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Are corruption and economic growth associated? Empirical evidence for Brazilian States

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Abstract. This paper seeks to investigate whether corruption influences and may be associated with per capita economic growth in Brazilian states. For this, information about per capita economic growth and an indicator of corruption for each Brazilian state are considered, in addition to control variables that aim to isolate the influence of corruption, such as the illiteracy rate of young people over 15 years old, population, GDP real, real GDP per capita, openness, total public expenditure, total public expenditure weighted by real GDP, total credit weighted real GDP and value-added of agriculture weighted by real GDP. The effects of these variables on per capita income are not linear and that is why the generalized method of moments (GMM) in 1st difference is used. The results indicate that corruption and economic growth are associated, and the three estimated models present the variables referring to the corruption indicator as statistically significant. These findings are useful for the scientific literature that investigates the influence of corruption on economic growth by bringing empirical evidence to Brazil and for more efficient decision-making by political decision-makers in combating corruption and the use of public resources.
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JEL. E02, E23, O11, O47.

1. Introduction

Citizens of emerging countries frequently hear about investigations by control bodies into corruption scandals. Infrastructure works halted under suspicion of irregularities in tenders, interruption in the supply of goods, and provision of services under signs of overpricing in contracts are just a few examples. Meanwhile, the population talks on the streets about what reality would be like if there were no misappropriation of public money, imagining how they could have a higher quality of life with this scenario. After the 1990s, the corruption hearing attracted the attention of several researchers in the areas of economics, political science, and sociology, attracted by the news and accusations of illegal practices in governments, both in developed and developing countries, large and small, liberal or conservative political orientation (Carraro, Fochezatto & Hillbrecht, 2006).

Carraro *et al.* (2006) state that although corruption is not a new phenomenon, the level of attention it has received suggests that there is more corruption than in the 20th century and reveal that with the increase in the number of countries with democratic governments in recent decades, it has been allowed the growth of spaces for discussing corruption, whether political or bureaucratic. At the same time, the growth of non-governmental

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institutions such as Transparency International has helped publicize corruption not only as a moral or political problem but also as an economic problem.

Serife & Gulbahar (2017), apud Bliss & Tella (1997), Ades & Tella (1999), Choi & Thum (1999), and Svensson (2005), demonstrate that with the increase in the number of databases available it was possible to analyze the economic effects of corruption. The authors outlined a broad theoretical framework on the economic causes of corruption and its effects, stating that most studies in the area focused on the relationship between corruption and macroeconomic indicators such as economic growth rate, GDP per capita, market structure, investment rate, public expenditure, volume of foreign direct investment, inflation, and international trade.

Therefore, the present work seeks to investigate the influences of corruption on the per capita economic growth of Brazilian states. For this, the Generalized Method of Moments (GMM) in the first difference is used - which aims to capture the non-linear effects of the variables - and a data panel composed of information on GDP per capita, an indicator of corruption, youth illiteracy rate over 15 years old, population, real GDP, real GDP per capita, openness, total public expenditure, total public expenditure/real GDP, total credit/real GDP and agricultural value-added/real GDP for the 27 federative units of Brazil in the period covers 1999 to 2007.

The results indicate that corruption and economic growth are associated, and the three estimated models present the variables referring to the corruption indicator as statistically significant. Furthermore, the control variables that aimed to isolate the non-linear effects of other components that may be associated with the per capita economic growth rate also proved to be significant. The contribution of this work is to generate empirical results so that economic policymakers can act effectively to obtain the best performance in the per capita economic growth of Brazilian states, combating corruption, and carrying out excellent public management, including not regarding public resources.

In addition to this introduction, this work has four more sections, where in Section 2 a literature review is constructed and in Section 3 the methodological aspects related to the data and the method used are presented. Section 4 presents the results and discusses them and, finally, Section 5 concludes.

2. Literature review

Several studies have investigated the effects of corruption and the possible determinants of economic growth, Mauro (1995) found that corruption had adverse effects not only on economic development but also on investments and the structure of official institutions. He found, through research, evidence that countries with low productivity and large state participation in the economy tend to have low economic growth and high levels of corruption. According to the author, in developed countries the degree of corruption in the economy is lower and there is a hypothesis that the greater the participation of the public sector, the greater the presence of corruption.

Boll (2010) apud Mauro (1995, 1997, and 1998), states that this author was a pioneer in the use of cross-section analysis to estimate the effects of how economic growth is affected by corruption. He highlights from his research, among other points, that with: - reduction of investment incentives -

entrepreneurs are aware that, with corruption, part of the profits from their future investments can be claimed by corrupt public officials; - reduction in the efficiency of aid flows - the diversion of public resources destined for social projects leads to a decrease in the volume of resources from aid funds, as many donors give up on making donations; tax collection losses – occur when there is corruption due to the misuse of arbitrary tax exemptions, or tax evasion. He cites that it was found that corruption and government spending on education are negatively related. Corrupt public officials prefer to carry out the types of expenditure through which they can collect bribes, so spending on education and health is sidelined overspending on major works, where it is easier to divert funds and collect bribes.

According to Serife & Gulbahar (2017), corruption, as an economic disease, is seen as one of the reasons behind poor economic performance. The negative effect of corruption on economic development has been the subject of many theoretical and empirical studies. There is quite an extensive literature claiming that corruption negatively affects economic growth and development, reduces investments, and leads to wasted resources. Corruption also undermines competition between people and institutions and leads to unfair social, political, and economic structures. Conversely, some researchers have argued that corruption can positively contribute to economic growth in countries with a weak institutional framework. Studies that support this view argue that in countries with a complex and stagnant bureaucratic structure, corruption in the form of bribery accelerates investments and boosts economic growth.

According to Ho & Huang (2011), the common point between Brazil, Russia, India, China, and South Africa, known as BRICs, is that they represent large countries with huge populations that are capable of generating immense needs and purchasing power. China, India, and Russia additionally benefit from its immense workforce, while Russia and Brazil enjoy abundant natural resources. In recent years, these four countries have experienced miraculous economic growth, not only because of the above reasons but also because they exported large quantities of goods, services, and resources and quickly built up foreign reserves. However, each of the BRIC countries faces other economic problems, such as a large income gap between rich and poor and money debt resulting from political corruption. Despite having a lower corruption perception index on average and therefore being countries known to face significant corruption, the BRIC countries still enjoy high economic growth rates likely to be accelerated by huge foreign investments.

Boll (2010) apud Tanzi & Davoodi (1998), report that in their research, the authors concluded that corruption distorts decisions regarding public investment. The degree of distortion is even greater when public institutions lack control, especially auditing. Studies indicate that corruption is directly associated with increased public investment, decreased government revenue, reduced expenditure on operations and maintenance, and poor quality of public infrastructure. Empirical evidence also shows that corruption encourages increased public investment and reduces productivity. The author's conclusion leads to the fact that the more resources available to corrupt agents, the greater the possibility of diverting them and, therefore, the greater the need to increase the volume of resources available through public investments.

According to Carraro, Fochezatto, & Hillbrecht (2006) and Mauro (1995), & Al-Marhubi (2000), in the economic aspect, there are several reasons why economy and corruption are related. First, by reducing revenues and increasing public spending, corruption can contribute to the generation of fiscal deficits, which in turn can have inflationary consequences. The existence of corruption in an economy can scare away (or discourage) the private investor from making new investments, as its existence, in addition to raising the cost of the investment, also increases the uncertainty about its success, which ends up negatively affecting the country's growth.

Third, according to the government, seigniorage has a reason to create inflation. The existence of corruption in tax collection and tax evasion can motivate the government to transform the inflation tax into another source of government revenue, generating more inflation. By affecting the return on capital, corruption will decrease a country's income potential by reducing the productivity of capital. Likewise, by affecting capital income, corruption affects gross household income, and consequently, household net income and household savings.

Serife & Gulbahar (2017) apud Aliyu & Elijah (2008), state that in a study conducted in Nigeria, the authors found that corruption negatively affected economic development, human capital development, and total employment. Knack & Keefer (1995), Mo (2001), Leite & Weidmann (2002), Neeman, Paserman, & Simhon (2004), Pellegrini & Gerlagh (2008), Méon & Sekkat (2005) and Ahmad (2008) reveal that corruption negatively affected economic development and GDP per capita. Aidt, Dutta, & Sena (2008) argued that corruption negatively affects economic development in countries with high institutional quality, while corruption has no impact on economic growth in countries with low institutional quality.

Caldeira (2016) states that corruption is an activity widely present in Brazil and a driver of widespread dissatisfaction, lack of credibility, displeasure, and social distress, with many political and economic losses, as well as delays in social development. It corrupts all layers of society and is considered a strong drag on development and economic growth. Based on the research of several authors, She highlights two points of view on the topic:

Researchers can argue that corruption can serve as a boost to economic growth as it helps to overcome bureaucratic constraints, inefficient public service delivery, and inefficient laws in countries with a weak system typical of developing countries; conversely states that: - other researchers have the opposite view and believe that corruption can only have negative effects on a society's economic and political system and only have a negative correlation with economic growth, due to rent-seeking, inefficient investments, poor allocation of resources and the creation of market uncertainty.

It is with this scientific literature that this work seeks to contribute by providing empirical evidence of the impacts of corruption on GDP per capita growth in Brazilian states.

3. Methodology

3.1. Data

The data used are annual observations from the 26 Brazilian federative units from 1999 to 2007, forming a balanced panel. The period selected is due to the availability of information by the Brazilian control body - the Federal

Audit Court - regarding the reports of irregularities that make up the corruption indicator, which is only for these years. The dependent variable is the growth rate of real GDP per capita ($RRGDPpc$), obtained from the work of Bertussi (2010) - after being constructed from data from Ipeadata and the Brazilian Institute of Geography and Statistics.

The explanatory variable of interest is the corruption indicator ($CorI$), obtained from the work of Boll (2010) - which was constructed using the methodology of the Government Corruption Indicator of each Brazilian State. The purpose of this indicator was to use the database (CADIRREG) of accounts considered irregular by the Federal Audit Court (TCU) to form a composite indicator of government corruption that would weigh the financial value of accounts considered irregular by the population, GDP, number of accounts considered irregular by a state about the national total and the value corresponding to the annual expenses of the three powers of the Republic, established by the Annual Budget Law (LOA).

Furthermore, the control variables population (Pop) and illiteracy rate of young people over 15 years old (IR) obtained from the Brazilian Institute of Geography and Statistics, real GDP ($RGDP$) and real GDP per capita ($RGDPpc$) obtained from the Institute of Applied Economic Research, openness (Op) constructed from data from the federal government's secretariat of foreign trade and Ipeadata, total public expenditure (TPE) and total public expenditure/real GDP $\left(\frac{TPE}{RGDP}\right)$ obtained from the Secretariat of Brazilian National Treasury, total credit/real GDP $\left(\frac{TC}{RGDP}\right)$ and agricultural value-added/real GDP $\left(\frac{AVA}{RGDP}\right)$ obtained from the Central Bank of Brazil. Table 1 presents the descriptive statistics of the variables.

Table 2. *Descriptive statistics*

Variables	Min.	Mean	Median	Max.	Std. Dev.
$RRGDPpc$	-0.232400	0.038200	0.025400	0.512700	0.088170
$CorI$	0.00000	0.212037	0.14900	0.950000	0.189299
Pop	321722.1	6640973.	3331348.	41055734	7916835.
IR	3.730000	14.05213	11.1400	32.76000	7.774549
$RGDP$	867672.9	47202686	201157093	5.17E+08	84555068
$RGDPpc$	1.500000	5.881250	4.975000	23.29000	3.697659
Op	0.68000	45.78921	32.41500	210.1800	42.29570
TPE	2.68E+08	3.66E+09	1.087E+09	3.20E+10	5.36E+09
$\frac{TPE}{RGDP}$	4.640000	11.62245	10.39500	36.34000	5.393898
$\frac{TC}{RGDP}$	59.60587	541.1049	455.0023	3817.134	411.5344
$\frac{AVA}{RGDP}$	0.021000	43.63341	26.30117	246.9888	50.02588

Source: Elaborated by authors.

3.2. Generalized moment method

According to Hall (2011), GMM estimation provides a computationally convenient way to estimate parameters of economic models. It can be applied equally in linear or non-linear models, in single equations or systems of equations, and in models involving cross-section, panel, or time series data. This convenience and generality have led to the application of GMM in many areas of empirical economics, and the method is often used in

macroeconomics. The emergence of GMM can be considered one of the most important developments in the econometric analysis of macroeconomic models in the last 35 years. Once the data is defined, the econometric model can be used based on Equation (1).

$$RRGDPpc_{it} = \beta_0 + \beta_1 RRGDPpc_{it-1} + \beta_2 CorI_{it} + \beta_3 (CorI)^2_{it} + \beta_4 Pop_{it} + \beta_5 (Pop)^2_{it} + \beta_6 IR_{it} + \beta_7 (IR)^2_{it} + \beta_8 RGDP_{it} + \beta_9 (RGDP)^2_{it} + \beta_{10} RGDPpc_{it} + \beta_{11} (RGDPpc)^2_{it} + \beta_{12} Op_{it} + \beta_{13} (Op)^2_{it} + \beta_{14} TPE_{it} + \beta_{15} (TPE)^2_{it} + \beta_{16} \frac{TPE}{RGDP}_{it} + \beta_{17} \left(\frac{TPE}{RGDP}\right)^2_{it} + \beta_{18} \frac{TC}{RGDP}_{it} + \beta_{19} \left(\frac{TC}{RGDP}\right)^2_{it} + \beta_{20} \frac{AVA}{RGDP}_{it} + \beta_{21} \left(\frac{AVA}{RGDP}\right)^2_{it} + u_{it} (1)$$

It is observed that this empirical model of Equation (1) tests non-linear relationships between the explanatory variables and the variable of interest. Brei, Ferri, & Gambacorta (2018) also use, among the independent variables they selected in their work, the same square variables, precisely to test non-linear relationships between these independent variables and the dependent variable.

4. Results

Once the methodological aspects are defined, the empirical results can be verified. Using GMM, the selected variables are empirically tested using 3 models. The difference between them is that while model 1 presents all contemporary variables, model 2 lags the variables of corruption by one lag, and model 3 lags the variables of total public expenditures also in a lag. Table 2 presents the estimation results of the 3 models.

Table 2. *Results*

	Dependent Variable		
	RRGDPpc		
	Model 1	Model 2	Model 3
$RRGDPpc_{t-1}$	-0.059103 *	-0.234938 *	-0.227154 *
	(0.716708)	(0.115941)	(0.178938)
$CorI$	-0.082658 *	0.076267 *	1.021696 *
	(1.032362)	(0.431509)	(0.601240)
$(CorI)^2$	0.301466 *	-0.770238 *	-1.051220 *
	(1.499318)	(1.684538)	(0.820959)
Pop	-1.50E-06 *	4.45E-08 *	-2.92E-07 *
	(5.38E-06)	(8.40E-07)	(6.09E-07)
$(Pop)^2$	3.48E-14 ***	-4.02E-07 *	-2.06E-15 *
	(7.65E-14)	(1.78E-14)	(1.57E-14)
IR	0.0544308 *	-0.034498 *	-0.0077146 *
	(0.144942)	(0.064358)	(0.097979)
$(IR)^2$	-0.001372 ***	0.001134 **	0.002252 *
	(0.003804)	(0.002362)	(0.003512)
$RGDP$	3.79E-08 ***	-6.71E-10 *	-1.30E-08 *
	(6.17E-08)	(2.41E-08)	(5.52E-08)
$(RGDP)^2$	-0.000647 *	-4.59E-18 *	5.41E-17 *
	(0.013685)	(1.04E-16)	(1.39E-16)
$RGDPpc$	0.008864 *	0.350195 *	0.339718 *
	(0.627749)	(0.109477)	(0.157223)
$(RGDPpc)^2$	-0.000647 *	-0.006506 *	-0.005879 *
	(0.013685)	(0.005145)	(0.007202)

Op	0.001419 *	-0.008172 *	-0.013725 *
	(0.008671)	(0.006361)	(0.011875)
$(Op)^2$	-3.89E-05 *	2.07E-05 ***	6.28E-05 *
	(4.41E-05)	(4.11E-05)	(6.00E-05)
TPE	1.64E-10 *	-4.09E-11 *	-1.23E-10 *
	(5.47E-10)	(6.80E-10)	(2.47E-10)
$(TPE)^2$	-3.68E-21 *	1.58E-21 *	4.03E-21 *
	(9.62E-21)	(2.68E-20)	(2.81E-20)
$\frac{TPE}{RGDP}$	0.000290 *	0.093861 *	0.163252 *
	(0.234263)	(0.158379)	(0.223646)
$\left(\frac{TPE}{RGDP}\right)^2$	-9.50E-05 *	-0.001859 *	-0.003879 *
	(0.004765)	(0.002971)	(0.004644)
$\frac{TC}{RGDP}$	-0.000246 *	-0.000316 *	-0.000512 *
	(0.001039)	(0.001279)	(0.001454)
$\left(\frac{TC}{RGDP}\right)^2$	8.63E-08 *	6.52E-08 *	2.31E-07 *
	(3.68E-07)	(4.47E-07)	(4.78E-07)
$\frac{AVA}{RGDP}$	-0.006639 *	-0.000431 *	0.005033 *
	(0.006955)	(0.006444)	(0.009923)
$\left(\frac{AVA}{RGDP}\right)^2$	2.46E-05 *	8.23E-06 *	-1.60E-05 *
	(1.73E-05)	(2.09E-05)	(2.47E-05)
Effects Specification			
Sum squared resid	14.20049	2.405054	11.48710
J-statistic	8.16E-13	4.161525	0.850843

Note: (*): prob < 1%; (**): 1 < prob < 5%; (***): 5% < prob. <10%. Instrument specification: ($RRGDPpc_{t-2}$) and constantly added to the Instruments list.
Source: Elaborated by authors.

The dynamic model presented shows the growth rate of GDP per capita being explained by itself lagged by one year and by the explanatory variables related to corruption, population, illiteracy rate of young people over 15 years old, real GDP, real GDP per capita, openness, public expenditure, public expenditure weighted by real GDP, total credit weighted by real GDP and added value of agriculture weighted by real GDP, in addition to each of these variables in their quadratic form.

In all models, the estimated coefficient of GDP per capita growth rate is negative and statistically significant at the 1% level. The sign of the estimated coefficients, focusing on the pairs of explanatory variables and their respective squares included in the model, contribute to verifying how these variables would behave considering the curve that would be formed - concave or convex. With the sign of the original variable being positive and its respective square negative, it will represent a concave curve, where higher values/volumes of a given explanatory variable in the model listed in Equation I would indicate a drop in the per capita economic growth rate to a minimum point; but from this lowest point on the curve, the higher the indicator value, the higher the per capita economic growth rate.

On the other hand, if the sign of the original variable is negative and its respective square is positive, the slope of this curve will be convex, in which greater quantities of the explanatory variable will lead to an increase in the per

capita economic growth rate up to a maximum point; however, from this maximum point on the curve, the higher the value of the indicator, the lower the per capita economic growth rate tends to be.

Therefore, it is necessary to highlight an exception that exists in the empirical results of the models in question. In model 2, the real GDP variable and its respective square both present negative estimated coefficients, and the same happens in model 3 with the population variable and its squared value. For both cases, this mathematical measurement based on concave and/or convex functions is not possible.

The corruption variables are statistically significant at 1% in the 3 models. In model 1 they form a convex curve and in models 2 and 3 they produce a concave curve. With model 1, the increase in corruption provides an increase in the per capita economic growth rate of Brazilian states, as happens in developing economies that have inefficient laws, severe bureaucratic restrictions, and precarious public services; however, this happens up to a certain point and, from that point on, new episodes of corruption tend to reduce per capita economic growth.

In models 2 and 3, initially, the increase in corruption would lead to a reduction in per capita economic growth to a minimum point; however, after this minimum point, the continuation of widespread corruption, through the various intricacies existing in Brazilian politics - such as the carrying out of works and fraudulent tenders - these public resources used - even if defrauded - would contribute to an increase in the growth rates of Brazilian states. Serife & Gulbahar (2017) confirm this situation by stating that some researchers argue that corruption can contribute positively to economic growth in countries with weak institutional structures. Studies supporting this view argue that in countries with a complex and stagnant bureaucratic structure, corruption in the form of bribery accelerates investment and boosts economic growth.

The explanatory variable related to population is significant at 1% in the 3 models, while the squared variable is significant at 10% in model 1 and 1% in models 2 and 3. This pair of indicators in model 1 forms a convex curve and in model 2 a concave function, while in model 3 both signs are negative - representing that population growth tends to continually reduce the per capita economic growth rate. In model 1, population increase tends to increase per capita economic growth up to a maximum point; however, from this point onwards, the demographic increase would bring a reduction in the per capita economic growth rate. In model 2, however, the opposite of model 1 happens, as at first the population increase would cause the drop in the per capita economic growth rate to return to a minimum point, but after that, new inhabitants would contribute directly to the evolution of the population. per capita economic growth rate.

The variables related to illiteracy among young people over 15 years old, openness, and public expenditure - and their quadratic forms - present similar characteristics in the formation of the curves. In model 1, concave curves are formed and in models 2 and 3, convex curves are presented. In terms of statistical significance, the illiteracy rate of young people over 15 years old presents 1% for the 3 models, while its specific square brings 10% in model 1, 5% in model 2, and 1% in model 3. Conversely, openness is statistically significant at 1% in the 3 models and its respective variable squared at 1% in

models 1 and 3 and 10% in model 2. The public expenditure variable - in both forms - is statistically significant at 1% in 3 models.

These three pairs of variables, when forming concave curves in model 1, specifically show that larger quantities of their measurement units generate a drop in per capita economic evolution, until reaching a minimum point; but from this point onwards, the continued evolution of the respective units of measurement would provide an increase in per capita economic growth rates. For models 2 and 3, the interpretation and justification are exactly opposite, convex curves. Initially, its units of measurement would generate an individual increase in terms of economic growth up to a maximum point; however, from this point onwards, new and increasing values of these units of measurement would cause a reduction in per capita economic growth rates.

The real GDP indicator is statistically significant at 10% in models 1 and 1% in models 2 and 3, while the squared indicator is statistically significant at 1% in model 3. Its behavior is practically the same as the three previous pairs of parameters. The exception is in model 2, in which both variables have a negative sign, indicating constancy in the sense of causing a drop in the per capita growth rates of Brazilian states.

The variables representing real GDP per capita, and public expenditure weighted by real GDP - and their quadratic forms - are statistically significant at 1% and the two pairs of indicators form concave curves for the 3 models. This reduction means that increases in the volume of variable measurements would initially cause a reduction in the per capita economic growth rate of Brazilian States, to a minimum point; however, from this point onwards, the atomization of these measurement units would tend to increase per capita economic growth rates.

About total public expenses weighted by real GDP, it is possible to verify that these expenses primarily benefit the dominant classes, through the action of influential agents linked to politics, thus concentrating economic progress. Only after a certain period would the less favored classes have access to public spending, through the capture of quality public services, such as education, health, insurance, and other benefits.

The variables representing total credit weighted by real GDP and total credit weighted by real GDP squared are, in the 3 models, significant at 1% and form convex curves. This means that the increase in credit granting, weighted by real GDP, generates an increase in per capita economic growth rates up to a certain limit; and from then on, new loans would reduce the economic growth of Brazilian states. Looking at Brazilian society, this finding could make sense, since initially, more people would have access to credit.

This would support the most diverse activities and, consequently, a positive increase in per capita economic growth rates. However, at a certain point, access to credit would become more difficult, and only a small portion of the population - the most socially influential - would continue to have access to these resources, which could generate income concentration and negatively impact GDP per capita growth rates.

The indicators of agricultural value added weighted by real GDP - and their quadratic form - are significant at 1% in the 3 models. In models 1 and 2, convex curves are formed and the interpretation of these results follows the same reasoning as for total credit indicators weighted by real GDP. Model 3, conversely, forms a concave curve, for which the amounts of rural credit lent would initially cause a reduction in per capita economic growth rates; until,

after a minimum level, new amounts disbursed would provide an increase in per capita levels of economic growth.

It makes sense to think that, first, the granting of rural credit would be concentrated, due to rates subsidized by the federal government and scarce resources, with access only to the most influential. Only after this - if there were resources left over - would credit be disseminated, with the consequent reach of small rural producer families through the National Family Farming Program (Pronaf).

Finally, when making an analogy, it can be stated that the J Test for the GMM model would be analogous to the R^2 adjusted in the ordinary least squares (OLS) model. Also, low estimator values - such as the results obtained in this work - may indicate well-adjusted models, with adequately estimated variables and, in a second analysis, the absence of endogeneity bias between the explanatory variables. Additionally, when considering the sum of the squares of the residuals, model 2 - by presenting the smallest sum of the tested values - behaves as the best-adjusted model.

5. Conclusion

The present work sought to investigate possible influences of corruption on the Brazilian per capita economic growth rate. For this, the generalized moment method (GMM) and annual data from 1999 to 2007 are used for the 27 Brazilian federative units referring to the per capita growth rate, an indicator of corruption, the population, the illiteracy rate of young people above 15 years, real GDP, real GDP per capita, openness, total public expenditure, total public expenditure weighted by real GDP, total credit weighted by real GDP and the added value of agriculture weighted by real GDP.

It seems clear to a group of researchers from developing economies that, with inefficient laws, corruption can initially be favorable to economic growth, as it can help to overcome bureaucratic restrictions and inefficient provision of public services. However, conversely, corruption only has negative effects on the economic and political system of a society, derived from the search for rent, inefficient investments, the poor distribution of resources, and, finally, the creation of uncertainty in the market.

The results indicate that corruption and economic growth are associated. In the 3 models tested, the variables referring to the corruption indicator were statistically significant at 1%. In model 1 corruption presented a convex curve and in models 2 and 3 a concave curve. Thus, it is possible to see through the 3 models that the corruption indicator is influencing the per capita economic growth rate, sometimes contributing to a positive increase and other times generating a per capita reduction in economic growth. Furthermore, all control variables that aimed to isolate the non-linear effects of other important components that can influence the per capita economic growth rate also proved to be significant in the estimated models.

These findings are useful for the scientific literature that investigates the influences of corruption on economic growth by bringing empirical evidence to Brazilian states, to economic policymakers who aim for actions that promote economic growth, and to policymakers who seek to combat corruption and manage public resources more efficiently.

References

Ades, A., & Tella, R.D. (1999). Rents competition and corruption. *American Economic Review*, 89(1), 982–993. doi. 10.1257/aer.89.4.982

Ahmad, N. (2008). Corrupt clubs and the convergence hypothesis. *The Pakistan Development Review*, 45, 1001–1009.

Aidt, T., Dutta, J., & Sena, V. (2008). Governance regimes, corruption and growth: Theory and evidence. *Journal of Comparative Economics*, 36, 195–220. doi. 10.1016/j.jce.2007.11.004

Aliyu, S.U.R., & Elijah, A.O. (2008). Corruption and economic growth in Nigeria: 1986–2007. *MPRA Paper*, No. 12504. [Retrieved from].

Alexeev, M., & Song, Y. (2013). Corruption and product market competition: An empirical investigation. *Journal of Development Economics*, 103, 154–166. doi. 10.1016/j.jdeveco.2013.02.010

Al-Marhubi, F.A. (2000). Corruption and Inflation. *Economics Letters*, 66(2), 199-202. doi. 10.1016/S0165-1765(99)00230-X

Bertussi, G.L. (2010). Gastos públicos com infra-estrutura de transporte e crescimento econômico: Uma análise para os estados Brasileiros. Tese (Doutorado em Economia) - UnB. [Retrieved from].

Boll, J.L.S. (2010). A corrupção governamental no brasil: construção de indicadores e análise da sua incidência relativa nos estados brasileiros. Dissertação (Mestrado em Economia do Desenvolvimento) – PUCRS. [Retrieved from].

Bliss, C., & Tella, R.D. (1997). Does Competition Kill Corruption? *Journal of Political Economy*, 105(5), 1001–1023. doi. 10.1086/262102

Brei, M., Ferri, G., & Gambacorta, L. (2018). Financial structure and income inequality. *BIS Working Papers*, Monetary and Economic Department, No.756. [Retrieved from].

Caldeira, D.R. (2016). Corruption in Brazil and its Effects on Economic Growth. Tallinn University of Technology, School of Economics and Business Administration. Department of Finance and Economics. Chair of Theoretical Economics. [Retrieved from].

Carraro, A., Fochezatto, A., & Hillbrecht, R.O. (2006). O impacto da corrupção sobre o crescimento econômico do brasil: aplicação de um modelo de equilíbrio geral para o período 1994-1998. ANPEC: Área 5 - Crescimento, Desenvolvimento Econômico e Instituições. [Retrieved from].

Choi, J.P., & Thum, M. (1999). The economics of repeated extortion. *The Rand Journal of Economics*, 35(2), 203–223. doi. 10.2307/1593688

Hall, A.R. (2011). Generalized Method of Moments. University of Manchester. [Retrieved from].

Ho, Y.H., & Huang, C.J. (2011). The corruption-economic growth nexus: Evidence from four BRIC countries based on the panel data approach. *Journal of Global Business & Technology*, 7(2), 44-53.

Huang, C.J. (2016). Is corruption bad for economic growth? Evidence from Asia-Pacific countries. *The North American Journal of Economics and Finance*, 35, 247-256. doi. 10.1016/j.najef.2015.10.013

Jiang, T., & Nie, H. (2014). The stained China miracle: Corruption, regulation, and firm performance. *Economics Letters*, 123, 366–369. doi. 10.1016/j.econlet.2014.03.026

Knack, S., & Keefer, P. (1995). Institutions and economic performance: Cross-country tests using alternative institutional measures. *Economics and Politics*, 7(3), 207–227. doi. 10.1111/j.1468-0343.1995.tb00111.x

Leite, C., & Weidmann, J. (2002). Does mother nature corrupt? Natural resources, corruption, and economic growth. *In* G.T. Abed & S. Gupta (Eds.), *Governance, Corruption, & Economic Performance*. Washington: International Monetary Fund, Publication Services.

Mauro, P. (1995). Corruption and crowth. *The Quartely Journal of Economics*, 110(3), 681-712. doi. 10.2307/2946696

Mauro, P. (2017). Why worry about corruption? FMI, *Economic Issues,* No.6. [Retrieved from].

Mauro, P. (1998). Corruption and the composition of government expenditure. *Journal of Public Economics*, 69(2), 263-279. doi. 10.1016/S0047-2727(98)00025-5

Méon, P.G., & Sekkat, K. (2005). Does corruption grease or sand the wheels of growth? *Public Choice*, 122, 69-97. doi. 10.1007/s11127-005-3988-0

Neeman, Z., Paserman, D., & Simhon. A. (2004). Corruption and openness. *Department of Economics. Hebrew University Working Paper*, No.353. [Retrieved from].

Özsahin, S., & Üçler, G. (2017). The consequences of corruption on inflation in developing countries: Evidence from panel cointegration and causality tests. Economies, 5(4), 49. doi. 10.3390/economies5040049

Pellegrini, L., & Gerlagh, R. (2008). Causes of corruption: A survey of cross country analyses and extended results. *Economics of Governance*, 9, 245–263. doi. 10.1007/s10101-007-0033-4

Svensson, J. (2005). Eight questions about corruption. *Journal of Economic Perspectives*, 19(3), 19–42. doi. 10.1257/0895330057743578 60
Tanzi, V., & Davoodi, H. (1998). Corruption, public investment, and growth. *In* The welfare state, public investment, and growth. [S.l.]: Springer, p. 41–60. [Retrieved from].