

# Corruption, Investments and Economic Growth

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*Empirical evidence is mixed concerning the effects of investments and corruption on economic growth. This paper uses multivariate regressions for 28 European countries starting from an extension of Lucas' model that introduces public physical capital and the qualitative component of human capital. It concludes that private investments have a positive influence on economic growth, whereas public investments and corruption are not determinants of the economic growth on the period 1996-2005. Corruption affects the allocation process of public funds to public investments in infrastructure. The results are important for understanding economic growth in European Union and for improving the decision of public funds allocation.*

Field of research: Economic Growth of Open Economies

## 1. Introduction

This paper aims at explaining the impact of determinant factors on economic growth. The issue is very important for public authorities in order to base their financial decisions, the ultimate objective being to insure economic growth. It is also important in the valuation process of the efficiency of public and private funds allocations. Many studies try to find the determinants of the economic growth. Private investments, public investments and corruption are often mentioned. The aim of this study is to determine the relationship between investments, corruption and economic growth.

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## 2. Literature Review

The theoretical studies of Barro, Lucas and Romer (Darreau, 2003) emphasize the positive role of public and private investments on economic growth and its velocity. Some empirical studies, especially on the European Union countries, report a negative correlation between different kinds of public investment and economic growth. Casseli, Esquivel and Lefort (1996) and Dessus (2000) find a negative correlation between public expenses for education and economic growth. Dessus (2000) considers that this is the effect of the inefficiency of public education systems. Wang and Huang (2006) emphasize the inefficiency of public investments in research and development in most of the countries. On the other hand, there are studies that conclude a positive effect of the public investment on economic growth. These studies find that public investments generate economic growth, also leading to the increase of the productivity of private investments (Chatterjee, Sakoulis and Turnovsky, 2003; Everaert, 2003; del Mar Salinas-Jimenez, 2004; Chakraborty, 2004; Rivera and Currais, 2004; Pina and St. Aubyn, 2005).

Other studies on the effect of public investments on economic growth conclude that there is a positive correlation between the two variables only if some conditions are fulfilled. These conditions refer to the fiscal and budgetary policy and to the level of incorporated technology (Blankenau and Simpson, 2004), or to the substitution rate elasticity between private and public goods (Akira, 2004). Kriekhaus (2002) demonstrates that economic growth depends on public sector ability to mobilize financial resources for investment. Public investments are particularly important for the economic development. Fielding (2003) mentions that the income inequalities and health degree are important factors of the economic growth that are influenced by the public investment levels. Lopez (2003) analyses the Latin American case and finds out that public subsidies do not replace public investment, revealing that the lack of public investments in infrastructure and human capital leads to economic stagnation, social inequities and environmental destruction.

Many studies in the financial literature analyse the efficiency of the public investments (Alfonso and Fernandes 2005; Esteller and Sole, 2005; Alfonso, Schuknecht and Tanzi, 2006). Other studies determine the influence of public investments and the impact of corruption in the public sector on economic growth (Mauro, 1995; Sarkar and Hasan, 2001; Ventelou, 2002). Many recent papers conclude that overall financial development and legal system efficiency influence economic growth (Beck, Demirgüç-Kunt, Levine and Maksimovic, 2001; Beck and Levine, 2002; Demirgüç-Kunt and Maksimovic, 2002; Levine, 2002). Corruption represents the most important dysfunction of the decisional process in public investments. According to Sarkar and Hasan (2001), corruption is a public authority abuse for private benefits. Its well-known manifestation is bribery, but it also appears under the form of influencing public decision for the decision maker's personal interest. Mauro (1995) demonstrates that it affects economic growth by determining a suboptimal use of the existing stock of public investments, but also the future growth, by generating an inadequate allocation of public funds for investments.

The two manifestations superpose on the concept of efficiency of public fund allocation for investments and exploitation efficiency (Semenescu, 2006).

However, some economists state that corruption may also have a positive effect on the economic growth provided that public authorities' decisions are improper (Acemoglu and Verdier, 1996). Del Monte and Papagni (2000) considers that in order to estimate the entire impact of corruption on economic growth it is necessary to quantify two effects: a direct effect resulting from the exploitation of public investments and an indirect effect determined by the allocative inefficiency of public investments decisions<sup>i</sup>. Two final remarks impose. First, the corruption effect on economic growth is induced by other channels too, such as public and private consumption, private direct investments, portfolio investments (Lambsdorff, 2003; Habib and Zurawicki, 2003). Corruption is a phenomenon that affects, independently or correlatively, all the determinants of the economic growth.

### 3. Methodology and Research Design

The analysis is based on a simple model that constitutes an extension of Lucas' model of endogenous economic growth. In Lucas' model, the determinants of output are: physical capital, labour, and human capital.

We introduce the following hypotheses:

- 1. The physical capital is composed of private physical capital (K) and public physical capital (I) mainly constituted of infrastructure goods.
- 2. Labour (L) is the quantitative component of human capital while public investments in human capital generate the qualitative component (H) of it.

Hence, our model introduces (i) public physical capital and (ii) the qualitative component of human capital generated only by public investments in human capital. The introduction of the public physical capital in the model is realized by a factor I that determines, along with the physical private capital K and the labour factor L, the output level. The public infrastructure is considered entirely formed by pure public goods characterized by non-rival consumption and free supply. The quality of human capital is generated by public investments in education, culture and health services with non-rival consumption and free supply.

The population is composed of N identical agents who consume, in each period, a part  $\mu$  of their time for realising a homogenous productive good and the rest of the time  $(1-\mu)$  for education or actions that improve the future productivity. The current output is produced by using the entire stock of private physical capital, public infrastructure and labour force. Like in Lucas' model, we assumed the hypothesis of an endogenous economic growth based on human capital quality. Moreover, the hypothesis of an intergenerational altruism, which allows considering the population composed of individuals with infinite lifetime and horizon, is also assumed. All individuals have the same education level generated by public investments in education and use the same share of their time  $(1-\mu)$  in order to benefit from public investments in human capital.

The corruption in public administration determines a certain degree of inefficiency. Thus, we introduce a factor named CPI to explain this effect. CPI is an estimator for the corruption degree taking high values for low corruption. It is used to reflect the effect of public system corruption on human capital accumulation, but also on public investments in physical capital<sup>iii</sup>.

Hence, we model the output function as follows:

$$Y=A*K^{\alpha}*(I*CPI)^{\beta}*L^{\gamma}*(H*CPI)^x, \quad (1)$$

where:

A is a coefficient that estimates the technology level,

K is the private physical capital,

I is the public physical capital,

L quantifies the labour force,

H is the qualitative component of human capital.

The exponents respect the condition  $\alpha+\beta+\gamma=1$ , and x reflects the external effects of the qualitative component of human capital which is the endogenous economic growth factor. As in the case of human capital, the public physical capital is also influenced by corruption that reduces the public funds allocation efficiency.

Equation (1) becomes:

$$Y= A * K^{\alpha} * (I*CPI)^{\beta} * (\mu*N)^{\gamma} * (H*CPI)^x \quad (1')$$

The production function per capita becomes:

$$y=A * k^{\alpha} * (I*CPI)^{\beta} * \mu^{1-\alpha-\beta} * (H*CPI)^x \quad (2)$$

where:

k is the endowment with physical private capital of the population.

The average public physical capital per habitant can be computed as bellow<sup>iv</sup>:

$$I*CPI/N= I*CPI$$

Using the logarithm, the equation (2) becomes:

$$\ln(y) =\ln(A)+\alpha\ln(k) +\beta\ln(I) +\beta\ln(CPI) +(1-\alpha-\beta)\ln(\mu) + x\ln(H)+ x\ln(CPI) \quad (3)$$

or:

$$\ln(y) = \ln(A)+\alpha\ln(k) +\beta\ln(I)+ (\beta+x) \ln(CPI) +(1-\alpha-\beta)\ln(\mu) + x \ln(H) \quad (3')$$

in growth rates:

$$gy= \alpha*gk+\beta*gl+(\beta+x)*gCPI+ x*gH \quad (4)$$

Following in the paper, this model is tested on a sample of countries containing the European Union member states, Norway and Iceland.

Two hypotheses are introduced to adjust our model in order to apply to real economy case:

- 3. The growth rate of physical capital is the growth rate of investments<sup>v</sup>.
- 4. The growth rate of qualitative component of human capital is the growth rate of public investment in human capital<sup>vi</sup>.

In this study, the gross domestic product per capita growth rate was chosen as indicator for economic growth. The data about the gross domestic product is obtained from the International Monetary Fund database. The gross domestic product based on purchasing-power-parity (PPP) per capita was preferred in order to better reflect the cost of life and the development level for the countries in the sample. The corruption, is represented in the study by the Transparency International's annual Corruption Perception Index (CPI). The Transparency International Corruption Perception Index ranks countries in terms of the degree to which corruption is perceived to exist among public officials and politicians, with a range from 0 (minimal value) to 10 (maximal value). Public investment was divided in two parts: infrastructure investment and the human investment. This operation was performed in order to study the effect of each kind of public investment on the economic growth.

The data about the public investments was obtained from Eurostat, the European Commission database. The annual growth rate of private investment per capita was supplied, also, by Eurostat. This paper develops an international empirical study on a sample of countries containing 26 member states of the European Union, Norway and Iceland. The data sample covers the period from 1996 to 2005 and contains annual information about 28 countries, meaning 280 records. In this study, Luxemburg was excluded from the sample because it records a very high gross domestic product per capita compared to the other records<sup>vii</sup>. The variables used in this study are described in Table no. 1.

**Table 1. Variables.**

Variables	Symbol	Description
Gross Domestic Product PPP per capita	GDP	Considered as an estimator for economic growth. Source: IMF database.
The growth rate of the Gross Domestic Product PPP per capita	gy	
Corruption perception index	CPI	Considered as estimation for the corruption. Source: Transparency International
Corruption perception index growth rate	gCPI	
The public investment in infrastructure	Inv	Estimators for the public investment in infrastructure
The public investment in infrastructure growth rate	gl	
The public investment in human capital	HI	Indicators for the public investment in human capital
The public investment in human capital growth rate	gH	
The annual private investment per capita	k	Considered as estimators for private investment
The annual growth rate Of private investment per capita	gk	

The analyses that have been done by asking a question in the survey about the influence of the data published in the past years on the answers given in the present survey revealed no correlation of the CPI with its past values and allow using it in a regression. Due to the characteristics of the database, with a great number of states and ten different years, we performed an analysis with panel data and fixed effects. The idea is to assign dummy variables to each country in the panel, in order to describe the characteristics of each country.

In order to test the significance of private and public investment and corruption on economic growth, the following equations were selected.

$$gy_t = \alpha \cdot gl_t + \beta \cdot gH_t + \gamma \cdot gH_{t-1} + \delta \cdot gk_t + \lambda \cdot gCPI_t + \varepsilon \quad (5),$$

and

$$gy_t = \alpha \cdot g(I^*CPI)_t + \beta \cdot g(H^*CPI)_t + \gamma \cdot g(H^*CPI)_{t-1} + \delta \cdot gk_t + \lambda \cdot gCPI_t + \varepsilon \quad (6).$$

The second regression tests if corruption has a stronger effect on economic growth when it manifests in the process of funds allocation for public investments or in the exploitation of public investments.

## 4. Discussion of Findings

The results for the regression (5) are presented in table 2.

**Table 2. Results for regression (5)**

Independent variables	<b>gy<sub>t</sub></b>
	<b>Regression (5)</b>
<b>gk<sub>t</sub></b>	0.113451*** [8.139559]
<b>gy<sub>t-1</sub></b>	0.196713*** [3.567654]
<b>C</b>	0.039119*** [13.53594]
<b>F-statistic</b>	24.24713***
<b>Durbin-Watson test</b>	2.098
<b>Number of observations</b>	198

$$gy_t = \alpha * gk_t + \mu * gy_{t-1} + \sum \beta_i d_i + \sum \gamma_i c_i + c + \varepsilon \quad (5')$$

$$gy_t = 0.113451 * gk_t + 0.196713 * gy_{t-1} + 0.039119 + \sum \beta_i d_i + \sum \gamma_i c_i + \varepsilon \quad (5''),$$

where  $d_i$  are dummy variables for each country in the sample (for example,  $d_1=1$  for Austria and 0 for the other countries) and  $c_i$  are dummy variables corresponding to each year analyzed. The results show that public investment in infrastructure is not a determinant factor of economic growth, as well as public investment in human capital. Also, the perception on the corruption in public administration does not have a significant influence on the economic growth. This result may be explained by the low level of corruption in the developed countries. Private investments are determinants of the economic growth, as well as its level in the previous year, suggesting that private investments represent a better allocation of the national income than public investments and hence sustaining the neoclassical theory regarding public finance. The results for regression (6) are presented in table 3:

**Table 3. Results for regression (6)**

Independent variables	<b>gy<sub>t</sub></b>
	<b>Regression (6)</b>
<b>G(I*CPI)<sub>t</sub></b>	-0.002884* [-2.161201]
<b>gk<sub>t</sub></b>	0.076425*** [4.696519]
<b>gy<sub>t-1</sub></b>	0.421222*** [6.363595]
<b>C</b>	0.027490*** [8.494466]
<b>F- statistic</b>	29.88124***
<b>Durbin-Watson test</b>	2.2119

$$gy_t = a * g(i * cpi)_t + b * gk_t + e * gy_t + c + \sum \beta_i d_i + \sum \gamma_i c_i + \varepsilon \quad (6')$$

$$gy_t = -0.002884 * g(i * cpi)_t + 0.076425 * gk_t + 0.421222 * gy_t + 0.027490 + \sum \beta_i d_i + \sum \gamma_i c_i + \varepsilon \quad (6')$$

where  $d_i$  are dummy variables for each country in the sample (for example,  $d_1=1$  for Austria and 0 for the other countries) and  $c_i$  are dummy variables corresponding to each year analyzed. This test was performed in order to reflect if corruption has an effect on the economic growth through public investments in the moment of the allocation of public funds for investments. As Mauro (1995) and Dell Monte and Pagani (2001) show, corruption affects public investments in the moment of the funds allocation, but also during the exploitation of public investment. Hence, corruption determines economic growth. However, it is not sure that these are the only channels through which corruption affects economic growth. The method used in this study is introduced by Akira (2004) that mentions that the effect of corruption on economic growth due to its manifestation in the phase of public funds allocation can be measured by considering in the regression a term that equals public investment divided by corruption.

Because the estimator for the corruption in this study is the corruption perception index that has high values for low degrees of corruption in the public sector, the terms reflecting the public investments in the regressions were formed by multiplying their value by the corruption perception index calculated for the corresponding period. The results of the regression show that when using the public investments corrected by corruption, the term for corruption remains irrelevant meaning that corruption does not significantly affect economic growth, however public investments in infrastructure corrected by corruption becomes a relevant determinant for the economic growth, suggesting that corruption affects the allocation of public funds for investments.

The negative sign of public investments in infrastructure may be a sign of inefficiency of public investments in infrastructure, but also may be due to the fact that public investments in infrastructure represent an instrument of economic cycle correction. Hence, for the European countries in the period 1996-2005 the model does not hold. A possible explanation can be that of public investments policy changes due to the new rules imposing public deficit limitations. Hence, for the major part of the European countries, having benefited from high public investments in infrastructure and human capital in the previous period, the new rules did not affect economic growth allowing higher private investments which prove to be more efficient than the public ones on the analysed period.

## 5. Conclusions

The empirical study performed on the 28 countries in the sample during the period 1996-2005 shows that private investments are determinants of the economic growth, which also depends on its previous values, whereas public investments in infrastructure and in human capital, as well as corruption have not a significant influence on the economic growth. The study also shows that corruption affects economic growth mainly by

interfering in the allocation of public funds for investments in infrastructure. Their negative influence on the economic growth may be determined by the need of the governments of using them as instruments to correct economic cycles. The study is important for understanding the economic growth in the European Union countries in the last decade and for improving the decision of public funds allocation. Hence, private investments prove to be more efficient than the public ones for the period analysed, but a future research in to be made in order to verify this conclusion on a long run.

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## Endnotes

- i. The allocative efficiency of public investments decisions is introduced in the model by the investment/corruption rate. In our study, we also use this indicator in order to quantify the effect of the corruption on economic growth through the public investments channel.
- ii. However, these results should be interpreted with caution.
- iii. We use a methodology similar to Del Monte and Pagani (2001).
- iv. Because of the characteristics of non-rivalry and non-exclusion of public goods, the following relation stands:  $I/N = I$ .
- v. The physical capital has a finite lifetime. Hence, each year, a part of physical capital has to be replaced. It is supposed to be equal to the level of investments in the previous year.
- vi. The hypothesis is necessary for adjusting the model to the real case of finite lifetime population.
- vii. It could be noticed that the GDP / capita for Luxemburg vary between 44,594.44 USD (in 1997 year) and 69.799,6 USD (in 2005 year), comparatively to the maximal value of GDP per capita of 42.364.2 USD, recorded by Norway in 2005 year. On the other side, CPI for Luxemburg has varied between 8.4 and 9 and the private investment per capita growth rate on the period was mainly negative. Taking into account this country, the results of the regression would be altered. One possible explanation is that Luxemburg is in large extent a fiscal paradise.

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