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## Interaction of inflation and corruption in developing markets in the context of technological changes

**Abstract.** Corruption being a multi-layer phenomenon has its direct and indirect effects on the economic life in different spheres. Taking into account this circumstance, we made an attempt to reveal the existing connections and dependence between corruption and inflation. Data of 161 countries were included in the carried-out analysis on inflation, corruption perceptions index (CPI), control of corruption index (COC), as well as Freedom of Corruption Index (FFC), whereas the countries have been divided into four large groups according to per capita GDP. Modern tendencies of the given groups of countries having strong foundations of institutional control or corruption «restraints» have been studied in this context. The correlation analysis has been carried out to study the dependence of corruption and inflation according to income groups. Research of previous experiences and results of the carried out analysis indicate that implementation of the efficient policy aimed at control of manifestations of corruption presumes some high level of institutional development in countries. Results of the correlation analysis prove the inverse relationship between corruption and inflation as well as its weaknesses for all income groups in countries.

**Keywords:** Inflation; Corruption Perceptions Index; Control of Corruption Index; Freedom of Corruption Index; Level of Income; Correlation Analysis; Correlation Indicators

**JEL Classification:** E31; C40; K40; O11

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### 1. Introduction

Corruption is a multi-layer phenomenon that is like a contagious disease for the social system especially damaging the economy. It is a complicated phenomenon, for the description of which a series of quantitative indicators are to be considered and introduced. These are the indices of corruption perceptions, control of corruption and freedom of corruption. The latter, as the name denotes, describes different sides of corruption. The experience of a variety of reforms demonstrate that implemented institutional reforms and factors of cultural and civilized environment as well as neglect of values and traditions of the society not always lead to success. Quite the contrary is true in this case: such reforms can result in institutional traps, one of which is corruption (Polterovich, 1999).

«Corruption trap» is a serious institutional threat that was combatted during years and is an on-going process in a number of countries up to now. Experts of International Monetary Fund George Abed and Hamid Davoodi (2000) correlate it with low level of development of economic structures and institutions as well as delays of reforms. According to S. Arefin (2018), corruption affects all aspects of economic life either directly or indirectly. The public seems to believe that corruption can pose serious threats to economic conditions, can reduce morality in society (Braun & Tella, 2004). We can specifically highlight the impact of corruption phenomena in the context of formation of innovative economies. The research of correlation between corruption and inflation is especially peculiar under such circumstances.

## 2. Brief Literature Review

A variety of studies have been carried out to characterize and detect the relationship between corruption and inflation especially in the course of the last two decades. According to S. Ghosh and K. Neanidis (2017), corruption has a negative effect on different indicators of growth due to the increase in income tax and prices. According to Braun and Tella (2004), corruption is predicted mostly by inflation variance and not by indicators characterizing inflation itself, and this is the case when «corruption leads to inflation variability». The latter has been stated in a series of different works. Studies conducted in transition countries have demonstrated that serious structural reforms encourage not only low level of corruption but also low levels of inflation (Abed & Davoodi, 2000). In the study of 20 developing countries the effect of corruption on the level of inflation has also been detected (Özşahi n & Üçler, 2017). In his research on 41 countries, Al-Marhubi (2000) pointed out the existence of relationship between corruption and inflation and introduced its institutional basis connected with government policies that incentivize inflation, how organizations respond to corruption by going underground as well as capital flights.

In some Middle Eastern and North African countries lack of positive correlation between corruption and inflation, for instance, was conditional on the increase in non-productive government expenditure. Nevertheless, control or elimination of corruption directly leads to the decrease in inflation (Samimi, 2011). Research of data on Gulf Cooperation Council countries from 1996 up to 2016 indicated that unemployment and corruption significantly lead to price increases (Alharthi, 2019). It seems intriguing that according to Bayar, research results of the former USSR and East Asian countries indicate that corruption negatively affects unemployment, inflation and per capita GDP (Bayar, (2011). According to Hefeker (2009), a strong relation between the issues of corruption and fiscal policy is highly visible in developing countries and countries having middle-income ranks. According to Dimakou (2015), such issues are mainly reflected in the form of inflation.

Huang and Wei (2003) cast doubt on the opinion that the incentive of governments to decrease inflation can finally prove useful in the fight against corruption. Taking into account this statement is «essential in the process of monetary policy formation of developing countries». Myles and Yousefi (2015) state that «increase of high inflation can be the result of its response to the rational policy of corruption». Elkamel (2019), while studying data of 72 countries, concluded that control of corruption affecting inflation presumes the implementation of actions connected with provision of central bank's independence and management of government bonds. Abed and Davoodi (2000), trying to unveil the essence of the phenomenon of corruption, consider that various economic indicators are predominantly explained by the registered results of structural reforms that are «statistically more significant and economically more important».

Braun and Tella (2004) demonstrated in their model, that in case of issues referring to information «inflation variability can lead to a reduction in investment and growth via an increase in corruption». In the carried out research on company level, Asiedu and Freeman (2009) observed corruption and inflation on the same surface as factors affecting investments (firm size, trade orientation, industry, GDP growth and other factors). Accordingly, corruption has a negative and significant effect on investment growth for transition countries. New evidence and analysis of data for 175 countries over the period of 2012-2018 indicate that besides inflation, corruption leads to the decrease in foreign direct investments (Gründler & Potrafke, 2019).

A number of authors highlighted the institutional aspect of relationship between corruption and inflation. Especially, according to Arefin (2018), «corruption is a problem of institutions and institutions determine the economics process and plans». Other authors consider that the impact of decentralization on inflation is conditional on the level of perceived corruption and political institutions.

Countries with high level of manifestations of corruption can have serious problems connected with control of inflation that point out the low level of institutional development of fiscal policy in that country (Dimakou, 2015). We should also point out from the point of view of institutional development that even high democratic level can have negative impact on the fight against corruption, therefore governments should equalize the policies led in this direction (Audí & Ali, 2019).

### 3. Research Methodology

Within the framework of the research, a series of indices of inflation and corruption have been studied and juxtaposed based on the data collected from 161 countries of the world as of 2019 (which is a data set available at the time of research conducting). Indicators characterizing corruption are taken from corruption perceptions index, control of corruption and freedom of corruption and the so-called «trust in government» indices (Transparency International, 2019). Inflation was introduced in the form of annual percent changes in consumer price index (International Monetary Fund, 2020), while presenting it in the form of growth rate instead of additional growth rate. Correlation analysis has been implemented to find out the correlation between corruption and inflation based on 161 countries.

It is evident that correlation exists between inflation and corruption that simultaneously emerges from the involvement of other possible factors. Implementation of correlation analysis produced the results to observe corruption as a whole. Afterwards, sample of the countries was divided by income groups, where 54, 40, 46, 25 countries have been included respectively in each group. The level significance of the latter has been tested for the coefficients of correlation results. All available corruption and inflation tendencies and findings of indicators in all groups of countries involved in the research have been studied as of 2019 and a comprehensive analysis has been implemented.

The next stage of the research juxtaposed the correlation coefficients' dynamics according to the main macroeconomic indicators of the income groups of the countries (Real GDP growth rates, unemployment rate), as well as quality of technological changes and dynamics of Global Innovation Index measuring.

### 4. Research of the Current Conditions

As of 2019, the highest indicators of the inflation were registered in countries with no high income level, especially in Sudan (50.99%), Iran (41.02%), Liberia (26.91%), Haiti (50.99%) and Turkey (50.99%). When summarizing available data on corruption perceptions index, we should point out that in 2019, leaders among countries with high income level (excluding Singapore and New Zealand) are the developed countries of Western Europe headed by Denmark (87) (Transparency International, 2019): the average indicator of the countries in this group included in the research is 65. The highest indicator among the countries with upper-middle income is in Botswana (62) and the lowest is in Equatorial Guinea (16): the average indicator of the countries in this group is 36.8 (Figure 1).

Noticeable is the fact that Bhutan considered to be lower-middle income country (68) exceeds the leading country Botswana in the previous group by this indicator: the same is true about the last country of the group - Congo (22) (Figure 2).

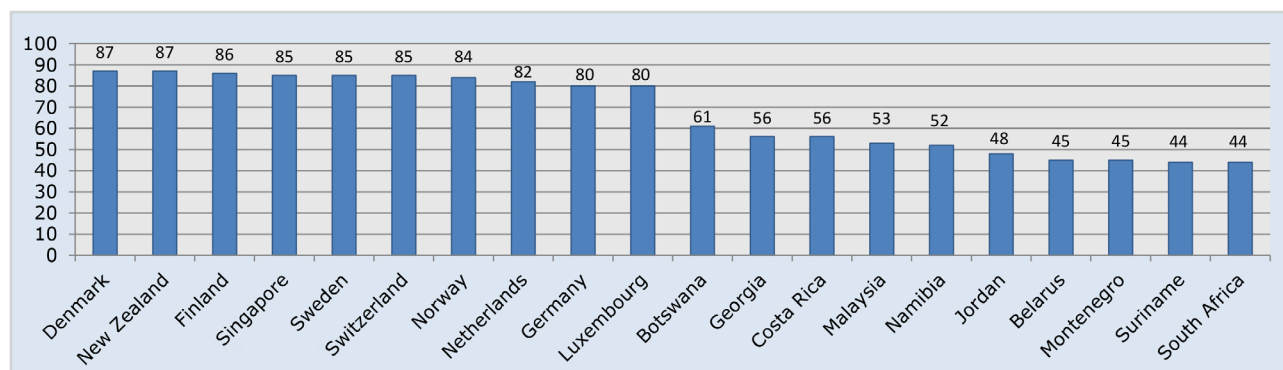
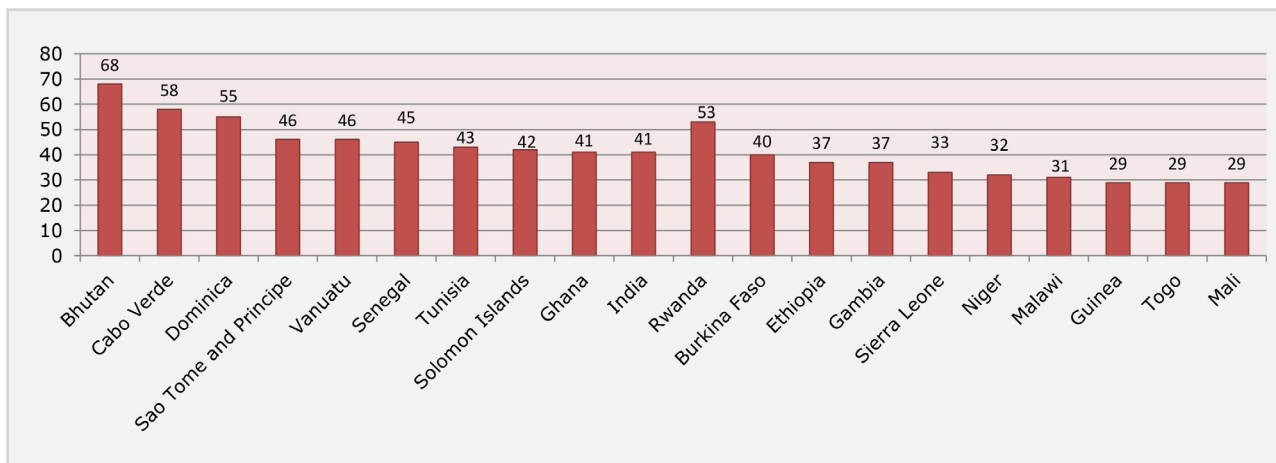


Figure 1:  
**Corruption perceptions index in high and middle income rank countries in 2019**  
Source: Compiled by the authors based on the data of Transparency International (2019) and the World Bank (2019)



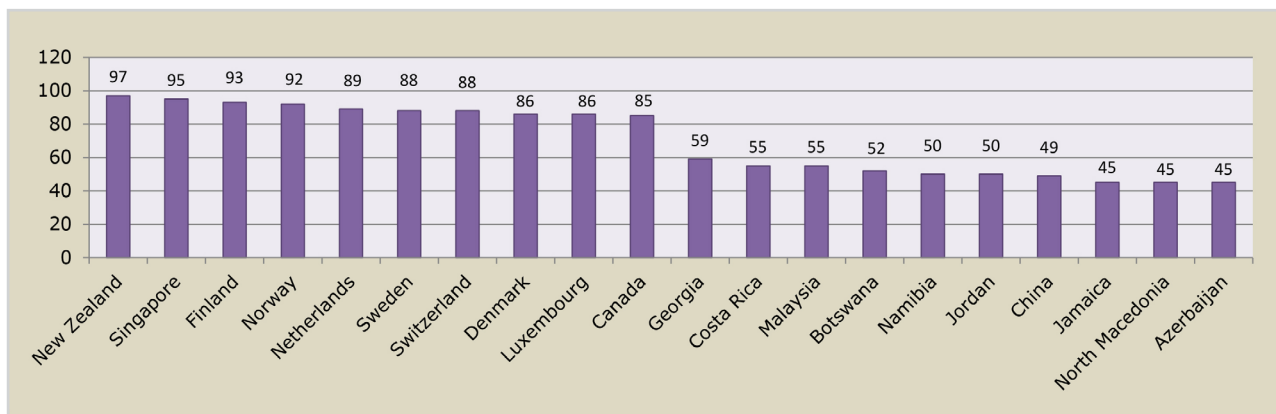
**Figure 2:**  
**Corruption perceptions index in lower-middle and low income countries in 2019**  
Source: Compiled by the authors based on the data of Transparency International (2019) and the World Bank (2019)

Rwanda is on the first line (53) for its corruption perceptions index among countries with low income. The worst indicator among 165 countries involved in the research is Yemen (15). The corruption perceptions index in lower-middle income countries is 34.7 and in low income group countries it is 26.8. The next corruption characterizing index is corruption control indicator, so Benelux countries as well as Scandinavian countries were pointed out, and New Zealand (2.17) and Singapore (2.16) are respectively on the first and second lines within the research framework. As was in case of corruption perceptions level, the same is true for this indicator as well, where Botswana (0.741), Bhutan (1.62) and Rwanda (0.56) are leading among countries with respective upper-middle, lower-middle and low income countries (Figure 2). It is notable that upper-middle income country Equatorial Guinea (-1.72) is the last one among all 165 countries (World Bank, 2019).

While continuing to observe the results of the fight against corruption in affluent countries, we see that the list of countries that achieved success in freedom of corruption index are almost the same such as New Zealand (97) and Singapore (95), and the average indicator of 54 countries is 63. The latter is 36.4 in the countries with high income, and Georgia is on the first line (59) (Figure 3).

Rwanda (68) again caught attention among countries with lower-middle and low income level having the highest indicator that is followed by Bhutan (55) and the lowest as in case of corruption perceptions index, is Yemen.

It should be noted that these groups of countries are almost on the same level for the average value of the indicator, respectively 31.7 and 28.4 (Figure 4).



**Figure 3:**  
**Freedom of corruption index in high and upper-middle income countries in 2019**  
Source: Compiled by the authors based on the data of the Heritage Foundation (2019) and the World Bank (2019)



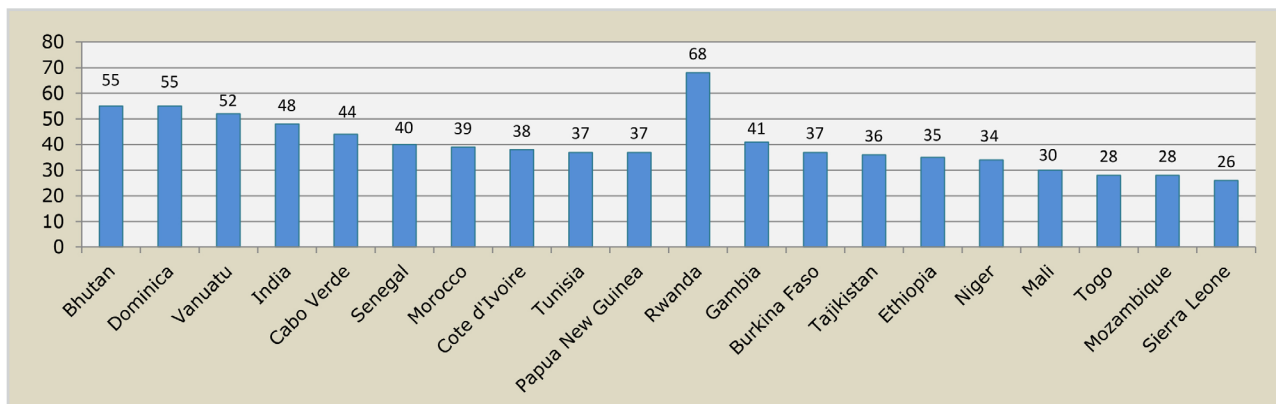


Figure 4:  
**Freedom of corruption index in lower-middle and low income countries in 2019**  
Source: Compiled by the authors based on the data of the Heritage Foundation (2019) and the World Bank (2019)

### 5. Results of Correlation Analysis

In the quantitative analysis of the research we initially observed the correlation of interconnections of corruption and inflation tandem according to countries of income clusters, afterwards the obtained indicators (coefficients) were juxtaposed with other main macroeconomic indicators peculiar to the groups of countries such as movement tendencies of real growth of Gross Domestic Product (GDP), unemployment rate as well as Global Innovation Index (GII). The correlation analysis implemented to study the dependence between different indicators of corruption and inflation in 165 countries produced the results given in Table 1.

Table 1:  
**Results of the correlation analysis depicting the correlation between different indices of corruption and inflation according to countries of different income groups**

Results of correlation analysis	Number of countries	INF-CPI	INF-COC	INF-FFC
All countries	161	-0.30	-0.28	-0.24
High-income countries	50	-0.05	-0.04	-0.15
Upper-middle income countries	40	-0.29	-0.29	-0.31
Lower-middle income countries	46	-0.21	-0.21	-0.24
Low income countries	25	-0.29	-0.19	-0.08

Source: Authors' own research

We notice that the correlation coefficients obtained from calculations are significant. Therefore, while interpreting the obtained results, we can state that mutual dependence of inflation and corruption perceptions index within the observed countries accounts for -0.3. This connection is not strong, but we cannot neglect the latter. Nevertheless, according to the initial hypothesis, there is an inverse dependence between these two values. The other correlation refers to inflation and control of corruption index that comprises -0.28. And finally, the dependence between inflation and freedom of corruption index comprised -0.24.

54 countries are in the group of high-income countries. The coefficients obtained as a result of the implemented correlation analysis of different indicators of corruption and inflation of the latter ones is really significant. The obtained results demonstrated a rather low correlation. For instance, the highest connection was observed between inflation and freedom of corruption index comprising -0.15. Correlation between all indicators of corruption and inflation in these countries also had an inverse relationship.

Around 40 countries are included in the other group having upper-middle income levels. The correlation between corruption perceptions index and inflation as well as control of corruption index and inflation in the case of these countries is -0.31. We have an inverse and low than average correlation. On the other side, the dependence between inflation and freedom of corruption index is -0.31.

The next group of countries refers to countries with lower-middle income, number of which is 46. In case of these countries, the correlation between corruption perceptions index and inflation and, on the other hand, correlation between control of corruption index and inflation was -0.21.

The coefficient is significant, although the relationship is inverse and is low than average. The relationship between inflation and freedom of corruption index is  $-0.24$ . Finally, the relationship between respective indicators of corruption and inflation in low income countries was observed, in 25 countries overall. In this case, the correlation between inflation and corruption perceptions index is  $-0.29$ . The correlation between inflation and control of corruption, as well as inflation and freedom of corruption index account for respectively  $-0.19$  and  $-0.08$ .

Within the framework of the research of groups of different income level countries, the dynamics of interrelationship between inflation and corruption has been studied and it was juxtaposed according to an integral indicator such as Global Innovation Index (GII) describing the technological changes in the observed countries and other essential macroeconomic indicators such as dynamics of real Gross Domestic Product and unemployment indicators.

Time period 2012-2020 has been observed and a number of countries in different groups had to be changed, because data on some countries for 2020 were still unavailable. Particularly, 44 countries were included in the group of high-income countries, 25 countries in upper-middle income countries and 14 countries in lower-middle income countries.

As presented in Figure 5, high positive correlation between inflation and corruption was observed in high-income countries in 2014 accounting for  $0.17$ , in 2015 accounting for  $0.18$  and in 2016 accounting for  $0.16$ . During the same years especially in 2015 in higher-middle and lower-middle income countries the correlation between inflation and corruption is  $-0.49$  and  $-0.52$ , respectively. In 2020, under the conditions of COVID-19 Sars-2 coronavirus crisis, the correlation between corruption and inflation in the group of high-income level countries accounted for  $-0.05$ , while in the group of upper-middle income countries it accounted for  $-0.4$ , and in group of lower-middle income countries it accounted for  $-0.35$ .

In Figure 6, three core indicators of the groups of observed countries namely, Global Innovation Index, dynamics of unemployment rate and real GDP growth rate, dynamics for the period 2012-2020 were introduced. The dynamics of these indicators can be juxtaposed to dynamics of correlation indicators of corruption and inflation obtained for the respective income groups. We have analyzed the developments for the group of countries with high-income levels (Figure 6).

According to Figure 6, in the groups of high-income countries, the levels of Global Innovation Index for the years of 2014, 2015 and 2016 accounted for respectively  $49.71$ ,  $50.86$ , and  $50.1$  scores, when the correlation between corruption and inflation was positive. In 2020 the Global Innovation Index accounted for  $47.48$  scores, when corruption and inflation correlation was negative. In 2014, 2015 and 2016, the unemployment rate accounted for  $8.4\%$  accordingly.

We have respectively juxtaposed it in case of the group of higher-middle income countries (Figure 7).

We should remember that in case of this group the correlation between corruption and unemployment in 2015 accounted for  $-0.49$ . In the group of upper-middle income countries, in 2015, the Global Innovation Index had a value of  $35.95$ , unemployment rate accounted for  $10.3\%$ , and economic growth accounted for  $2.5\%$ . In 2020 all the indicators in these groups decreased, namely,

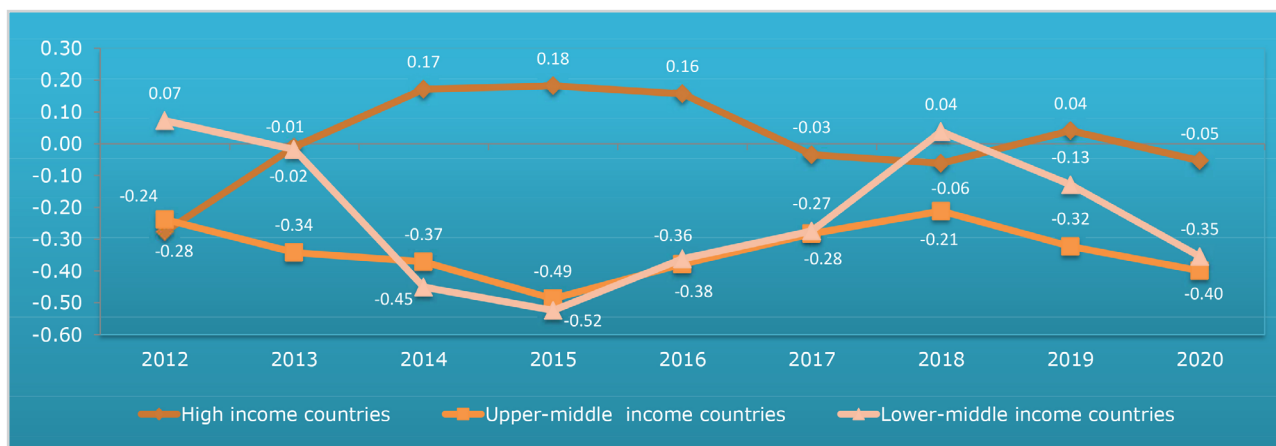


Figure 5:

**Dynamics of correlation coefficient of corruption and inflation in the groups of high income, upper-middle income and lower-middle income countries over time period 2012-2020**

Source: Compiled by the authors based on the data of the World Bank (2020)

GII score accounted for 32.48, unemployment rate increased up to 12.4%, and economy reduced up to 3.9%. In this case, the correlation between corruption and inflation accounted for -0.4. It shows that the inverse relationship has strengthened compared with 2019.

We will finally observe the group of lower-middle income countries (Figure 8).

According to Figure 8, this time the correlation between corruption and unemployment was observed on the level of -0.52 in 2015. In 2015, in the group of lower-middle income countries, the Global Innovation Index reached a score of 31.19, unemployment rate accounted for 7% and

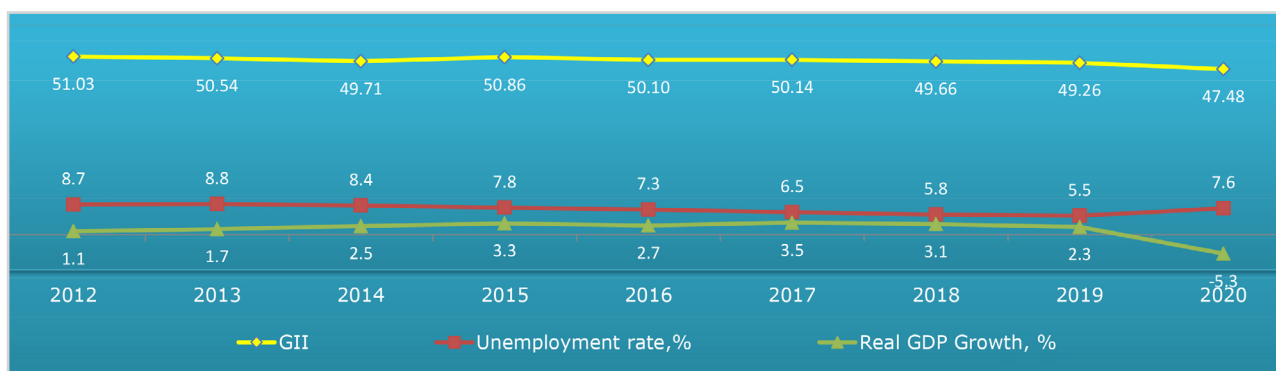


Figure 6:  
**Dynamics of core socio-economic indicators for the group of high-income countries from 2012 up to 2020**

Source: Compiled by the authors based on the data of the World Bank (2020)



Figure 7:  
**Dynamics of core socio-economic indicators for the group of upper-middle income countries from 2012 up to 2020**

Source: Compiled by the authors based on the data of the World Bank (2020)

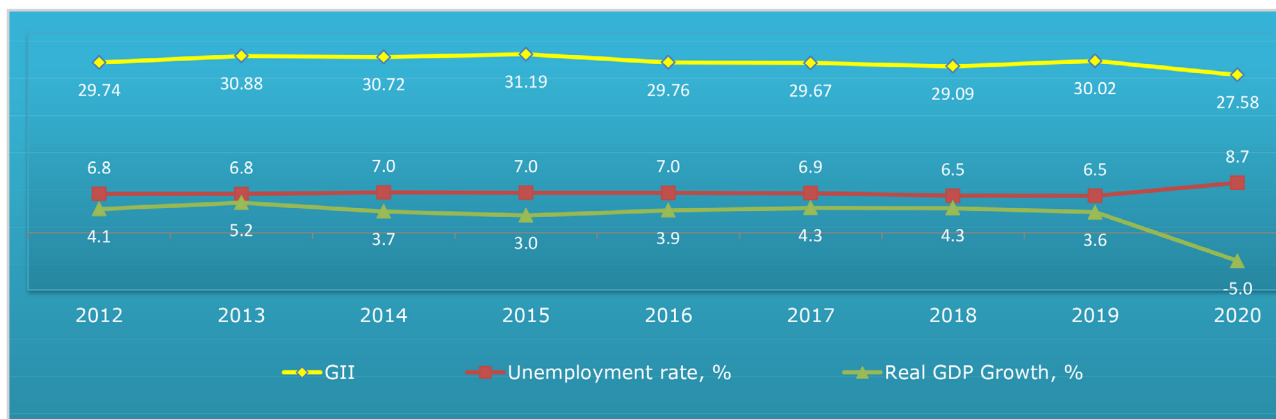


Figure 8:  
**Dynamics of core socio-economic indicators for the group of lower-middle income countries from 2012 up to 2020**

Source: Compiled by the authors based on the data of the World Bank (2020)

economic growth accounted for 3%. In 2020, the core indicators in this group were as follows: GII score accounted for 27.58, unemployment rate reached 8.7% and economy decreased by 5%. Under these circumstances, the correlation between corruption and inflation accounted for -0.35. It means that the inverse relationship has strengthened compared to 2019.

## 6. Conclusions

Within the framework of the research, as a result of available literature on the issues detected, previously conducted studies, as well as obtained results of the conducted analysis indicate that the implementation of accurate evaluation on the relationship of corruption and inflation are the topicality of the prerequisites for economic development and advances as well as they are necessary for the institutional advances of the countries.

Analysis of all three indicators characterising corruption indicated that Western European and especially Scandinavian countries demonstrated exemplary results in the fight against corruption as well as New Zealand and Singapore that was reflected in control and restraint processes of inflation: this indicator in these countries did not exceed three per cent.

Therefore, we should summarize the obtained results:

1. Independent of the fact that we have observed the dependence of corruption indicators and inflation according to general groups or according to income groups, the relationship between the values is inverse and less than 0.31.
2. The weakest relationship was registered in the group of high-income countries.
3. In upper-middle income countries, compared with countries included in other groups, correlation between different indicators of inflation and corruption accounted for about -0.30 and -0.31.
4. In the case of lower-middle income countries, the correlation between the indicators of inflation and corruption accounted for a minimum of -0.21, and the maximum accounted for -0.24.
5. In low income countries, the connection between inflation and corruption perceptions index is highlighted that accounted for -0.29.

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