

Corruption, public debt and economic growth – evidence from developing countries

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Abstract

Purpose – The purpose of this paper is to empirically examine the effect of corruption on public debt and economic growth in 20 developing countries over the period 1996-2018.

Design/methodology/approach – This study makes use of the autoregressive distributed lag (ARDL) model to detect the long-term relationships, on the one hand, between corruption and public debt and, on the other hand, between corruption and economic growth.

Findings – The empirical results reveal that corruption increases the debt-to-GDP ratio and that the interactions between corruption and public revenues and between corruption and public spending have a positive influence on public debt in the long run. The estimations also show that high corruption hampers long-term economic growth and increases the negative effect of public debt on economic growth in developing countries.

Originality/value – While corruption is a prevalent phenomenon in most developing countries, the literature still lacks empirical examination of its economic effects. This study fills this gap with the aim of highlighting that high corruption hinders development in developing nations. This study also examines the impact of the interactions between corruption and components of the fiscal balance on public debt. Moreover, while the existing empirical literature uses regression techniques, this paper uses a panel ARDL approach to detect the long-term effects of corruption.

Keywords Corruption, Public debt, Economic growth, Panel ARDL, Developing countries

Paper type Research paper

1. Introduction

Corruption is a widespread phenomenon in developing countries. It is “the misuse of public office for private gain” (Mauro, 1995). Corruption can be manifested in different aspects of public activities. In many developing countries, individuals and firms must spend time obtaining the licenses and authorizations required to engage in various activities. Administrative delays encourage citizens to pay bribes to public officials to speed up bureaucratic procedures. Additionally, corruption encourages governments to increase public investment spending through an increase in the number and size of capital projects, from which corrupt public officials and investors who pay the highest bribes benefit, at the expense of the rest of society. Additionally, when corruption is prevalent, tax evasion increases, and investors face higher uncertainty.

An increasing number of studies have examined the effects of corruption on economic growth and public debt. Many studies find that corruption hampers economic growth



(Gupta *et al.*, 2000; Mauro, 1995; Nur-tegin and Jakee, 2019) and increases public debt (Benfratello *et al.*, 2017; Cooray *et al.*, 2017; Tanzi, 1998; Velasco, 2000).

This study contributes to the existing literature in various ways. First, the paper focuses on the economic effects of corruption in the developing world. While most developing countries have below average performance in terms of control of corruption (World Bank, 2019), empirical examination of this issue in these countries is still lacking. The existing empirical studies cover large samples of developing and developed countries at the same time. This analysis uses a sample of 20 developing countries from various regions across the world. All these countries have high levels of corruption compared to the other developing nations. Thus, the purpose of this paper is to test whether high corruption increases public debt and reduces economic growth in developing countries. The “control of corruption” indicator produced by the World Bank is used to measure the influence of corruption on public debt and economic growth. The indicator captures the abuse of public power for private interests.

Second, some empirical studies analyze the relationship between corruption and public debt by examining the effects of corruption on public expenditures. Cooray *et al.* (2017) found that the positive impact of corruption on public expenditures further increases public debt. However, this study aims to examine the interactions between corruption and public expenditures and between corruption and public revenues to check how these interactions influence public debt in developing countries in the long term. The findings suggest that higher corruption increases public debt, which is consistent with the literature. The results also show that the interactions between corruption and components of the fiscal balance increase public debt.

Third, the paper examines the effect of corruption on economic growth to confirm whether corruption prevents countries in the developing world from achieving higher development in the long term. In addition, public debt is included in the analysis to test whether corruption increases the negative effect of higher public debt on economic growth in developing countries. The results show that corruption reduces economic growth in the long term and that higher borrowing becomes more harmful to long-term economic growth in developing countries when corruption is prevalent.

Finally, the paper uses an autoregressive distributed lag (ARDL) technique, which has not been used before in this context, to investigate the relationships between corruption and public debt and between corruption and economic growth in the long term. The estimation is based on the pooled mean group (PMG) ARDL model developed by Pesaran *et al.* (1999). This model allows cointegrating terms to vary across cross-sections and thus provides consistent estimates. The dynamic panel heterogeneity analysis estimates the long-term effects of corruption on public debt and economic growth in developing countries and indicates the speed of adjustment toward the long-term equilibrium.

The rest of this paper is structured as follows. Section 2 presents the theoretical and empirical studies that investigate the impact of corruption on public debt and economic growth, and Section 3 presents the data and methodology used in this study. The results of the panel ARDL estimations are discussed in Section 4. Section 5 concludes the paper.

2. Literature review

The interest of academics and policymakers in studying the economic and social effects of corruption has increased. While Braguinsky (1996) and Bardhan (1997) argue that corruption may improve efficiency and promote economic growth in a competitive capitalist environment, other economists consider corruption an obstacle to economic growth. Baumol (1990) argues that in corrupt countries, individuals are encouraged to pursue rent-seeking activities instead of productive investments, which hampers growth. Mauro (1995) also indicates that corruption limits labor productivity and domestic investments thus reducing

economic growth. In the theory of regulation, [Stigler \(1971\)](#) argues that in corrupt countries, firms can extract additional rents by capturing corrupt regulators, who can implement certain regulations that increase the costs to new firms, reduce new firm entry and hence lower the level of competition in the market. Additionally, corruption can be perceived as a tax for investors because they are required to pay bribes to obtain the necessary permits and invest in corrupt countries. These high costs, in addition to the uncertainty prevalent in corrupt countries, reduce entrepreneurs' incentives to invest.

Empirical evidence of the relationship between corruption and economic growth is also controversial. Many studies argue that corruption has positive effects. By helping firms overcome government regulations and bureaucratic rigidities, some empirical literature suggests that corruption can increase efficiency, specifically in regulated economies. [Dreher and Gassebner \(2013\)](#) apply an extreme bound analysis to a panel of 43 countries to identify whether corruption can be indirectly beneficial to economic growth. The authors conclude that by reducing the negative effect of regulations on entrepreneurship, corruption accelerates firm entry in highly regulated countries and hence increases entrepreneurial activity and economic growth. However, the authors note that the beneficial relationship between corruption and regulation might not be valid in the long term. [Vial and Hanoteau \(2010\)](#) found empirical evidence of a positive influence of corruption on plant output and productivity growth in Indonesia by using ordinary least squares (OLS) regressions. These findings are consistent with those of [Leff \(1964\)](#), who argues that corruption can encourage innovations and promote economic activities that increase economic development in underdeveloped countries.

Nevertheless, these arguments are contradicted by many empirical studies that do not find any benefit from corruption. Indeed, several studies conclude that there is a negative direct relationship between corruption and economic growth. [Nur-tegin and Jakee \(2019\)](#) look at different forms of corruption to check whether the effect is beneficial or harmful to businesses and the economy. They conclude that even though some types of corruption, such as bribes that accelerate entry into the market, can be growth-promoting, the overall effect of corruption is more detrimental. [Gupta et al. \(2000\)](#) find that while bribes accelerate individual transactions, the number of transactions may increase in a corrupt environment, which counteracts the efficiency of each single operation. In addition, corrupt entrepreneurs could use their relationships with corrupt bureaucratic officials to prevent the entry of new firms into the market. Therefore, corruption facilitates the entry of firms with connections at the expense of the most efficient firms ([Rose-Ackerman, 1996](#)). Additionally, corruption reduces entrepreneurs' incentives, specifically when the entrepreneurs expect that the corrupt environment may prevent them from making high returns ([Murphy et al., 1991](#)). In addition, [Wei \(2000\)](#) shows using the OLS method on a sample of 45 host countries that corruption has a negative influence on foreign direct investment (FDI). The results confirm the negative association between corruption and growth. [Cieřlik and Goczek \(2018\)](#) used the generalized method of moments (GMM) technique on a sample of 142 countries to test the direct impact of corruption on economic growth. The empirical investigation shows that corruption directly reduces real GDP per capita by denying countries access to international financing and hindering investment, whereas a lack of corruption increases the investment ratio. [Méon and Sekkat \(2005\)](#) used the generalized least squares regression and found that corruption reduces growth by reducing the accumulation of capital. The authors show that slower growth is worse in countries with poor governance, specifically in countries with weak rule of law, high political instability and government inefficiency.

Corruption can also lower economic growth indirectly through different channels. [Mauro \(1995\)](#) finds that corruption reduces the investment to GDP ratio because, in a corrupt environment, the projects chosen by the government are not necessarily the most efficient

ones. The author extends his analysis by including the impact of corruption on the composition of public spending to investigate the channels through which corruption affects economic growth (Mauro, 1996). The results of the cross-country regression analysis confirm that corruption reduce economic growth through the reduction of private investments and the distortion of public spending, mainly through the decrease of public expenditure on education. Mauro suggests that corrupt governments allocate public spending toward the sectors in which bribes can be easily collected. Similarly, Delavallade (2006) concludes that corruption distorts the structure of public spending by reducing expenditures on education, health care and social protection in favor of sectors in which corrupt agents expect to obtain the highest amounts of bribes, such as the defense and energy sectors. Lower expenditures in the education and health-care sectors prevent corrupt countries from laying the foundations for development. The author uses the three-stage least squares method for a sample of 64 developing and developed countries. Tanzi and Davoodi (1997) found that, in addition to distorting the composition of public investment, corruption lowers the productivity of public investments, reduces public revenues and lowers the quality of public infrastructure. Using regression analysis, the authors conclude that corruption reduces economic growth indirectly through these three channels.

Regarding the relationship between corruption and public debt, the literature indicates a positive relationship. One aspect that gives rise to corruption is public revenues, mainly taxation. When there is a lack of state control of tax and customs administrators and when tax collection requires frequent contact between taxpayers and tax inspectors, payment of bribes increases (Tanzi, 1998). Hence, corruption reduces tax revenues when official sectors pay bribes to tax collectors to evade taxes or to benefit improperly from tax exemptions. Tax revenue reduction worsens the fiscal balance and increases the issuance of public debt (Kaufmann, 2010). Friedman *et al.* (2000) and Johnson *et al.* (1997) argue that corruption increases the size of the shadow economy, which leads to a fall in tax revenues. The tax evasion conducted by the unofficial sector undermines the government's ability to provide public goods hence leading to more borrowing and higher public debt.

Corruption can also manifest in public spending, specifically in investment spending, in which favoritism and commission payments are the basis of the selection of firms to execute public projects. Corrupt public officials can inflate the prices of the goods and services needed to provide public services and invest in public projects. Corruption increases the number and size of these projects, leading to higher public expenditures, higher fiscal deficits and hence additional borrowing to offset the deficit (Tanzi and Davoodi, 1997). Kaufmann (2010) provides similar arguments by arguing that corrupt government officials are inclined to charge bribes through rent-seeking capital projects in which many parties are involved, making these projects less transparent and more lucrative. Such projects are primarily financed through the issuance of debt, which again implies that corruption leads to higher public debt. Similarly, Velasco (2000) argues that corruption increases public investment spending, from which only fragmented interest groups benefit, at the expense of the whole society, which bears the tax costs. The increased public spending presents an incentive to issue more debt.

Empirical studies find a positive association between corruption and public debt. Cooray *et al.* (2017) used OLS, panel fixed effects and GMM techniques to examine the impact of corruption on public debt in 106 countries. They find that corruption has a positive influence on public debt and that government expenditures and the shadow economy increase the positive effect of corruption on public debt. Apergis and Apergis (2019) explore the nonlinear relationship between corruption and government debt by using a panel smooth transition regression framework for a panel of 120 countries. They find that public debt

responds faster to highly corrupt regimes than to less corrupt regimes. [Liu et al. \(2017\)](#) found using a dynamic panel regression model on American states and local governments that levels of public debt are higher when corruption is higher. Similarly, by using the GMM technique on a large panel of countries, [Benfratello et al. \(2017\)](#) found that corruption increases sovereign debt. The authors show that the positive influence is stronger in high-income countries and weaker in less-developed countries.

Nevertheless, overborrowing in corrupt countries may harm the whole economy by distorting the allocation of resources. Corrupt governments use public revenues in rent-seeking activities and loan resources in unproductive sectors, which are less transparent and difficult to monitor, at the expense of high-value sectors, such as education and health ([Gupta et al., 2001](#); [Shleifer and Vishny, 1993](#); [Tanzi and Davoodi, 1997](#)). As a result, public debt in corrupt countries may become harmful to economic growth.

In summary, while corruption may have minimal benefits, most studies conclude that it increases public debt and reduces economic growth. The aim of this study is to confirm the long-run positive relationship between corruption and public debt in developing countries. In addition, this study aims to examine the long-term relationship between corruption and economic growth and to test whether higher public debt becomes more harmful to economic growth when corruption is widespread.

All the studies mentioned previously use regression techniques on large samples of developed and developing countries. This paper uses a cointegration technique to examine long-term relationships. The study focuses on 20 developing countries to better understand the economic influence of corruption in the developing world.

3. Methodology

This study uses a cointegration approach to estimate the long-term relationship, on the one hand, between corruption and public debt and, on the other hand, between corruption and economic growth. The analysis makes use of yearly data from 20 developing countries that have high levels of corruption. Fuel-exporting countries are excluded from the sample. The data related to the corruption indicator, which is the main variable to estimate, are available from 1996. Thus, the data availability limits the analysis to the period spanning from 1996 to 2018.

Public expenditures as a percentage of real GDP, public revenues as a percentage of real GDP, inflation rate, GDP per capita and real interest rates on long-term deposits are the control variables used in the estimation of the relationship between corruption and public debt. The control variables are selected based on the previous literature. Public expenditures and public revenues are the main determinants of the public debt level, as they affect the fiscal balance. [Cooray et al. \(2017\)](#) include government expenditure on GDP and the tax revenue-to-GDP ratio in a GMM estimation to test the impact of these variables on the public debt-to-GDP ratio. The authors also include per capita income and inflation rate in their estimation. A higher inflation rate can increase the public debt ratio by increasing interest payments on debt ([Reinhart and Rogoff, 2010](#)), and a lower GDP per capita can increase public debt by reducing public revenues and therefore increasing fiscal deficits. Regarding real interest rates on long-term deposits, this variable affects the savings rate and the investment level in the economy, which, in turn, affects the fiscal balance and public debt. [Penalver and Thwaites \(2006\)](#) used the real interest rate as a control variable in their model aimed at examining the determinants of public debt dynamics in Brazil. In addition, GDP per capita, inflation rate and interest are among the control variables used by [Benfratello et al. \(2017\)](#) in their empirical model to investigate the effect of corruption on public debt. The public debt-to-GDP ratio is the dependent variable in this estimation. Annual data for these variables are collected from the World Bank (World Development Indicators) and the

International Monetary Fund. The control of corruption indicator constructed by [Kaufmann et al. \(2009\)](#) is used as a measure of corruption. This indicator ranges from -2.5 (most corrupt) to $+2.5$ (least corrupt). This index has been rescaled so that 0 stands for least corrupt and 5 for most corrupt.

Another estimation is performed to study the impact of corruption and public debt on economic growth in developing countries. The real GDP growth rate represents economic growth. The corruption indicator and the debt growth rate are the main regressors to be estimated. Gross fixed capital formation (GFCF) as a percentage of real GDP, consumption as a percentage of real GDP, FDI net inflows as a percentage of real GDP, and the population growth rate are the control variables used in this second analysis. These control variables have been used previously in the literature. The GFCF is a main determinant of long-term economic growth, as it represents the investment level in the economy. For the population growth rate, its increase should negatively affect long-term economic growth based on the Solow growth model. [Eberhardt and Presbitero \(2015\)](#) used capital stock, constructed from the GFCF and population growth rate as main control variables to study the long-term relationship between public debt and economic growth. Similarly, [Méon and Sekkat \(2005\)](#) used the investment to GDP ratio and population growth rate to study the effect of corruption on economic growth. Regarding FDI, this variable plays a crucial role in the development process in developing countries through the transfer of skills and technology ([Balasubramanyam, 2002](#)). [Cieřlik and Goczek \(2018\)](#) used FDI as a control variable to study the effects of corruption on investment and economic growth. The authors also use consumption as a control variable in their model. Many studies show that economic growth in developing countries is consumption-led ([Diacon and Maha, 2015](#); [Kim, 2017](#)). This variable is included in the estimation to check whether the positive effect of consumption on economic growth in developing countries is valid in the long run. The data related to these regressors are obtained from the World Bank.

All values are deflated by the CPI to be expressed in real terms ([Table 1](#)).

The primary objective of this study is to test the long-term influence of corruption on public debt and economic growth in developing countries that have high corruption levels. Different techniques, such as the [Johansen's \(1991\)](#) cointegration test, could be used to detect the long-run relationship. However, this paper uses the ARDL approach to cointegration, developed by [Pesaran and Shin \(1995\)](#). The advantage of this technique is that it can

Variables	Mean	SD	Minimum	Maximum
Public expenditures as % of real GDP	19.65	14.00	1.46	169.74
Public revenues as % of real GDP	17.45	12.21	0.80	146.94
Debt-to-GDP ratio	50.74	25.33	10.21	152.24
Real interest rates on long-term deposits	0.91	5.02	-30.34	17.22
Inflation rate	6.56	6.71	-2.24	51.46
GDP per capita growth rate	2.97	4.94	-39.99	19.37
Corruption	3.09	0.36	2.39	4.42
Debt growth rate	12.54	22.65	-55.46	256.70
Real GDP growth rate	4.68	4.89	-38.82	22.28
GFCF as % of real GDP	21.87	7.56	0.00	49.59
Consumption as % of real GDP	79.62	14.99	0.00	115.06
FDI net inflows as % of real GDP	3.44	3.95	-1.44	35.73
Population growth rate	1.67	0.89	-0.13	7.76
Number of observations = 460	-	-	-	-

Table 1.
Descriptive statistics

estimate whether a long-run cointegration relationship exists among variables even when the variables are of different orders, whereas the Johansen cointegration approach requires the variables to be integrated of order 1. In addition, ARDL considers the dynamic heterogeneity of the adjustment process and detects possible convergence toward the long-run equilibrium. The PMG estimator of Pesaran *et al.* (1999) is used to estimate the panel ARDL. This approach adapts the simple ARDL model to a panel setting by allowing cointegrating terms to differ across cross-sections. The advantage of the PMG ARDL method is that it provides consistent coefficients in the presence of country heterogeneity.

The augmented Dickey and Fuller (1979) (ADF) and the Phillips and Perron (1988) (PP) unit root tests examine the stationarity of each variable and determine the order of integration. Each variable should be stationary of either order I(0) or order I(1) to apply the ARDL technique. The Akaike information criterion (AIC) is used to estimate the optimal lag of each variable in ARDL models.

Equation (1) represents the ARDL (p, q) model:

$$y_{it} = \sum_{j=1}^p \alpha_{ij} \Delta y_{i,t-j} + \sum_{z=1}^k \sum_{j=0}^q \beta_{ij} \Delta X_{z,i,t-j} + \varepsilon_{it} \quad (1)$$

In equation (1), i represents the country, and t represents time. y_{it} represents the dependent variable, and $X_{z,i,t-j}$ is the vector of regressors with $z = 1, \dots, k$ regressors. α_{ij} is the coefficient of the lagged dependent variable, and β_{ij} represents the coefficients of the lagged regressors. ε_{it} represents the error term.

Equation (2) represents the reparameterization of the PMG ARDL estimation into the error correction model (ECM) based on Pesaran *et al.* (1999):

$$\Delta y_{i,t} = \sum_{j=1}^{p-1} \alpha_{ij} \Delta y_{i,t-j} + \sum_{z=1}^k \sum_{j=0}^{q-1} \beta_{ij} \Delta X_{z,i,t-j} + \theta_i ECT_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $ECT_{i,t} = y_{i,t-1} - X_{i,t} \varphi$.

$ECT_{i,t}$ is the error correction term (ECT) that results from the long-term relationship. θ represents the speed of adjustment toward that equilibrium. Δ is the difference operator.

This study performs two PMG ARDL estimations. The first estimation examines the long-term cointegrating relationship among, on the one hand, public expenditures, public revenues, real interest rates on long-term deposits, inflation rate, GDP per capita growth rate and corruption and, on the other hand, the debt-to-GDP ratio.

Equation (2) can be rewritten as follows to perform the first PMG ARDL estimation:

$$\begin{aligned} \Delta \text{debt/gdp}_{it} = & \sum_{j=1}^{p-1} \alpha_{ij} \Delta \text{debt/gdp}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{1ij} \Delta \text{exp}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{2ij} \Delta \text{rev}_{i,t-j} \\ & + \sum_{j=0}^{q-1} \beta_{3ij} \Delta \text{inf}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{4ij} \Delta \text{GDPcapita}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{5ij} \Delta \text{r}_{i,t-j} \\ & + \sum_{j=0}^{q-1} \beta_{6ij} \Delta \text{corr}_{i,t-j} + \phi_i \text{debt/gdp}_{i,t-1} + \nu_{1i} \text{exp}_{i,t-1} + \nu_{2i} \text{rev}_{i,t-1} \\ & + \nu_{3i} \text{inf}_{i,t-1} + \nu_{4i} \text{GDPcapita}_{i,t-1} + \nu_{5i} \text{r}_{i,t-1} + \nu_{6i} \text{corr}_{i,t-1} + \varepsilon_{it} \end{aligned} \quad (3)$$

where debt/gdp denotes the debt-to-GDP ratio; exp and rev represent public expenditures and public revenues as a percentage of real GDP, respectively, inf represents the inflation

rate; GDPcapita represents the growth rate of GDP per capita; r represents the real interest rate on long-term deposits; and corr is the corruption indicator.

$\nu_1, \nu_2, \nu_3, \nu_4, \nu_5$ and ν_6 denote the long-run relationship between each regressor and the debt-to-GDP ratio.

The second estimation aims to test the long-term cointegrating relationship among the debt growth rate, corruption and economic growth. Equation (2) can be rewritten as follows:

$$\begin{aligned} \Delta \text{GDP}_{it} = & \sum_{j=1}^{p-1} \alpha_{ij} \Delta \text{GDP}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{1ij} \Delta \text{GFCF}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{2ij} \Delta \text{Cons}_{i,t-j} \\ & + \sum_{j=0}^{q-1} \beta_{3ij} \Delta \text{FDI}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{4ij} \Delta \text{pop}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{5ij} \Delta \text{debt}_{i,t-j} \\ & + \sum_{j=0}^{q-1} \beta_{6ij} \Delta \text{corr}_{i,t-j} + \phi_i \text{GDP}_{i,t-1} + \nu_{1i} \text{GFCF}_{i,t-1} + \nu_{2i} \text{Cons}_{i,t-1} \\ & + \nu_{3i} \text{FDI}_{i,t-1} + \nu_{4i} \text{pop}_{i,t-1} + \nu_{5i} \text{debt}_{i,t-1} + \nu_{6i} \text{corr}_{i,t-1} + \varepsilon_{it} \end{aligned} \quad (4)$$

where GDP represents the real GDP growth rate, GFCF, Cons and FDI represent GFCF, consumption and FDI as a percentage of real GDP, respectively. Pop denotes the population growth rate, and debt indicates the public debt growth rate.

$\nu_1, \nu_2, \nu_3, \nu_4, \nu_5$ and ν_6 denote the long-run relationship between each dependent variable and the economic growth rate.

In each equation, the ECT examines whether a long-term cointegrating relationship exists. In addition, the PMG ARDL results illustrate the long-term impact of each regressor on the dependent variable.

4. Empirical results and discussion

4.1 Panel unit root tests

The following condition is required to perform the panel ARDL technique: each variable should be stationary of either order $I(0)$ or order $I(1)$. The ADF and PP tests examine the existence of unit roots for each variable and hence their stationarity. The null and alternative hypotheses to be tested are as follows: H_0 : the variable has a unit root vs H_1 : the variable does not have a unit root.

Table 2 reports the results of the panel unit root tests and supports the existence of a unit root for the following variables: public expenditures, public revenues, debt-to-GDP, corruption, consumption and FDI. The remaining variables are stationary at levels. All variables become stationary at the first difference.

The presence of some variables integrated of order 0 and other variables integrated of order 1 validates the use of the panel ARDL estimation to test the long-run equilibrium.

4.2 Pooled mean group autoregressive distributed lag results

The first panel ARDL estimation tests the existence of a long-term relationship between corruption and public debt. Table 3 reports the long-term estimates of the four-panel ARDL models. The optimal lag length of these models based on the AIC is 1. Model 1 examines the influence of the control variables of public expenditures, public revenues, inflation rate, GDP per capita growth rate and real interest rates on long-term deposits on the public debt-to-GDP

Table 2.

Panel unit root tests

Variables	Test of stationarity at level		Test of stationarity at first difference	
	ADF test statistic	PP test statistic	ADF test statistic	PP test statistic
Public expenditures as % of real GDP	8.57	8.33	−6.62***	−12.64***
Public revenues as % of real GDP	8.66	8.53	−6.21***	−12.33***
Debt-to-GDP ratio	0.7	0.66	−6.32***	−10.58***
Real interest rates on long-term deposits	−4.08***	−7.87***		
Inflation rate	−5.16***	−12.69***		
GDP per capita growth rate	−5.50***	−10.91***		
Corruption	−0.88	−1.47*	−9.39***	−14.83***
Debt growth rate	−9.46***	−10.36***		
Real GDP growth rate	−5.65***	−10.93***		
GFCF as % of real GDP	−1.78**	−1.77**		
Consumption as % of real GDP	−1.52*	−1.79**	−8.70***	−17.39***
FDI net inflows as % of real GDP	1.5	−0.94	−9.28***	−24.12***
Population growth rate	−2.39***	−2.90***		

Notes: Statistics marked ***, ** and * indicate significance at the 1, 5 and 10% levels, respectively

Table 3.

Long-run estimates of PMG ARDL with debt-to-GDP ratio as a dependent variable

Dependent: debt-to-GDP ratio	Model 1 ARDL (1,1,1,1,1,1)	Model 2 ARDL (1,1,1,1,1,1,1)	Model 3 ARDL (1,1,1,1,1,1,1,1)	Model 4 ARDL (1,1,1,1,1,1,1,1,1)
Public expenditures as % of real GDP	10.75*** (6.94)	7.46*** (7.53)	6.63*** (6.53)	7.42*** (7.06)
Public revenues as % of real GDP	−9.50*** (−5.77)	−6.82*** (−6.51)	−7.23*** (−6.38)	−7.54** (−4.96)
Inflation rate	2.05*** (4.11)	0.99** (2.36)	1.55*** (3.79)	1.48*** (3.48)
GDP per capita growth rate	−2.70*** (−3.72)	−1.99*** (−4.30)	−1.99*** (−4.26)	−1.89*** (−4.21)
Real interest rates on long-term deposits	10.82*** (7.66)	5.78** (7.52)	6.69*** (7.25)	6.29*** (7.12)
Corruption	—	6.28*** (3.82)	5.50*** (3.38)	5.46*** (3.33)
Corruption*public expenditures as % of real GDP	—	—	0.40* (1.78)	—
Corruption*public revenues as % of real GDP	—	—	—	0.26* (1.12)
ECT	−0.07***	−0.09***	−0.09***	−0.09***

Notes: *t*-statistics in parentheses. Coefficients marked ***, ** and * indicate significance at the 1, 5 and 10% levels, respectively. ARDL models are selected based on the AIC. Maximum dependent lags:1, dynamic regressors (1 lag) for Model 1, Model 2, Model 3 and Model 4 ARDL. Included observations: 440

ratio. As predicted, the estimations of Model 1 show that public spending increases the debt-to-GDP ratio and that public revenues reduce the debt-to-GDP ratio in the long run. Hence, a fiscal surplus decreases public debt. The results of Model 1 also show that high inflation and high real interest rates on long-term deposits increase the debt-to-GDP ratio, whereas an increase in the GDP per capita growth rate reduces public debt in the long term. High inflation increases interest payments on debt, which therefore increases the debt level, specifically when external debt constitutes a large proportion of the total public debt. Moreover, an increase in interest rates on long-term deposits encourages people to save in the aim of making high returns at the expense of investing their funds in productive sectors.

Thus, an increase in the interest rate reduces the country's investment level and the tax revenues, which in turn expands the fiscal deficit and leads to higher borrowing to offset the deficit. However, an increase in the production and investment level reduces public debt in the long run, and the negative coefficient of GDP per capita growth rate confirms this negative impact.

The inclusion of the corruption index in Model 2 shows that corruption has a significant positive impact on public debt. A 1% increase in corruption raises the debt-to-GDP ratio by 6.28%. Thus, the more corrupt a country is, the higher the public debt. This finding is consistent with the results of [Apergis and Apergis \(2019\)](#), [Cooray *et al.* \(2017\)](#) and [Liu *et al.* \(2017\)](#). However, this study extends the results in the empirical literature by including the interactions between corruption and the components of the fiscal balance to examine the impact of these interactions on public debt. The impact of each control variable on the debt-to-GDP ratio remains significant in Model 2.

Models 3 and 4 estimate the interaction between corruption and public expenditures and between corruption and public revenues, respectively. The results of Model 3 show that the interaction between corruption and public expenditures increases public debt. This effect can be explained by highly corrupt politicians and government entities driving an increase in public spending and thus raising the fiscal deficit and public debt. Politicians tend to enlarge the size of investment projects to obtain more substantial commissions and bribes from the contractors that execute these projects. These results confirm the analysis of [Tanzi and Davoodi \(1997\)](#) and [Velasco \(2000\)](#), who argue that corruption increases mainly investment spending because capital projects constitute an easy opportunity for corrupt officials to collect bribes. The increase in public expenditures leads to an increase in the issuance of public debt.

The results of Model 4 demonstrate that the interaction between corruption and public revenues raises the debt-to-GDP ratio. The positive relationship can be explained by the dominance of bribes paid to government officials to avoid paying taxes or fees in corrupt countries. Corruption increases bribes and tax evasion, which reduces public revenues and raises public debt. This finding is consistent with [Friedman *et al.* \(2000\)](#) and [Tanzi and Davoodi \(1997\)](#), who found a negative relationship between corruption and government revenues.

The estimation of each PMG ARDL model in the ECM form shows that the coefficients of the ECT are negative and significant. Thus, these models converge toward equilibrium in the long run. The speed of adjustment toward equilibrium is between 7% and 9%.

Based on these results, there is a long-term cointegrating relationship between corruption and public debt in developing countries. By increasing public spending and reducing public revenues, corruption raises the fiscal deficit and thus public debt. These results confirm that public debt levels tend to be higher in corrupt countries.

The second panel ARDL estimation examines the long-term impact of corruption and the public debt growth rate on economic growth in the developing countries included in this study. [Table 4](#) reports the results of the long-term estimations of Models 5 and 6. Based on the AIC, the optimal lag length of each variable in these models is 2. Model 5 evaluates the impact of each control variable and the public debt growth rate on the real GDP growth rate. The results of Model 5 indicate that all the control variables are significant. An increase in GFCF, FDI or the population growth rate has a positive impact on the economic growth rate in developing countries. However, an increase in the debt growth rate reduces the real GDP growth rate. The corruption variable is included in Model 6 to examine the long-run relationship between corruption and the economic growth rate. The results show that corruption has a negative and significant influence on economic growth. A 1% increase in

corruption reduces economic growth by 2.05%. This result is consistent with that of Cieslik and Goczek (2018) and Méon and Sekkat (2005). However, this analysis extends the existing literature by studying the impact of public debt on economic growth in corrupt countries. Model 6 shows that when corruption is included in the estimation, the negative effect of public debt on economic growth increases from 0.07% to 0.19%. Thus, public debt becomes more harmful to economic growth when developing countries are highly corrupt.

Moreover, the coefficients of the ECT are negative and significant at the 1% level in Models 5 and 6. Hence, both models converge toward long-term equilibrium. Therefore, high corruption and high debt levels reduce long-term economic growth rates in developing countries. The finding of the negative association between corruption and economic growth is consistent with the literature. The more indebted and corrupt a country is, the more difficult it is for the country to achieve higher growth rates in the long run. Corruption distorts incentives and encourages entrepreneurs to invest in unproductive and rent-seeking activities, which reduces economic growth (Tanzi, 1998). In addition, the misallocation of government investment spending in a corrupt environment reduces capital productivity and economic growth. Some infrastructure and capital projects require continuous maintenance because of poor quality, and other projects are not used. Additionally, the higher spending on public investment projects chosen by corrupt officials reduces the resources that can be allocated to other spending categories, such as education, health care and current expenditures on maintenance. Thus, the lower quality of infrastructure projects, the increase in investment spending allocated to projects with low productivity, and the decrease in government expenditures on the education and health-care sectors explain the negative impact of corruption on economic growth (Tanzi and Davoodi, 1997).

5. Conclusion

This study provides empirical evidence that corruption has a positive long-term impact on public debt and a long-term negative influence on economic growth in developing countries. This paper covers 20 developing countries over the period 1996–2018.

The results of the first panel ARDL estimation show that corruption increases public debt in developing countries in the long run. This empirical result is consistent with that of Cooray *et al.* (2017) and Liu *et al.* (2017). However, the estimation in this study extends further to include the interactions between corruption and public revenues and between corruption and public expenditures to check whether corruption increases public debt through its impact on the components of the fiscal balance. The findings confirm that these interactions have a positive influence on public debt and are consistent with the literature

Table 4.
Long-run estimates
of PMG ARDL with
the real GDP growth
rate as a dependent
variable

Dependent: real GDP growth rate	Model 5 ARDL (2,2,2,2,2,2)	Model 6 ARDL (2,2,2,2,2,2)
GFCF as % of real GDP	0.28*** (9.50)	0.26*** (11.43)
Consumption as % of real GDP	−0.05*** (−5.70)	0.07*** (4.92)
FDI net inflows as % of real GDP	0.52*** (6.32)	0.09*** (2.10)
Population growth rate	2.78*** (9.12)	−0.06 (−0.56)
Debt growth rate	−0.07*** (−6.44)	−0.19*** (−17.54)
Corruption		−2.05*** (−4.33)
ECT	−0.49***	−0.41***

Notes: *t*-statistics in parentheses. Coefficients marked ***, ** and * indicate significance at the 1, 5 and 10% levels, respectively. ARDL models are selected based on the AIC. Maximum dependent lags: 2, dynamic regressors (2 lags) for Model 5 and Model 6 ARDL. Included observations: 420

(Kaufmann, 2010; Tanzi and Davoodi, 1997). Corruption reduces public revenues, increases public expenditures and hence increases the issuance of public debt to offset the fiscal deficit.

The results of the second panel of ARDL estimations confirm that corruption hampers the long-term economic growth in developing countries. Corruption increases the cost of doing business, reduces incentives and thus lowers investment and economic growth. The results are consistent with the theoretical and empirical studies that find a negative relationship between corruption and economic growth (Baumol, 1990; Cieřlik and Goczek, 2018; Mauro, 1995; Wei, 2000). In addition, the results indicate that higher public debt in developing countries becomes a greater deterrent for economic growth when these countries are corrupt. Corruption increases the issuance of public debt, which is used to finance rent-seeking and unproductive activities, resulting in lower long-term economic growth.

Therefore, the implementation of fiscal policies aimed at reducing fiscal deficits in developing countries does not succeed in attaining lower public debt levels when corruption is prevalent. Corruption reduces the optimal collection of public revenues. Thus, adding new taxes or increasing the rates of existing taxes does not result in higher public revenues in a corrupt country because of tax evasion. Additionally, governments cannot reduce government expenditures when bribes and rent-seeking projects are widespread in the economy. The implementation of economic and monetary policies to attract investments and encourage capital accumulation is not enough to increase economic growth in corrupt countries. Bribes and favoritism distort the optimal allocation of resources, lower the level of competition in the market and reduce investments and economic growth. Thus, eliminating corruption should go hand in hand with any policy implemented in these developing countries to achieve lower debt levels and higher growth rates in the long run. Anticorruption laws should be reinforced and should apply to high-level and low-level positions in the public sector.

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