracy, and colonial legacy, have an impact on the perception of corruption in developing countries.

Ghaniy and Hastiadi (2017) in a study for 92 countries, with data for 2014, suggest that different economic, political, and social factors, such as the level of economic development, political stability, religion, level of education, state of democracy, and economic freedom, have an impact on the perception of corruption in these countries, although the magnitude of this impact differs between developing and developed countries.

Using a panel data model, with data for the period 1996-2019 for the Visegrad countries, Linhartová and Halásková (2022) suggest that different economic and political factors affect the perception of corruption in these countries, such as: level of economic development, degree of globalization, government consumption, degree of urbanization, share of women in the labor force, regulatory quality, and income inequality.

Using the CPI as a measure of corruption, and data for the period 2003-2021, Karasaç and Halil (2022) use a panel data model to identify the determinants of corruption in Developing-Eight (D-8) countries. The authors suggest that human development index, economic freedom, and taxes as % of Gross Domestic Product (GDP) have an important impact on the corruption index, while government spending, GDP, and inflation are

statistically insignificant. In the literature, there are some studies that analyze the impact of corruption on the economy of the Western Balkan countries, but there are relatively few studies that identify the factors that affect the demand for it. These studies suggest several individual factors, mainly demographic, that determine corruption in the Western Balkans. In a study for Albania, Çera and Sinamati (2017) using data from a questionnaire conducted in the period January-February 2016, using cross-sectional data, where the level of corruption was measured on a scale from 1 to 10, reached the conclusion that the level of income, area of living, and political orientation, all have an impact on corruption, while gender, age, capital, and previous experience with corruption do not appear to have an impact on corruption. With data from the National Survey of Citizens' Perceptions in Bosnia-Herzegovina, Mangafić and Veselinović (2020) use a logistic regression to analyze the likelihood that people engage in corrupt behavior, offering bribes to employees in the medical, judicial, police, public service, and education sectors. The study's findings indicate that those who are well-educated, reside in cities, and have high incomes are more likely to offer bribes. The study also shows that the impact of these factors is different in different sectors.

This work will complement the existing literature on this topic, identifying some macroeconomic and institutional factors that influence the demand for corruption in the Western Balkan countries. Another contribution of this article is the methodology used: panel data has more information, allows for more variability, and provides more robust estimates than the cross-sectional method.

4. Empirical Analysis

4.1. Model Specification

Various researchers have tried to analyze the factors that motivate people to engage in corrupt practices. These factors are of an economic, social, and political nature, as well as cultural factors. The purpose of this research paper is to identify the factors that can affect the level of corruption in the Western Balkan countries. Two models will be constructed for this purpose. In the first model, the Control of Corruption index will be used as a measure of corruption, while in the second model, the Corruption Perception Index will be used. Independent variables in both models will be real income per capita, unemployment rate, government efficiency, rule of law, and inequality gap:

$$CC/CPI = f(RGDPC, UNEMPL, GE, RL, IG) \quad (1)$$

Where:

- CC represents the Control of Corruption index. Data is taken from the World Bank database[2].
- CPI represents the Corruption Perception index. Data is taken from the Transparency International Database[3].
- Real GDP per capita, or RGDPc, measures a country's economic development and is expressed as PPP (constant 2017 international dollars). Previous research has suggested a negative relationship between RGDPc and corruption index (Bai, Jayachandran, Malesky, & Olken, 2013) which means that a higher level of economic development will be associated with an improvement inthe corruption index's score. A higher level of income will reduce people's motivation to engage in corrupt acts. Data for this variable is taken from the World Bank database.
- UNEMPL measures a country's unemployment rate. According to Bouzid (2016) there is a positive correlation between unemployment and corruption, meaning that higher unemployment rates are associated with a higher likelihood of corruption acts (a fall in the corruption index). Data for this variable is taken from the World Bank database.
- Government Efficiency (GE) variable tries to capture perceptions of the public about the effectiveness of government policies to adopt appropriate measures to combat corruption, about the involvement of the public administration in corrupt acts, and the degree of autonomy from political influence. This variable takes values in the interval -2.5 to + 2.5. The smaller the value, the less efficient the government is perceived to be, while high values indicate good governance performance. Data for this variable is taken from the World Bank database.
- RL represents the rule of law, the degree to which agents adhere to and trust societal norms, particularly regarding the police, judicial system, property rights, and contract enforcement, as well as the likelihood of crime and violence. This variable has values between -2.5 and 2.5; low values indicate poor governance performance, while high values indicate great governance performance. Data for this variable is taken from the World Bank database.
- IG stands for the gap in inequality. In order to maintain and expand their status, privileges, and interests, the wealthy are probably more inclined to participate in bribery and fraud, and at higher degrees of inequality, the impoverished are more susceptible to extortion (You & Sanjeev, 2005). Data for this variable shows the pre-tax national income that goes to the bottom 50% of the adult population. Data is

[2] https://data.worldbank.org/
[3] https://www.transparency.org/en

taken from the World Inequality Database[4] for the years 2013-2021. Data for the 2022 is not available, so for this year, the average of the two previous years is used as an estimate.

First, the data is tested through Pooled regression. This model suggests that all countries have the same characteristics and analyses panel data as time-series data:

$$Y_t = \beta_0 + \beta_1 X_{1,t} + \beta_2 X_{2,t} + \cdots + v_t (2)$$

The model results with a single intercept and coefficients for all countries, ignoring heterogeneity. However, since the study includes different countries, there is the possibility of heterogeneity, which captures specific characteristics of different countries. In pooled regression, these characteristics are included in the error term, which may be correlated with one or several of the independent variables:

$$COV(X_t v_t) \neq 0 (3)$$

The Pooled model can result in coefficients that are not Best Linear Unbiased Estimators (BLUE), i.e. biased and inconsistent. Therefore, in the second stage, the data will be tested through the Fixed effect and Random effect models, which consider the existence of unobserved heterogeneity. The Fixed Effect model allows for different intercepts for each country, although these intercepts are time-invariant:

$$Y_{it} = \beta_{0i} + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + \theta_i + \varepsilon_{it} (4)$$

Where:

β_{0i} shows the intercepts of the equations in each country; θ_i is a country-dependent error term, which is time-invariant, but different for different countries.

The Random Effect model includes heterogeneity in the error term, unlike the fixed effect model, which includes it in the intercept:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + \vartheta_{it} (5)$$

Where:

β_0 is the average value of all intercepts of the Fixed Effects model.

ϑ_{it} is the error term, which is composed of two components: country-specific error term and idiosyncratic error term, which shows the effect of unobserved variables.

To determine which model between Pooled regression and Fixed Effects is more appropriate, the Likelihood ratio test is used. If p-value < 0.05 then the Fixed Effects in more appropriate than Pooled model. To choose between Fixed Effects and Random Effects, we use the Hausman test. If p-value < 0.05 then random effects may be correlated with the independent variables, therefore the Fixed Effect model is more appropriate.

This study covers the period 2012-2022, and data is processed with the statistical package EViews 12.

4.2. Variables Analysis 2012-2022

Figure 1 shows the Control of Corruption Index values for the Western Balkan countries for the period 2012-2022. During these years, regardless of what index is used to measure corruption, the Western Balkans are positioned in the group of countries with a high level of corruption. The corruption control index is negative for all countries, indicating a ranking below their average level. The best performance is that of Montenegro, which has values very close to 0.In 2018, there was a positive assessment of corruption control in Montenegro. During the period under study, the index has improved in Albania and Kosovo, while in Bosnia and Herzegovina, North Macedonia, and Serbia, deterioration has been observed.

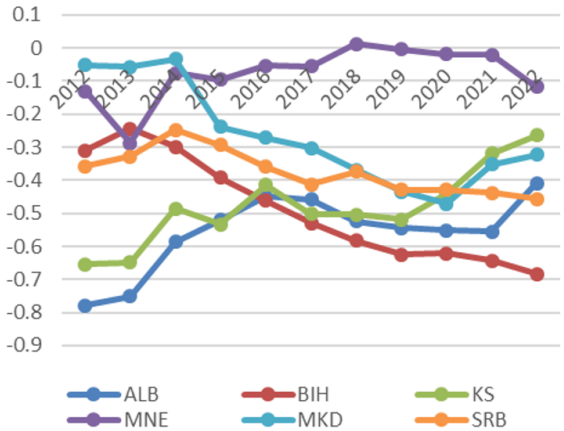

Figure 1. Control of corruption index WB, 2012-2022.

[4] https://wid.world/data/

As it is shown in Figure 2, if the CPI is used as a measure for corruption, all countries, except for Montenegro, have a low estimate of between 30-40 points for the entire period, showing no strong improvement in the indicator. Montenegro has an assessment of over 40 points throughout the entire period, an assessment that has always been increasing, reaching 46 points in 2021 and with an average assessment of around 45 for the entire period. The country with the lowest rating is Albania, which is rated between 31 and 39 points with an average rating of around 35 for the entire period, followed by Kosovo with an average rating of 36 points.

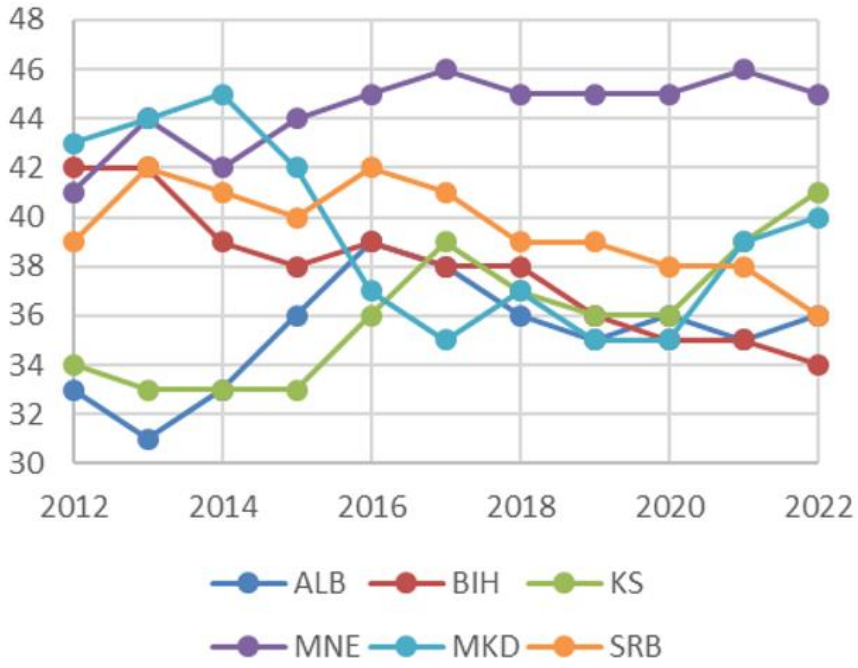

Figure 2. Corruption perception index WB, 2012-2022.

Figure 3 shows the level of GDP per capita in the Western Balkans, which has been constantly increasing. At the beginning of the period, the per capita income was between about $8,100 (Kosovo) and $16,800 (Montenegro). In the following years, the growth of GDP per capita has been stable, except for 2020, where GDP per capita has decreased in all countries, due to the pandemic. In 2022, GDP per capita increased, and the level exceeded that of the period before the pandemic.

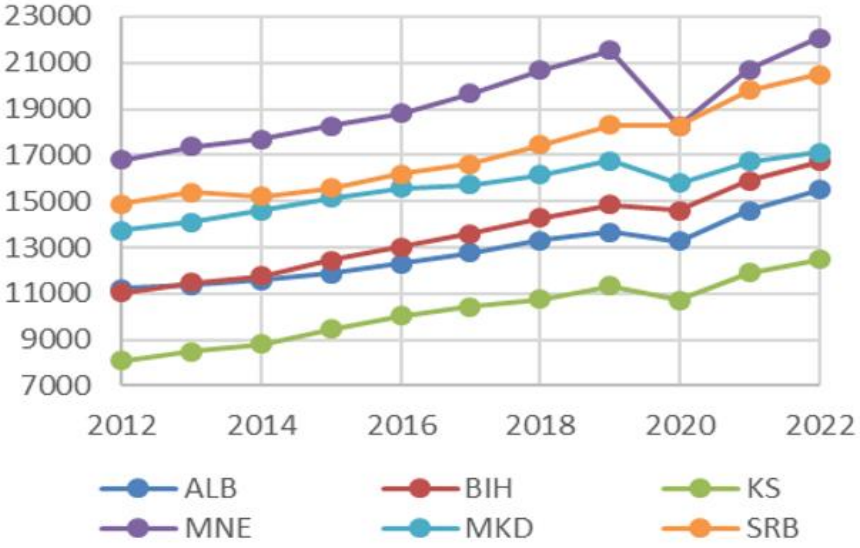

Figure 3. Real GDP/c in WB, 2012-2022.

Although GDP per capita has increased in allthe Western Balkans, the distribution of income has not been fair. Figure 4 shows the inequality gap between different groups of societies in these countries. Serbia is the country with the highest inequality, where, for the entire period, only about 15% of the income goes to the

bottom 50% of the population. The country with the best performance is North Macedonia, where on average, about 20% of the income goes to the bottom 50% of the population.

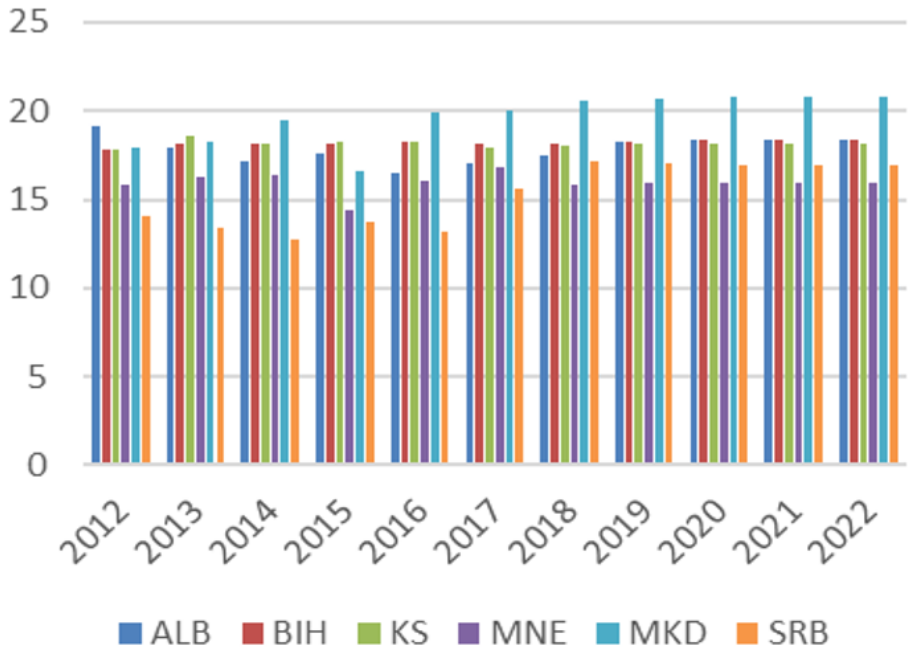

Figure 4. Inequality gap in WB, 2012-2022.

Regarding the level of unemployment, which is shown in Figure 5, during the period under study, unemployment has been consistently above the level of 9% for all countries, although the level has been in continuous decline. Albania and Serbia have the best performance, where the average unemployment rate for the entire period is around 14%, while in Bosnia & Herzegovina, and North Macedonia the average is around 22%. The worst-performing country is Kosovo, with an average unemployment rate of 27.5%.

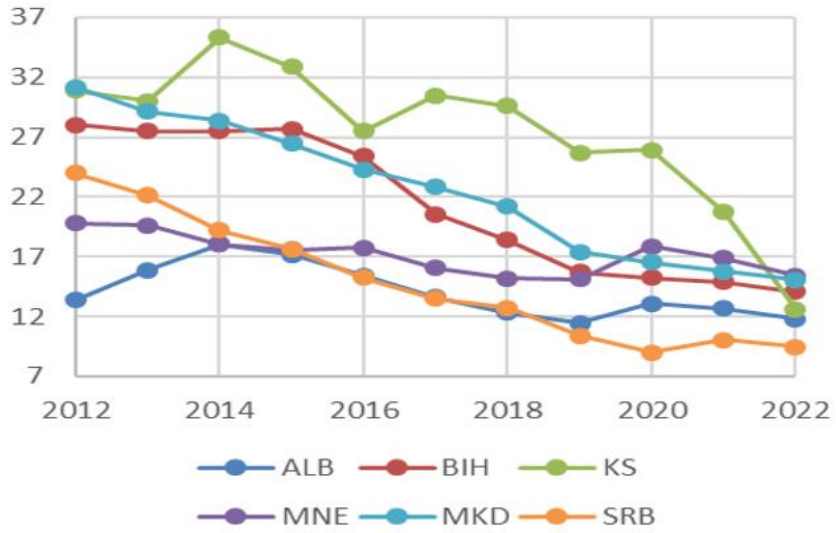

Figure 5. Unemployment rate in WB, 2012-2022.

4.3. Model Analysis

First, we analyse the data with the pooled regression model. Table 1 gives the results of the model for the two measures of corruption. Pooled regression model shows that regardless of how the dependent variable is measured, the model is statistically significant because p-value F-statistics < 5%. In the case where corruption is measured through CC, the model explains about 78% of the variation, while in the case of the CPI index, the model explains about 70% of the variation in the values of the corruption index. Regardless of the index used for corruption, RGDPc, UNEMPL, and RL have positive signs and are statistically significant. GE is statistically significant at 1% in the case of CC and 10% in the case of CPI. IG has a negative sign and is statistically significant in the case of CPI, while it is statistically insignificant in the case of CC.

Table 1. Pooled regression.

Variable	CC		CPI	
	Coefficient	p-value	Coefficient	p-value
RGDPc	0.44	0.00	6.13	0.01
GE	0.23	0.00	1.75	0.09
IG	-0.01	0.22	-0.56	0.00
UNEMPL	0.02	0.00	0.26	0.00
RL	0.47	0.00	11.6	0.00
R-sqr	0.78		0.71	
Adj R-sqr	0.76		0.68	
Prob. F-st	0.00		0.00	

In the second step, we test for Fixed Effects. Table 2 shows the results of this model for the two measures of corruption. The Fixed Effects model is statistically significant for both indices, CC, and CPI. Approximately 84% of the variation is explained by the CC model and 76% by the CPI model. These values are higher than the respective pooled regression values. In the case of the CC index, all variables are statistically significant at 5%, while in the case of the CPI index, only IG and RL are statistically significant. Regarding the real GDP per capita variable, the positive sign suggests a positive association between it and the corruption indexes: an increase in the level of income will be accompanied by an increase in the corruption rating. The same conclusion was reached by Bai et al. (2013) in their study. The negative sign of the Inequality Gap variable suggests an inverse relationship between this variable and the corruption indexes, so an improvement in the distribution of income in the economy is accompanied by a decrease in the corruption rating points. This result is consistent with the conclusion reached by You and Sanjeev (2005). The unemployment variable has a positive sign, contrary to the expectation of a negative impact on the value of the index.

Table 2. Fixed effects model.

Variable	CC		CPI	
	Coefficient	p-value	Coefficient	p-value
RGDPc	0.42	0.02	5.37	0.21
GE	0.22	0.02	3.67	0.10
IG	-0.04	0.00	-1.21	0.00
UNEMPL	0.01	0.00	0.12	0.26
RL	0.48	0.00	8.93	0.02
R-sqr	0.84		0.76	
Adj R-sqr	0.81		0.72	
Prob. F-st	0.00		0.00	

To choose between Pooled and Fixed Effects regression models, we perform the Likelihood ratio test, Table 3 shows the results of this test for the two measures of corruption. The likelihood ratio test shows that for both indices, the most appropriate model is the Fixed Effects model, because the p-value < 5%.

Table 3. Likelihood ratio test.

Effects test	CC		CPI	
	Statistic	P-value	Statistic	P-value
Cross-section F	4.17	0.00	2.72	0.02
Cross-section chi-square	21.2	0.00	14.6	0.01

In the next step we test for Random Effects in our model. Table 4 presents the results of the Random Effects model for the two measures of corruption. The analysis shows that the model is statistically significant, with the highest R-squared value in the case of the CC index. Regarding the variables, RGDPc, UNEMPL, and RL are statistically significant, while GE is statistically significant at 10% in the case of CPI. The IG variable is significant only in the case of the CPI.

Table 4. Random effect model.

Variable	CC		CPI	
	Coefficient	p-value	Coefficient	p-value
RGDPc	0.44	0.00	6.13	0.01
GE	0.23	0.00	1.75	0.07
IG	-0.01	0.16	-0.56	0.00
UNEMPL	0.02	0.00	0.26	0.00
RL	0.47	0.00	11.6	0.00
R-sqr	0.78		0.70	
Adj R-sqr	0.76		0.68	
Prob. F-st	0.00		0.00	

In the last step, we must decide whether the Fixed Effects or Random Effects model is more appropriate for our study. To choose between the two models, we perform the Hausman test. Table 5 presents the results of this test for the two measures of corruption. The p-value of the test is less than 5%, and this suggests that between Fixed Effects and Random Effects, the most appropriate model to explain the long-term relationship between independent variables and corruption is the Fixed Effects model, regardless of which index is used for measuring corruption.

Table 5. Hausman test results.

Test summary	CC		CPI	
	Chi-sq. statistic	p-value	Chi-sq. statistic	p-value
Cross-section random	20.9	0.00	13.6	0.01

5. Conclusion and Future Work

Corruption is considered a harmful phenomenon that negatively affects not only the economy, but also the rule of law and democracy. The design of strategies and implementation of measures against this phenomenon is a central topic of public and political debate. The success of these strategies depends on political, economic, social, cultural factors etc.

This article's goal is to list a few institutional and macroeconomic elements that influence the demand for the corruption in Western Balkan nations. Among the various factors suggested by previous studies on this phenomenon, this article includes Real GDP per capita, Unemployment Rate, Inequality Gap, Government Efficiency, and Rule of Law.

Between Pooled, Fixed Effects and Random Effects models, the most appropriate one to explain the long-term relationship between these variables and corruption is the Fixed Effects model. However, the model's conclusions depend on how corruption is measured, because in the case where the Control of Corruption Index is used to measure it, the model suggests that all variables are statistically significant, while in the case where the Corruption Perception Index is used to measure corruption, only Inequality gap and Rule of Law are statistically significant. Results show that the Control of Corruption model is more robust, as it explains about 84% of the variation, while the CPI model explains only about 76.4% of the corruption variation. This conclusion does not change even though the coefficients of the CPI model are greater than those of the CC model, as the purpose is to identify the factors that affect the corruption assessment, not the extent of this impact.

As expected, economic development is accompanied by an increase in the public's perception of keeping corruption under control, while the positive sign of the variable unemployment should be further investigated to discover the reasons for such an impact.

The model suggests that policymakers design strategies and implement policies that lead to a better distribution of income in the economy. Also, the strengthening of institutions and the rule of law will positively affect the perception of corruption control in the Western Balkans.

In the future, this work will be expanded, to include other microeconomic, social, and cultural factors that can influence the demand for corruption and other corruption indexes. It is the objective of the authors to also study the supply side of corruption to give a more complete picture of the economics of corruption.

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Appendix

Figure 1A shows the distribution of residuals. The shape of the histogram indicates that residuals are normally distributed.

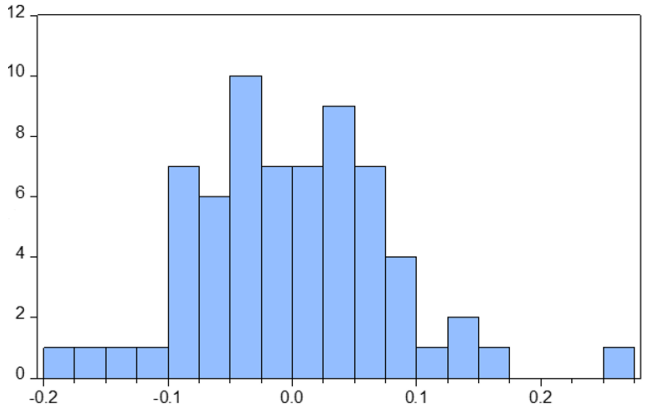

Figure 1A. Normality test of residuals.

Table 1A gives a summary of different tests that check for the cross-sectional dependence in residuals. All p-values are more than 5%, suggesting there is no evidence to reject the null hypothesis of no cross-section dependence.

Table 1A. Residual cross-section dependence test.

Test	Statistics	d.f.	Prob.
Breusch-Pagan LM	21.3	15	0.12
Pesaran scaled LM	1.15	15	0.24
Bias-corrected scaled LM	0.85	15	0.39
Pesaran CD	-1.34	15	0.17