At what level of corruption does economic growth decrease?

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Abstract
With reference to the grease-the-wheels hypothesis, the impact of corruption on growth seems ambiguous. Therefore, the questions to be addressed are to what extent corruption can be tolerated and at what threshold it has a detrimental effect on an economy.

In this article, we examine the impact of corruption on economic growth by testing the hypothesis that the relationship between these two variables is nonlinear and by assessing the veracity of the assumption that corruption is always detrimental to economic growth. In this article, a panel data analysis has been used to examine 88 countries over the 1984 to 2011 period. The findings indicate that beyond an optimal threshold, both high and low corruption levels can decrease economic growth. Under this optimal threshold, a moderate level of corruption, defined by the point of reversal of the curve of the marginal corruption effect on growth, could have advantages for economic growth.

Keywords: Corruption, Economic Growth, Panel data.
JEL: B23, C51, D73, O47.

Introduction
Various studies have focused on the link between corruption and economic growth by using different indices and rates published by Transparency International, the Government Quality Institute and the World Bank. These studies have shown that developed countries are known by low corruption levels and a relatively high growth rate (Cooper & al, 2006), and by contrast most developing countries are known by high poverty and corruption levels (Chetwynd & al, 2003; Umbreen and Saadat, 2015).

While most studies agree that corruption is detrimental to growth, other studies assume that corruption is a consequence of modernization and should not have a major impact on development (Huntington, 1968). This is not the view of Myrdal (1971) who argues that corruption is a major obstacle to growth. Such a view of corruption is confirmed by the econometric analysis conducted by Mauro (1995) who found that corruption delays growth and reduces investment. However, it should be noted that corrupt countries do not necessarily witness a delay in growth. Moreover, Kolstad and Wiig (2013) indicated that foreign investors prefer to invest in the most corrupt countries.

Section 1 of this paper presents a review of both the theoretical and empirical literature; section 2 presents the econometric model and the main results followed by a discussion of the findings in the final section.

1. Related Literature
The literature on corruption can be summarized in two opposing theories. The first assumes that corruption "lubricates the economic cycle" or "greases the economic wheel" and produces the most efficient economies (Leff, 1964; Nye, 1967; Huntington, 1968; Acemoglu and Verdier, 2000; Barreto, 2000; Egger and Winner, 2005; Méon and Weill, 2010 and Johnson & al, 2014). In contrast, the second theory blames corruption and sees it as a factor that slows down economic activity (Mo, 2001; Mironov, 2005; Méon and Sekkat, 2005 and Mushfiq, 2011).

Mauro (1995) detects a weak statistical significance between corruption and economic growth. However, this significance disappears once investment rate is introduced in the model. Mo (2001) finds that corruption negatively affects economic growth. However, the additional
introduction of variables like investment to GDP ratio, political stability and human capital weakens or eliminates the significance of this negative impact. The author shows that the impact of corruption on growth is explained at 50% by political stability, 20% by investment, 15% by human capital and 15% by an insignificant direct impact. Pellegrini and Gerlargh (2004) attribute the impact of corruption on economic growth to investment and trade openness.

Méon and Sekkat (2005) show that the impact of corruption on economic growth depends on institutional quality. Moreover, they reject the hypothesis of the lubricating effect of corruption. According to them, the negative effect of corruption is more pronounced when institutional quality is low.

Mironov (2005) distinguishes two forms of corruption: systematic corruption and residual corruption, respectively correlated and uncorrelated with governance components. The author concludes that systematic corruption negatively affects economic growth while residual corruption positively affects economic growth when institutional quality is poor.

Meon and Weill (2010) emphasize the hypothesis of the lubricating effect of corruption by studying the interaction between institutional quality, corruption and production efficiency, thereby validating the hypothesis that corruption may have a positive effect on economic activities.

Mushfiq (2011) tests corruption-growth relationship in a non-linear framework. He shows that corruption increases growth even at a higher level of corruption. In the same context, Allan and Roland (2012) use linear and non-linear panel methods over the period 1998 to 2009 for determining the causal relationship between economic growth and corruption in 42 developing countries.

Moreover, Aghion et al. (2016) show that corruption affects the marginal effect of taxation on growth and Agostino et al. (2016) conclude that the interactions of corruption with military spending and investment negatively affect economic growth.

All these studies indicate that corruption may have either positive or negative effects on economic growth, making the issue ambiguous and confirming the non-linearity of the relationship between corruption and growth. However, one must ask to what extent can corruption be tolerated and from what threshold would it become destructive to the economy. The questioning is motivated by the fact that studies don’t test whether there is a growth-enhancing or growth-reducing level of corruption and not one study thoroughly identified the corruption level that will allow an optimal growth.

2. Empirical analysis
2.1. Description of data
Corruption is not the only factor that affects economic growth (Barro, 1991 and Brunetti, 1997, Lambsdorff, 1999). Other control variables are also relevant (Fernando & al, 2016). According to theory and on the basis of arguments cited in the literature, we propose economic growth depends mainly on investment, inflation and trade openness.

Our study examines 88 countries over the 1984-2011 period using data taken from the World Development Indicators (Growth rate, Foreign direct investment, Inflation & Trade). The ICRG index has been obtained from the Quality of Government Institute, the Transparency International and International Country Risk Guide published by Political Risk Services group. The ICRG index (available since 1984) measures corruption within the political system and it covers a large number of countries. However, the descriptive analysis of the variables (Table 1) shows that average economic growth is 3.56% with an average corruption index of 3.17. Nonetheless, the high inflation mean (40.72) is due to outliers that range from (-11.686) % for Gabon in 1991 to 23773.13 for the Congo in 1994.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>2464</td>
<td>3.567912</td>
<td>4.177474</td>
<td>-17.14604</td>
<td>33.99047</td>
</tr>
<tr>
<td>Fdi</td>
<td>2464</td>
<td>2.458109</td>
<td>4.071154</td>
<td>-55.2422</td>
<td>33.56602</td>
</tr>
<tr>
<td>Inf</td>
<td>2464</td>
<td>40.72763</td>
<td>576.7237</td>
<td>-11.68611</td>
<td>23773.13</td>
</tr>
<tr>
<td>Trad</td>
<td>2464</td>
<td>72.55653</td>
<td>45.75878</td>
<td>10.74832</td>
<td>439.6567</td>
</tr>
<tr>
<td>Icrg</td>
<td>2464</td>
<td>3.175473</td>
<td>1.402537</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

On the other hand, considering the correlations between the different variables. It can be seen in Table 2 that there is no correlation between the variables except a low correlation between Trade and Investment (0.45).

Table 2: Coefficients of simple-linear correlation

<table>
<thead>
<tr>
<th>Inf</th>
<th>Fdi</th>
<th>Trad</th>
<th>Icrg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inf</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fdi</td>
<td>-0.0337</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Trad</td>
<td>-0.0464</td>
<td>0.4506</td>
<td>1.0000</td>
</tr>
<tr>
<td>Icrg</td>
<td>-0.0175</td>
<td>0.0245</td>
<td>0.0403</td>
</tr>
</tbody>
</table>

Where:

Growth: Annual growth rate of GDP per capita
Fdi: Percent of Foreign direct investment per GDP
Inf: Consumer price index inflation (annual %)
Trad: Exports plus imports as share of GDP.

These results highlight the overall statistical trend of the variables in the present analysis. However, they do not specify the dependency relationship between growth and corruption. To further probe this dependency relationship, an econometric study of the relationship between growth and corruption is necessary.

2.2. Econometric approach

Empirical studies generally opt for the non-linear approach to study the impact of corruption on economic growth (Mushfíq, 2011; Allan & Roland, 2012; Eatzaz & al, 2012, and Kolstad & Wiig, 2013). This is a quadratic function based on the hypothesis that the impact of corruption on growth is not always negative and that a moderate corruption level could have advantages for economic growth.

In order to verify this, a cross-sectional framework is used in which growth rate and the ICRG index are observed only once for each country. The figure below confirms the hypothesis that the relationship between corruption and economic growth (fitted values) is nonlinear.
Therefore, we propose the following quadratic model. Subscripts \( i (i=1,\ldots,88) \) and \( t (t=1984,\ldots,2011) \) denote index country and time, respectively.

\[
\text{Growth}_{it} = \alpha_i + \beta \text{Inf}_{it} + \gamma \text{Trad}_{it} + \mu \text{Fdi}_{it} + \delta \text{Icrg}_{it} + \lambda \text{Icrg}^2_{it} + \epsilon_{it} \tag{1}
\]

The Hausman test allows us to conclude that the estimation of the parameters of the fixed effects model is more appropriate. The results for GDP growth are reported in Table 3.

<table>
<thead>
<tr>
<th>Growth</th>
<th>Coef.</th>
<th>Std. Err</th>
<th>t</th>
<th>P&gt;</th>
<th>t</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inf</td>
<td>-0.0005167</td>
<td>0.0001402</td>
<td>-3.68*</td>
<td>0.000</td>
<td>-0.0007917</td>
<td>-0.0002417</td>
</tr>
<tr>
<td>Fdi</td>
<td>0.1127286</td>
<td>0.0242797</td>
<td>4.64*</td>
<td>0.000</td>
<td>0.065117</td>
<td>0.1603403</td>
</tr>
<tr>
<td>Trad</td>
<td>0.0279136</td>
<td>0.0058069</td>
<td>4.81*</td>
<td>0.000</td>
<td>0.0165266</td>
<td>0.0393007</td>
</tr>
<tr>
<td>Icrg</td>
<td>-0.8663069</td>
<td>0.3246814</td>
<td>-2.67*</td>
<td>0.008</td>
<td>-1.502996</td>
<td>-0.2296181</td>
</tr>
<tr>
<td>Icrg^2</td>
<td>0.1451232</td>
<td>0.051924</td>
<td>2.79*</td>
<td>0.005</td>
<td>0.043302</td>
<td>0.2469444</td>
</tr>
<tr>
<td>Cons</td>
<td>2.288748</td>
<td>0.6628514</td>
<td>3.45*</td>
<td>0.001</td>
<td>0.9889193</td>
<td>3.588576</td>
</tr>
</tbody>
</table>

* t-statistics are displayed in parentheses under the coefficient estimates.

It can be seen that corruption negatively affects (-0.8663069) economic growth unlike the square coefficient of corruption which positively affects (0.1451232) economic growth. The significance of \( \text{Icrg}^2 \) coefficient confirms the non-linearity of this model and shows the presence of a threshold above which there will be a change of sign.

### 2.3. Determining the threshold

In order to determine the corruption level that allows for achieving maximum growth, the resulting model is:

\[
\text{Growth} = 2.2887 - 0.0005\text{Inf} + 0.1127\text{Fdi} + 0.0279\text{Trad} - 0.8663\text{Icrg} + 0.1451\text{Icrg}^2 \tag{2}
\]
The marginal effect of corruption on growth is defined by equation 3:

$$\frac{\partial \text{Growth}}{\partial \text{Icrg}} = -0.8663 + 0.2902 \text{Icrg}$$

(3)

The optimum is reached when the marginal effect is equal to zero. Relationship (3) shows that this optimum is achieved by $$\frac{\partial \text{Growth}}{\partial \text{Icrg}} = -0.8663 + 0.2902 \text{Icrg} = 0$$, which implies $$\text{Icrg} = 0.8663/0.2902 = 2.985$$.

This finding leads to the determination of the means of economic growth of the 88 countries in this study according to various corruption indices. Table 4 confirms the finding that optimal growth is achieved under moderate corruption [2.5; 3], where average is equal to 4.47%. These results indicate that high corruption (average Icrg < 1.5, see Table 4) leads to lower economic growth. This result continues in the presence of low corruption ($$\text{Icrg} \geq 4$$). However, for an average corruption of (2.5 ≤ Icrg ≤ 3), an optimum level of growth is reached (Table 4, Figure).

<table>
<thead>
<tr>
<th>Table 4: Average values of Icrg and Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>0 ≤ Icrg &lt; 1.5</td>
</tr>
<tr>
<td>1.5 ≤ Icrg &lt; 2.5</td>
</tr>
<tr>
<td>2.5 ≤ Icrg &lt; 3</td>
</tr>
<tr>
<td>3 ≤ Icrg &lt; 4</td>
</tr>
<tr>
<td>4 ≤ Icrg &lt; 5</td>
</tr>
<tr>
<td>5 ≤ Icrg ≤ 6</td>
</tr>
</tbody>
</table>

The concave function (Figure) may be interpreted in the following way. Corruption, that facilitates tax evasion, has two types of effects in economics. It offers households an opportunity of tax savings that can be consumed or invested, as tax evasion leads to a transfer of public resources to private agents (Tanzi & Davoodi, 2000 and Cerqueti & Coppier, 2011). This could improve growth up to a certain threshold. This optimal threshold represents the reversal point of the curve; otherwise, the country may suffer underdevelopment like several countries immersed in corruption.

Similarly, Leff (1964) and Huntington (1968) argue that if the government produces a pervasive and inefficient regulations package, then corruption may help replace these regulations at a low cost and consequently, it is likely that corruption may improve economic growth.

This corruption, if significant, will reduce state resources because of productive public spending which will lead to a loss in economic growth, which sooner or later will lead to an uprising calling for establishing democratic principles and good governance.

This result may surprise those who advocate the negative effects of corruption but it can be explained by the fact that administrative delays resulting from absence of "bribes" paid in a corrupt economy may dampen economic growth and reduce economic development.

3. Conclusion

The aim of this paper is to examine the impact of corruption on economic growth. The results indicate that higher or lower levels of corruption negatively affect growth. Minimum corruption can be beneficial to economic growth. This confirms some theories that assume that corruption
"lubricates the economic cycle" and produces the most efficient economies. However, this lubricating effect has a threshold beyond which it becomes a threat to economic growth. This paper shows that the threshold would be a corruption level between 2.5 and 3, which represents the "acceptable corruption level ". This result is conforming to one of the ten principle of economics: “Rational people think at the marginal change”. This threshold represents the point where the marginal benefits from corruption is equal to marginal costs incurred by corruption. Conversely, lack of corruption may be a mechanism that slows down growth. Observing countries with a corruption index higher than 4 (Spain, Japan, USA, France, UK, Australia, etc. which are represented as developed countries) show that economic growth stabilizes at around 3%.

References