Long-Term Effects of Corruption Control and Economic Freedom on Economic Growth

Natanael Soares Leite, Francisco Germano Carvalho Lucio, Roberto Tatiwa Ferreira

Federal University of Ceará-UFC/CAEN, Fortaleza, Brazil
Email: natanaelsearesleite@gmail.com, germanocarvalho@caen.ufc.br, rtf2@uol.com.br

Abstract
Theoretical models and empirical evidence show that corruption control and economic openness have effects on economic growth. This paper aims to estimate the long-term effects of the anti-corruption effort and economic freedom on economic growth in a sample of 121 countries. We use autoregressive distributed lag (ARDL) models and estimation techniques appropriate to the case where there is a correlation between cross-section errors possibly generated by spillover effects. Besides, estimates of ARDL models are consistent even with endogenous regressors and integrated variables. The results indicate that economic growth of a country can be positively and significantly affected by the long-term corruption control and economic freedom.

Keywords
Economic Growth, Control of Corruption, Economic Freedom, Autoregressive Models

1. Introduction
Corruption, whether public or private, is a worldwide problem. This phenomenon diverts part of the available resources for investment, generating both inefficiency and waste in public spending. According to [1], corruption has negative effects on a nation’s wealth and economic growth, discouraging new investments and creating uncertainty over private and social rights. This uncertainty acts as a cost on entrepreneurship, decreasing return on investment and increasing its variation, which discourages investment activities. Similar results are presented in [2] [3] [4].

Additionally, several studies such as [5] [6] [7] [8] [9] show that corruption can reduce the level of human capital. The reasoning behind this is that corrup-
tion encourages inefficient allocation of government resources in areas with
great bribery capacity, diverting them from other important sectors such as
education. However, there are other studies that indicate a positive effect on
economic growth [10]-[16]. From this perspective, corruption would act as a way
to lessen bureaucracy, which would increase the economy’s efficiency, thereby
reducing barriers to investment and economic growth.

There is a possible relationship between economic freedom and corruption
and between economic growth and economic freedom. Results from [17] [18]
[19] point out a negative relationship between these variables. However, [20]
shows that an increase in economic freedom does not reduce corruption in more
corrupt economies. In such cases, greater economic freedom may increase cor-
rution problems, indicating that nations respond differently to different levels
of economic freedom.

Regarding economic freedom and growth, [21] shows that there is a strong
positive relationship between economic freedom and economic growth. Moreo-
ver, they show that economic freedom has substantially more explanatory power
than political freedom and civil liberties as determinants of economic growth.
According to [22], economic freedom is associated with higher levels of income,
income growth, human development rates, and lower unemployment.

Few studies analyze the relationship between this set of variables. An example
is [23], which estimates a panel VAR (PVAR) and finds evidence that corruption
and a low level of economic freedom have a negative effect on national income.

Most empirical evidence on this subject does not use a long-term analysis
method. Corruption may reduce bureaucracy and positively affect short-term
economic activity in some contexts, but may have negative effects on long-term
growth. Thus, the present work intends to fill this gap by estimating the
long-term effects of efforts against corruption and economic freedom on eco-
nomic growth from 121 countries for the period 2002-2015.

We use autoregressive distributed lagged (ARDL) models and estimation
techniques that take into account the correlation between cross-sectional errors,
possibly generated by spillover effects, an approach that has not been used by
other studies so far.

In addition to this introduction, this work has five more sections. The second
section presents the literature review. The third section presents the methodol-
y and data. The results are presented in the fourth section and discussed in the
fifth section. Finally, we present our conclusions in the last section.

2. Literature Review

2.1. Corruption and Growth

There is no consensus on the effects of corruption on economic growth. On the
one hand, corruption has negative effects on the economic growth of an econo-
my through the “sand the wheels” hypothesis. On the other hand, the “grease the
wheels” hypothesis argues that corruption in highly regulated countries can off-
set the effects of heavy bureaucracy and stimulate the economy by reducing barriers to investment [24].

In the first stream, the results found in [1] suggest that corruption directly hinders economic growth, making investment difficult. The authors use an open economy version of the endogenous growth model with international capital mobility. In the model, corruption negatively affects host country investment stocks and growth by the uncertainty caused by corruption. The authors empirically verify this hypothesis using a sample of 142 countries from 1994-2014 and GMM methods. Similar results are presented in [16], where data from 19 Asian Countries over the 2014-2015 period using D-GMM and quantile regression are used. [25] Investigate the effects of corruption in Nigeria and report that corruption is perverse and dangerous for the nation.

In [26] dynamic panel data models are estimated for a sample of 103 countries observed from 1996 to 2015. The results suggest positive effects of corruption control on economic growth performance.

The work of [9] reports that corruption reduces the level of human capital and the share of private investment. The author states that the most important channel through which corruption affects economic growth is political instability.

In the second stream, [24] analyzes the interaction between aggregate efficiency, corruption and other governance dimensions for a panel of 69 developed and developing countries from 1970-1998. Their results show that corruption is less detrimental to efficiency in countries where institutions are less effective. In countries where institutions are extremely ineffective, there may be a positive correlation between corruption and efficiency.

The work of [27] estimates the effects of corruption on foreign direct investment (FDI) for a sample of 73 developed and least developed countries in the period of 1995-1999. Their results show a positive short-term impact of corruption on the FDI and a long-term positive impact of corruption on host country's attractiveness for foreign investors.

In [16] the effect of corruption on economic growth is estimated in a sample of 19 Asian countries from 2004 to 2015. According to the author, corruption increases economic growth in countries with less economic freedom, but the impact of the beneficial effect of corruption diminishes as economic freedom increases.

2.2. Economic Freedom and Growth

According to the proponents of the new growth theory, see [28] for example, the quality of institutions and the economic environment are important for economic growth. For [29] more political freedom fosters economic freedom that stimulates economic growth. However, analyzing a panel of countries, [30] finds weak evidences of a negative correlation between democracy and growth. [31], using a different sample reports that democracy is unrelated to growth, but political stability and credibility are important determinants of growth.
[32] proposed a comprehensive index of economic freedom independent of political freedom. The authors report a positive and significant correlation between economic freedom and growth. Several works that use the broad index of economic freedom have similar results. For example, [21] shows that economic freedom is even more important than traditional growth factors, such as investment and human capital, and more potent than political freedom. The authors also report that there is no evidence of a reverse causality of growth and economic freedom.

[33] uses various indicators of economic freedom in a sample of 80 countries from 1975-1990 and conclude that higher economic freedom promotes growth, but as in [21], there is no reverse effect.

[34] investigates the relationship between economic freedom and economic growth in a sample of 50 US states from 1981 to 2004. The results point to a positive relationship among these variables, but the components of economic freedom affect growth in different ways.

According to [35] their study presents two contributions. The first contribution of the paper is to identify which indicators of economic freedom make the greatest contributions to growth. The second contribution of the article is to examine the effects of economic freedom, public spending and fiscal balance on growth in transition countries in the period 1994-2007 and after the financial crisis (2008-2009). The results generally show that economic freedom leads to higher growth rates largely by stimulating investment.

3. Methodology and Data

3.1. The ARDL Model

Several studies such as [36] [37] [38] show that autoregressive distributed lag models (ARDL) are useful for estimating long-term effects. These estimates are consistent even if there are endogenous regressors, stationary series, or integrated (unit root) processes. An ARDL model \((p, q)\) can be expressed as follows:

\[
y_{it} = c_i + \sum_{j=1}^{q} \phi_{il} y_{i,t-j} + \sum_{j=0}^{q} \beta_{il} x_{i,t-j} + \epsilon_{it}
\]

The estimate of the long-term effects is obtained by

\[
\hat{\theta}_j = \frac{\sum_{l=0}^{q} \hat{\beta}_{il}}{1 - \sum_{j=0}^{q} \hat{\phi}_{il}}
\]

However, a series of spillover effects, caused for example by human capital or financial crises can generate a correlation between cross-section errors of growth equations, undermining the inferences of a panel data model. In these cases, cross-sectional averages of regressors are added to the ARDL model (CS-ARDL), as suggested by [39]. This model can be represented as:
\[ y_t = c_t + \sum_{j=1}^{z} \theta_{ij} y_{t-j} + \sum_{j=0}^{q} \beta_{ij} x_{t-j} + \sum_{j=0}^{p} \alpha_{ij} T_{t-j} + \varepsilon_t \]  
\[ z = \left[ T^{1,5p} \right], \ \bar{y}_t = \frac{1}{N} \sum_{i=1}^{N} y_{it}, \ \bar{x}_t = \frac{1}{N} \sum_{i=1}^{N} x_{it} \]

Equation (3) is estimated by the common correlated effects approach. It is suggested by [40] and expanded by [41].

3.2. Data

The variables are corruption control (cp)\(^1\), also used in [1] [42], real GDP per capita (2010 US dollars), and economic freedom index. The former two are collected from the World Bank, and the latter is collected from the Fraser Institute\(^2\). The sample consists of 121 countries recognized by the United Nations (UN), from 2002 to 2015. Although the UN recognizes 193 countries, many of them have no data available for all variables of the chosen range.

Table 1 presents the descriptive statistics of the aforementioned variables. Countries with higher average income per capita have higher averages of both corruption control and economic freedom. On the other hand, countries with lower incomes have a lower average of both corruption control and economic freedom. Additionally, it is observed a greater deviation from the average in this group.

4. Results

Table 2 presents the results for three ARDL model specifications. In model (a) the only regressor is the variable degree of economic freedom, in (b) only the corruption control variable, and finally, in (c) both variables are included. Estimates of the long-term effects of the degree of economic freedom and/or corruption control on economic growth are presented. These models are estimated for \( p = q = z = (1, 2) \).

These early results suggest that there is some influence on the degree of economic freedom and the degree of corruption control over economic growth. In model (a), the coefficient that measures the long-term effects of economic freedom on growth has values ranging from 0.013 to 0.015. In model (b), there is a positive and statistically significant relationship of corruption control over economic growth around 0.001. In the model (c) these variables are not statistically significant.

However, the test statistics (CD) presented in [45] reject the null hypothesis of independence between cross-sections in all specifications. For this reason, models that include the cross-sectional averages (CS-ARDL) are estimated following the methodology proposed by [39]. These new results are in Table 3. CD statistics do not reject the null hypothesis of independence between cross-sections.

\(^1\)The CP measures the anti-corruption efforts of one country relative to other countries ranging from 0 to 100. For more details about this index see [23]. The corruption perception index is not suitable for this paper due to missing information at the beginning of the sample.

\(^2\)The Economic Freedom of the World – EFW index ranges from 0 to 10, where higher values represent higher levels of economic freedom. For more information of the EFW index see [43] [44].
Table 1. Descriptive Statistics by quartile of the average GDP of the countries.

| | GDP per capita (US$2010) | Control of Corruption | Economic Freedom |
|---|-----------------|-----------------|-----------------|
| Part 1(i) | | | |
| Mean | 839.7841 | 23.21198 | 5.99659 |
| Standard deviation | 458.5806 | 15.83528 | 0.8297683 |
| CV | 0.5460696 | 0.682203 | 0.1383734 |
| Asymmetry | 0.9453976 | 0.7969979 | −0.6952659 |
| Minimum | 219.19 | 0 | 2.93 |
| Maximum | 2428.78 | 75.48 | 7.57 |
| Part 2(ii) | | | |
| Mean | 3869.707 | 38.96807 | 6.535833 |
| Standard deviation | 1398.464 | 16.98863 | 0.7074648 |
| CV | 0.3613875 | 0.4359628 | 0.108244 |
| Asymmetry | 0.555083 | 0.1950256 | −0.7481322 |
| Minimum | 1326.24 | 0.51 | 4.4 |
| Maximum | 7612.02 | 84.85 | 7.69 |
| Part 3(iii) | | | |
| Mean | 13013.46 | 61.42305 | 6.933381 |
| Standard deviation | 4734.271 | 19.78453 | 0.8085445 |
| CV | 0.3637981 | 0.3221027 | 0.1166162 |
| Asymmetry | 0.5875943 | −0.9473012 | −1.801913 |
| Minimum | 5383.8 | 4.33 | 2.92 |
| Maximum | 25511.47 | 92.89 | 8.15 |
| Part 4(iv) | | | |
| Mean | 45472.26 | 89.16738 | 7.708119 |
| Standard deviation | 17599.36 | 10.70752 | 0.514882 |
| CV | 0.387035 | 0.1200834 | 0.066797 |
| Asymmetry | 1.582774 | −1.604113 | 0.475092 |
| Minimum | 19796.07 | 50.96 | 6.36 |
| Maximum | 111968.4 | 100 | 9.19 |

Quartiles of the average income per capita: (i) Countries below the 1st quartile; Countries between 1st and 2nd quartile; (iii) Countries between the 2nd and 3rd quartile; (iv) Countries above the 3rd quartile.

and the parameters of long-term effects are statistically significant in all cases, including model (c) that uses both economic freedom and corruption control.

5. Discussion

Our results indicate a long-term positive relationship between corruption control and economic growth, corroborating the “sand the wheels” hypothesis. Similar results are found in [26], which also uses the corruption control variable, and is lined with the results of [1] [9] [24] [25], among others.

Concerning economic freedom, our results corroborate the work of [21] [22] [29] [32], and also indicate a positive long-term relationship between
Table 2. Table Estimated Fixed Effect (FE) of the long-term effect based on the ARDL approach, 2002-2015.

| ARDL (FE) | 1 Lag (a) | (b) | (c) | 2 Lags (a) | (b) | (c) |
|----------|-----------|-----|-----|------------|-----|-----|
| $\hat{\theta}_{it}\_\text{free}$ | 0.015** | 0.013 | 0.013* | 0.011 |
| (0.059) | (0.111) | (0.074) | (0.147) |
| $\hat{\theta}_{it}\_\text{cp}$ | 0.001** | 0.001 | 0.001** | 0.001 |
| (0.017) | (0.048) | (0.016) | (0.044) |
| $\hat{\lambda}$ | -0.795*** | -0.790*** | -0.800 | -0.905*** | -0.894*** | -0.916 |
| (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Test CD | 88.94*** | 87.12*** | 88.32*** | 73.70*** | 80.68*** | 73.27*** |
| N × T | 1451 | 1451 | 1451 | 1330 | 1330 | 1330 |

(i) The symbols ***, **, and * denote significance at 1%, 5%, and 10% respectively. (ii) The values in parentheses represent the p-values. (iii) CD is the test statistics presented in [45] for the null hypothesis of independence between cross-sections.

Table 3. Estimate Fixed Effect (FE) of long-term effect based on cross-sectionally enhanced ARDL approach (CS-ARDL), 2002-2015.

| CS-ARDL (FE) | 1 Lag (a) | (b) | (c) | 2 Lags (a) | (b) | (c) |
|--------------|-----------|-----|-----|------------|-----|-----|
| $\hat{\theta}_{it}\_\text{free}$ | 0.018** | 0.016* | 0.018** | 0.016** |
| (0.030) | (0.059) | (0.023) | (0.049) |
| $\hat{\theta}_{it}\_\text{cp}$ | 0.001** | 0.001** | 0.001** | 0.001* |
| (0.014) | (0.046) | (0.022) | (0.074) |
| $\hat{\lambda}$ | -0.843*** | -0.833*** | -0.848*** | -0.945*** | -0.927*** | -0.956*** |
| (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Test CD | -0.66 | -0.74 | -0.73 | -0.75 | -0.81 | -0.83 |
| N × T | 1209 | 1209 | 1209 | 1209 | 1209 | 1209 |

(i) The symbols ***, **, and * denote significance at 1%, 5%, and 10% respectively. (ii) The values in parentheses represent the p-values. (iii) CD is the test statistics presented in [45] for the null hypothesis of independence between cross-sections.

economic freedom and economic growth, whether in the presence of the variable control over corruption or not.

In short, our results support the evidence that corruption and a low level of economic freedom negatively affect economic growth. Similar results are found in [23].

6. Conclusions

This study estimates the long-term effects of corruption control and economic
freedom on economic growth of 121 countries through autoregressive distributed lags (ARDL) models. The index of economic freedom used is broad and reflects various aspects of the economy, such as money and inflation, the structure of the economy, the presence of discriminatory taxes and international trade. For an economy to receive a high rating, it must have a stable monetary environment, with freedom for individuals to make their choices, low taxes, greater participation of private enterprise in production and economic openness with low trade barriers.

The results indicate positive long-term effects of corruption control and economic freedom on economic growth. Although the ARDL model and the estimation technique used are robust to endogeneity and other econometric problems, the currently available period is limited. Therefore, one should consider this caveat and read the results of this work as empirical evidence.

However, there is a possibility that corruption may be beneficial to growth in economies with high bureaucracy. Thus, one way to continue this research is to use nonlinear models that allow testing and estimating (endogenously) whether there is a level of corruption or bureaucracy above which the effects on growth are negative, but before that point the corruption’s effect is null or even positive on economic growth.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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