ASSESSING THE IMPACT OF CORRUPTION UPON THE ROMANIAN ECONOMY

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Abstract:

This paper is dedicated to estimating the influence of corruption upon Romania's economic growth by means of an econometric model ARMA component. In order to quantify the impact, firstly some indicators have been identified to properly assess the economic condition and corruption. The most important economic growth indicator is real GDP growth rate (or chain index of real GDP). In order to estimate the level of corruption, the authors have used the Corruption Perceptions Index, annually launched and calculated by Transparency International. The model chosen for this paper has an ARMA component and expresses the dependence of the economic variable on the corruption variable by a straight-line relationship. The model shows that one of the factors having a significant negative impact upon the economic growth is corruption.

Key words: *corruption; Corruption Perceptions Index; real GDP; Romania.*

JEL Classification: D73, K42, E6.

1. Introduction

Corruption is a social, economic and political issue spread all over the world to various extents. As well as other concepts, when defining corruption there is no international consensus.

In broad terms, corruption is public power abuse for private reasons and concerns (Lambsdorff, 2007, 16). According to the Explanatory Dictionary of the Romanian Language, corruption is "the state of violating morality, honesty and duty".

Corruption basically occurs in four main forms (Rohwer, 2009): bribery, embezzlement, fraud and extortion. Bribery is understood as the payment that is made or received in a corrupt relationship. These are all notions of corruption in terms of the money paid or favours done to employees in private enterprises, public officials and politicians. Embezzlement is the theft of resources by people who are responsible for managing them. Fraud involves the manipulation or distortion of information, facts and expertise by public officials for their own benefits. Extortion is money and other resources extracted by the use of coercion, violence or threats to use force.

In order to estimate a country's corruption level, what is most frequently used is: the Corruption Perceptions Index of the Transparency International non-governmental organization and the Worldwide Governance Indicators of the World Bank that comprise six headings of which one is the Control of Corruption. More recently, new instruments to measure corruption have emerged such as: the Global Corruption Barometer of the Transparency International organization and the Global Integrity Index of the Global Integrity organization.

Worldwide Governance Indicators to assess the corruption degree measure the level up to which public power is exerted for private gains, including low and high forms of corruption, as well as "capturing" of the state by elites and private interests.

The Corruption Perceptions Index (CPI) laid down by the Transparency International every year assess the degree to which corruption is perceived in the public

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sector of every country. The index was launched in 1995, with Romania having been assessed ever since 1997. It is a composite index that is calculated according to the information supplied by many sources, made up of data regarding corruption taken from specialized surveys undertaken by famous independent institutions and from scores prepared by experts (hazard assessment experts, country analysts). The Corruption Perceptions Index reflects opinions from all over the world including those of experts living in the countries already assessed. The aggregation mechanism of information about a country's or territory's corruption level and turning the information into a score included on a scoring scale from 0 to 10 or from 0 to 100, as in 2012, are complicated. The 0 minimum value means a very high corruption level and the 10 or 100 maximum value means the total lack of corruption. Once the Corruption Perceptions Index of the assessed countries has been announced, the Transparency International also introduces a ranking prepared according to the descending measures of the index.

The implications of this social issue are manifold as suggested by so many empirical studies in the specialized literature. Mo (2001) analyzes the relationship between corruption and economic growth for 54 countries and he finds that a 1% increase in the corruption level reduces the growth rate by about 0.72% and the most important channel through which corruption affects economic growth is political instability which accounts for about 53% of the total effect. Ali and Hodan (2003) indicate that corruption has a substantial explanatory power for economic growth and higher economic growth does not guarantee lower corruption in the future. Pellegrini and Reyer (2004) use straight-line regression models in order to quantify the effect of corruption on economic growth, both in a context with and without other independent variables (investment, schooling, trade openness, political instability). Using a sample of African countries in their survey, d'Agostino, Dunne and Pieroni (2012) assess how corruption affects the relationship between government spending and economic growth.

2. Corruption in Romania

The main causes triggering corruption in Romania are: the lack of political will, the weakness of public institutions, and tradition. Moreover, there has been faulty implementation of the steps taken over the years to decrease the scale of corruption, which has led to such steps' low efficiency (Radu and Gulyas, 2010). Corruption leads to the inefficient allocation of resources at national level, lowers the administrative system's efficiency, holds back the economic growth and contributes in the political system's decay (Iamandi and Voicu-Dorobanțu, 2007).

According to the National Anticorruption Directorate (2011), there is a high level of perceiving the connections between organized crime and corruption. Organized crime and corruption support each other and when organized crime rules, the public sector corruption is very likely to increase. According to the same survey, the most important premises of the connections between organized crime and corruption are that: public administration appointments do not occur due to merits, there are too many links between politicians and the business environment, and politicians do not act enough to stop the issue.

In the year 2010, Romania got a 3.7 score, it was the 69th in a general ranking (of 178 monitored countries) and the second to last in the ranking of European Union countries before Bulgaria (3.6) and Greece (3.5).

In 2011, our country's score was 3.6 and ranked the 75th at world level, the same as China (of 182 monitored countries). It was the second to last in the ranking of European Union countries as it had the previous year, higher than Greece (3.4) and Bulgaria (3.3).

In the year 2012, 176 countries were ranked according to the Corruption Perceptions Index, and Romania had a 44-point score as well as Saudi Arabia and Kuwait, ranking the 66th. It was the first year Romania had reported a significant increase of its score and ranking. It also advanced one more level in the European Union countries top, ranking before Italy (42), Bulgaria (41) and Greece (36).

Although survey sets and methodology have changed over the years, the progress of the Corruption Perceptions Index during 1997-2012 is interesting. Figure 1 shows the progress of the Corruption Perceptions Index in Romania along with the average progress in the European Union (for the year 2012 the index and the average have been divided by 10 in order to acquire uniform data).

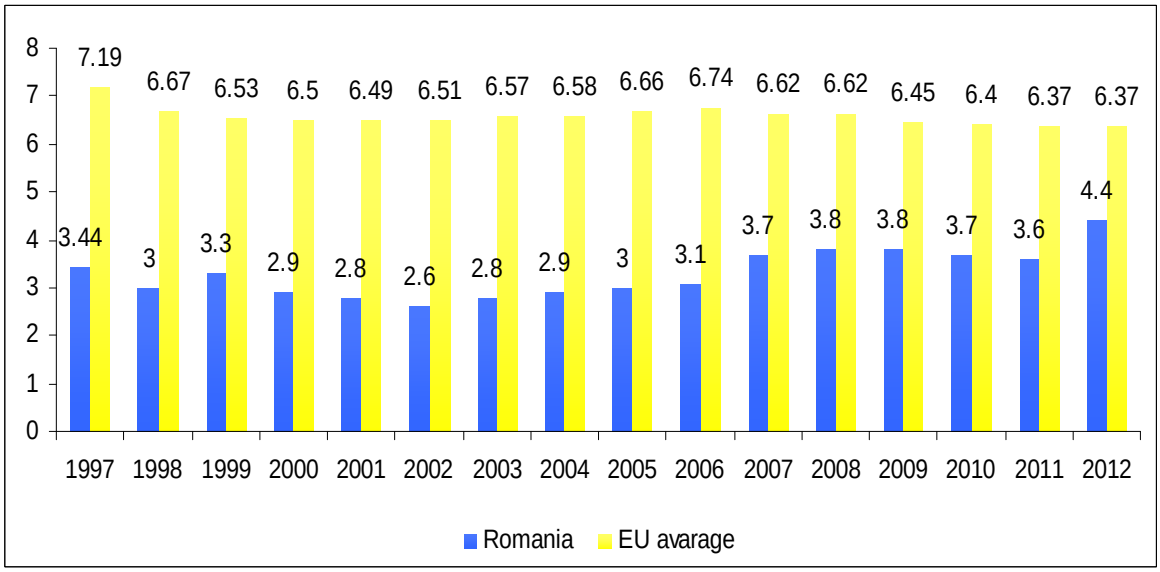

Figure 1. Romania vs. European Union average

Source: Prepared by the authors based on the data from Transparency International (http://www.transparency.org.ro/politici_si_studii/indici/ipc/2010/IPC2010Surse.pdf)

By comparing Romania's Corruption Perceptions Index with the EU average, it can be seen that our country's index during 1997-2006 was below the average with few exceptions, ranging from 3.6 to 3.8 points (3.23 the lowest in 1999, and 3.91 the highest in 2002). Although during 1997-2006 Romania's difference from the EU average can be said to have remained quite constant, the same difference started to significantly decrease in 2007 and ended up to 1.97 points in 2012.

Another concerning issue is the interdependence between corruption expressed by the Corruption Perceptions Index and economic crime expressed by the number of economic and financial offences. The correlation coefficient between the time series of the Corruption Perceptions Index and the number of economic offences in the case of Romania is $r = -0.639409$ (Erdniç and Manole, 2013, pp. 75-76), hence between corruption and economic crimes there is a direct significant correlation in terms of its intensity.

3. Empirical Research

3.1. Setting Significant Variables for the Present Survey

In order to estimate the impact of corruption upon the economic growth, one should first find indicators to express economic growth and corruption as well as they can.

In terms of an economic growth index, the authors have chosen the chain index of real GDP. The real value of a macroeconomic index is calculated by comparing the index

nominal value to the corresponding price index. Additionally, in order to assess the corruption level, the authors have chosen the Corruption Perceptions Index as it is the most complete instrument to measure corruption.

This paper includes the time series of the chain index of real GDP in Romania for 1991-2014 (Figure 2.) and the time series of Romania's Corruption Perceptions Index for 1997-2012 (Figure 1.).

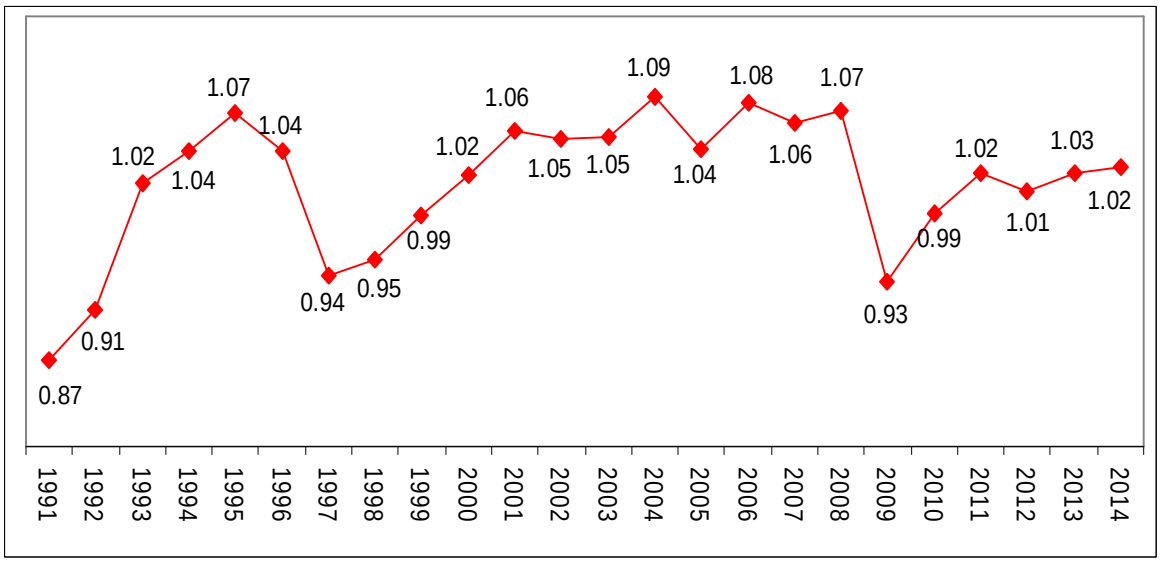

Figure 2. The Chain Index of Real GDP in Romania during 1991–2014

Source: Prepared by the authors based on processing the information taken from the Romanian Statistical Yearbook of 1990-2010 and from web site http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tec00115

The two series with all their terms being strictly positive have been logarithmized. Therefore, interpreting the coefficients in the regressions completed based on these series is easier as they are elasticities.

The necessary econometric assessments have been performed by means of the EViews 7.0 programme package.

3.2. Stationarizing the Time Series

An important aspect when analyzing the time progress of a chronological series is stationarity. If a given series is not stationary, successive differencing is applied until a stationary series is achieved (Dickey and Fuller, 1979).

The best-known surveys for the study of stationarity are Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Leybourne-McCabe (LM) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (Baltagi, 2008, pp. 361-364). Applying the ADF test means comparing the test values to the critical values corresponding to 1%, 5% and 10% significance thresholds. If the statistic value obtained is higher than the critical value corresponding to a significance level, then a null hypothesis is accepted which means the series is non-stationary. Otherwise, the chronological series is stationary.

By the use of Augmented Dickey-Fuller, one can test the logarithmized series stationarity of the chain index of real GDP (LI_GDP) and it can be noticed that the series is stationary (Table 1.).

Table 1. Results of ADF Unit Root Test for the First Difference of the Logarithm of GDP Variable

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.566462	0.0151
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

The same test helps show that the natural logarithms series of the Corruption Perceptions Index (L_CPI) is not stationary (Table 2.), whereas its former difference (DL_CPI) proves the stationarity requirement (Table 3.).

Table 2. Results of ADF Unit Root Test for the Logarithm of CPI Variable

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.405045	0.8849
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.

Table 3. Results of ADF Unit Root Test for the First Difference of CPI Variable Logarithm

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.814332	0.0141
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.

3.3. Model to Assess Corruption Impact upon the Economy

It is believed that economic growth of a certain time is influenced by the economic growth of recent previous times. Moreover, it is believed this there is a straight-line interdependence so that the model has an AR component (autoregressive process). Furthermore, one can start at the premise that the process level during a certain time depends on the average deviations in the past, so that there is also an MA component (moving average process). Hence, the model has an ARMA component. Therefore, there is only one explanatory variable signifying corruption and the model form is

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i y_{t-i} + \gamma c_t + \varepsilon_t + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j} \quad (1)$$

where

t = time expressed in years;

y_t = the first differences of the logarithms of the real GDP at time t;

c_t = the first differences of the logarithms of the CPI at time t;

α_i, β_j, γ = the unknown coefficients, $i = 0,1,\ldots, p$, $j = 1,2,\ldots, q$;

ε_t = error terms, variables that are normally distributed with mean 0 and variance σ^2.

The time series of the residual variable must be stationary and meet the following requirements:

$E(\varepsilon_t) = 0$, $E(\varepsilon_t^2) = \sigma^2$, $\forall t$;

$E(\varepsilon_t \varepsilon_s) = 0$, $\forall t, s$, $t \neq s$.

After several attempts, the order of AR parts of model $p = 6$ and the order of MA parts $q = 2$ have been chosen.

The most frequently used methods to estimate the parameters of econometric models are the least squares method and the method of maximum likelihood. Solving this model has been achieved by the least squares method.

3.4. Results and Analyses

The information related to the estimation of coefficients and diagnostic statistics of the model is provided in the following table (Table 4.).

Table 4. Estimation Results and Diagnostic Statistics of the Model

Dependent Variable: LI_GDP
Method: Least Squares
Date: 05/11/13 Time: 23:42
Sample (adjusted): 1998 2012
Included observations: 15 after adjustments
Convergence achieved after 29 iterations
MA Backcast: 1996 1997

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.032870	0.009284	3.540412	0.0076
LI_GDP(-1)	0.599784	0.191573	3.130829	0.0140
LI_GDP(-3)	-0.367423	0.160284	-2.292324	0.0511
LI_GDP(-6)	-0.331908	0.120753	-2.748652	0.0251
DL_CPI	0.135973	0.054589	2.490857	0.0375
MA(1)	-1.764213	0.134494	-13.11739	0.0000
MA(2)	0.794814	0.118141	6.727643	0.0001

R-squared	0.803896	Mean dependent var	0.026406
Adjusted R-squared	0.656818	S.D. dependent var	0.045358
S.E. of regression	0.026572	Akaike info criterion	-4.113229
Sum squared resid	0.005648	Schwarz criterion	-3.782806
Log likelihood	37.84922	Hannan-Quinn criter.	-4.116749
F-statistic	5.465784	Durbin-Watson stat	2.072210
Prob(F-statistic)	0.015792		

Inverted MA Roots	.88-.13i	.88+.13i

By replacing the estimated values of the coefficients, one can get this equation:

$$y_t = 0.032870 + 0.599784 y_{t-1} - 0.367423 y_{t-3} - 0.331908 y_{t-6} + 0.135973 c_t + \\ + \varepsilon_t - 1.764213 \varepsilon_{t-1} + 0.794814 \varepsilon_{t-2} \quad (2)$$

The model coefficients are significantly different from zero (with higher than 0.95 probability), as the corresponding values of the significance level (the values in the Prob. column) are lower than 0.05, except coefficient $\hat{\alpha}_3 = -0.367423$. Since the corresponding

probability of this coefficient slightly exceeds the 0.05 level, being 0.0511, it can be said that α_3 too is significantly different from zero.

The ratio of the explained variation to the total variation, expressed by the coefficient of determination (R-squared) is 80.39%. The adjusted value of this coefficient almost having the same significance but penalizing the occurrence of independent variables that have lower relevance upon a dependent variable, is high enough (65.68%).

The null hypothesis of the *F*-test (all the regression coefficients are zero) has low probability (Prob(F-statistic)), even lower than 5%, hence at least some of the regression parameters are nonzero with high probability (more than 0.95).

In addition, the process must be invertible, which means the inverse roots of the MA characteristic polynomial should lie inside the unit circle (Andrei et al, 2008, pp. 190-196). This requirement is met as it can be seen in the last part of the table above, with the inverse roots $0.88 \pm 0.13i$ and $|0.88 \pm 0.13i| = \sqrt{0.88^2 + 0.13^2} = 0.88955$.

The results obtained after applying such econometric tests lead to model validation and admittance.

The estimated value of the coefficient of variable expressing corruption $\hat{\gamma} = 0.135973$ shows that a 1% decrease in the corruption level results in 0.135973% economic growth.

The previous statement can be interpreted that a 1% increase in the Corruption Perceptions Index leads to a 0.135973% increase in the real GDP. It is estimated the real GDP shall rise by 3.1% in 2013 and amount to 649 billion lei (the National Prognosis Commission, 2012). Thus, as to the year 2013, a 1% decrease in the corruption level namely an increase in the Corruption Perceptions Index from 44 to 45 might result in a GDP value equalling $\frac{649 \cdot 1.03235973}{1.031} = 649.855931$ billion lei, that is a GDP increase by 855.931 million lei, which means $\frac{855.931}{3.320508} = 257.771$ million U.S. dollars (at the annual average exchange rate in 2013 of 1 US Dollar =3.320508 lei). It proves that the negative influence of corruption upon the economic growth is significant.

4. Conclusions

The present paper has researched the effect of corruption upon Romania's economic growth. In order to assess the impact of corruption upon the economic growth, the authors have used an econometric model with an ARMA component, where the dependent variable is a logarithm of chain index of real GDP, and the only explanatory variable is the first difference of the logarithms of the CPI.

The test results reveal that there is a statistically significant negative relationship between corruption and economic growth. Therefore, a 1% increase in the Corruption Perceptions Index leads to an increase in the real GDP by 0.135973%. As to the year 2013, a 1% of the Corruption Perceptions Index (from 44 to 45) might result in a GDP increase of 257.771 million U.S. dollars (at the annual average exchange rate in 2013 of 1 US Dollar =3.320508 lei).

As far as a more detailed study of the corruption influence upon the economic growth is concerned, other indices of the corruption level should be equally considered (Worldwide Governance Indicators, Global Corruption Barometer and Global Integrity Index), as well as other independent variables (investment, schooling, trade openness).

Besides, the effects of such a complex social issue are manifold and its economic costs are immense, as shown by empirical surveys in the specialized literature (the majority based on multiple regression models).

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