

Corruption's effect on BRICS countries' economic growth: a panel data analysis

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Abstract

Purpose – The theoretical debate of corruption's impact on economic growth remains unsettled, making it an empirical question. This study aims to investigate corruption's effect on BRICS countries' economic growth.

Design/methodology/approach – A panel dataset on BRICS countries spanning 1996 to 2020 was used. Bias-corrected estimators in small dynamic panels were employed to estimate a growth model as a linear-quadratic function of corruption that accounts for cross-sectional dependence, endogeneity and unobserved heterogeneity due to country and time-specific characteristics.

Findings – The results indicate that corruption is detrimental to economic growth in BRICS countries; the quadratic relationship implies corruption is less prevalent in some countries than others. Thus, governments of BRICS countries are encouraged to embark on anti-corruption policies to boost their economic performance.

Originality/value – An important limitation of corruption studies is the difficulty in measuring real corruption experiences due to the secretive nature of corruption and the fact that corruption is known not to leave a paper trail. For the uncertainty of the index estimates, the analysis used a continuous corruption composite score measuring the standard deviation of the extent to which public power is exercised for public gain. Furthermore, estimation and inference are robust to small dynamic panels with a general form of cross-sectional dependence.

Keywords Corruption, Economic growth, Panel data

Paper type Research paper

1. Introduction

The acronym "BRICS" represents a grouping of emerging economies comprising Brazil, Russia, India, China and South Africa. These countries' rapid rise in global economic strength is likely to continue, with a combined output expected to surpass that of the G-7 countries (Goldman Sachs, 2001). However, BRICS governments have been confronted with corruption concerns in their respective countries, possibly dampening their economic potential. Thus, understanding corruption's impact on economic growth is essential to ensure these countries' economic sustainability.

Generally considered unethical behaviour, corruption remains a critical challenge for BRICS economies. For example, in Brazil, investigations by the Brazilian Federal Police uncovered an alleged fraud and corruption scheme aimed at embezzling funds from Petrobras, an energy and petroleum company controlled by the Brazilian federal government. In China, reports from the ruling Communist party indicated it punished nearly 300,000 officials in 2015 for corruption. Similar concerns around corruption have also emerged in India and

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South Africa, with the November 2021 anti-corruption statistics reporting 620 arrests and 116 convictions, for a total asset value of ZAR 3.4 billion in South Africa. In the wake of these findings, there has been a growing interest in corruption's socio-political and economic costs in BRICS countries.

Theoretically, corruption affects the quality of institutions, which determines economic growth (Sarıtaş and Özmen, 2021). Yet, the literature on corruption's effect on economic growth remains ambiguous, and these studies are often plagued by disagreement over the correct measure of corruption. The contention is that corruption cannot be measured objectively. Thus, without an objective measure, scholars and researchers have resorted to subjective corruption measures, such as corruption perception indices. These indices are usually in the form of surveys targeted at individuals, households, firms or experts, asking them about their experience of corruption, either in the private or public sector or both. The problem, however, is that corruption perception indices are a poor reflection of real corruption experiences (Kaufmann *et al.*, 2006; González *et al.*, 2007; Olken, 2009). To address these shortcomings, Kaufmann and Kraay (2008) advised researchers to rely on various data sources to measure corruption.

Against this background, we hypothesised a growth model for BRICS economies as a linear-quadratic function of corruption besides traditional growth determinants, including political stability, trade integration, commodities prices and governance quality. Unlike previous studies, we used aggregate corruption perception scores, which combine the perception indices from different economic agents, thus mitigating measurement bias from one-dimensional perception indexes. In addition, bias-corrected estimation techniques were employed to account for econometric issues relevant in short dynamic panel models. Random effects and fixed-effects estimators were produced with Driscoll and Kraay's (1998) standard errors, which are robust in determining cross-sectional dependence (spatial effects) with minor sample adjustments. Moreover, bias-corrected least square dummy variable estimators were considered to control for endogeneity, which has proven to outperform consistent IV-GMM estimators, like those of Anderson and Hsiao (1981, 1982) and Arellano and Bond (1991) in small samples (Bruno, 2005).

The rest of the paper is organised as follows: the next section reviews relevant literature, followed by the methodology in section 3. Then, empirical results and a discussion are presented in sections 4 and 5. Finally, the paper ends with some concluding remarks and policy recommendations.

2. Literature review

No single definition of "corruption" exists in the literature. Instead, the definition of "corruption" is acknowledged to be dependent on that which is to be modelled and measured (Bardhan, 1997; Jain, 2001). That said, a broad consensus in the literature is that corruption entails the abuse of public office for personal gain (Bardhan, 1997; Jain, 2001; Svensson, 2005). Adhering to a convention in the literature, this study also defines "corruption" as the abuse or misuse of public office for private gain.

The above definition gives rise to three types of corruption associated with public office, based on the type of decision-maker, the source of misused power by a decision-maker and the models used to explain corruption. The first type is "grand corruption", which is corruption by political elites in economic policymaking. The second type is "bureaucratic corruption", referring to corruption by bureaucrats in their dealings with superiors, that is, political elites or the public. The third type is "legislative corruption", which refers to the extent to which voting behaviour by legislators can be influenced by interest groups (Jain, 2001).

Economic literature explains the various types of corruption using principal-agent and resource allocation models (Elliott, 1997; Jain, 2001; Martínez-Vásquez *et al.*, 2007).

In principal-agent models, corruption is modelled based on the benefits emanating from corrupt deeds relative to the costs incurred as a result of the corrupt deeds by the agent (Jain, 2001; Shleifer and Vishny, 1993; Treisman, 2007). Conversely, resource allocation models focus on rent-seeking behaviour and aim to explain levels of bribes and corruption considering competition for economic rents. Based on these models, corruption is rooted in three necessary conditions, namely (1) the discretionary powers of government officials; (2) the value of economic rents; and (3) the legal and judicial system, hence the hypothetical relationship between economic growth and corruption.

A systematic account of how corruption enters growth models is provided by Mo (2001), who postulates a production function characterised by:

$$Y = Tf(K, L) \quad (1)$$

where Y is the output level, T is total factor productivity, and K and L are the capital stock and labour, respectively. A differentiation of Y gives:

$$dY = fdT + T(f_K dK + f_L dL) \quad (2)$$

Dividing equation (2) by Y gives a decomposition similar to that of Solow (1957):

$$\frac{dY}{Y} = \frac{dT}{T} + Tf_K \frac{dK}{Y} + \frac{f_L L}{f} \frac{dL}{L} \quad (3)$$

According to Schumpeter (1939), this decomposition distinguishes between two classes of influence on an economy's evolution. The first class refers to changes in factor availability and the growth component, which is related to the growth rates of capital and labour in the production function. The second factor is social and technological changes and the development component, which is related to forces driving total factor productivity growth in the production function. These factors are characterised as follows:

$$GR = F[\gamma, IY, dLL], \quad (4)$$

where GR and γ are the growth rates of real GDP and total factor productivity, respectively, IY is the investment output ratio; and dLL is the growth rate of labour. F_γ is equal to 1, F_{IY} the marginal production of capital, and F_{dLL} is the elasticity of output to labour. Mo (2001) incorporated the four variables that Levine and Renelt (1992) identified as robust determinants of growth: the share of investment in GDP, the rate of population growth, the initial level of real GDP per capita and a proxy for human capital. Corruption and productivity growth are added to this framework, determined by:

$$\gamma = \gamma(CORRUPT, y_0, HUMAN) \quad (5)$$

where $CORRUPT$ is an index for the level of corruption, y_0 is the initial GDP per capita, and $HUMAN$ is an index for human capital stock.

This framework has been expanded to incorporate the influence of other variables. For instance, Pellegrini and Gerlagh (2004) employed a similar theoretical foundation as Mo (2001), but included trade openness and political stability as further determinants of economic growth. Meon and Sekkat (2005) also built on Levine and Renelt's (1992) framework but included corruption and governance indicators to test how the quality of governance affects corruption's impact on investment and economic growth. However, there is no theoretical consensus on the economic impact of corruption, be it directly or indirectly.

Corruption tends to remove government-imposed inefficiencies and rigidities, which, in turn, constrain firms' abilities to invest in the economy and entrepreneurs' innovative skills (Jain, 2001; Mo, 2001; Tanzi, 1998). Lui (1985) claims bribery can be used to accelerate

customer queues and services, resulting in the efficient allocation of time among them. [Beck and Maher \(1986\)](#) argue that outcomes from bribery may mirror those from a competitive bidding market without differences in efficiencies in both outcomes. [Lien \(1986\)](#) also added that, in bidding competitions, efficient firms are likely to afford higher bribes, and projects will thus be awarded to these firms without the loss of allocative efficiency in comparison to competitive bidding procedures.

However, the view that corruption has a positive impact on growth has been subjected to criticism. According to [Tanzi \(1998\)](#), corruption does not ease bureaucratic inefficiencies and rigidities since bureaucrats create such rigidities to extort bribes. Rather than accelerating processes resulting in the efficient allocation of time, corruption may, in fact, cause bureaucrats to deliberately slow the pace of processes to extort bribes from customers, leading to the inefficient allocation of time ([Leite and Weidmann, 1999](#)). [Shleifer and Vishny \(1993\)](#) note that a further criticism of this argument is related to the uncertainty and lack of enforceability associated with corruption contracts. Lastly, it has been argued that firms' ability to pay high bribes, and thus be awarded projects in bidding competitions, is not necessarily a reflection of such firms' efficiency, but rather their ability to engage in rent-seeking, which has a negative impact on economic growth ([Baumol, 1990](#); [Shleifer and Vishny, 1993](#)).

Various scholars concur that corruption has a negative impact on growth. [Romer \(1994\)](#) argues that corruption is a form of tax on profits, which may deter investment in physical capital. [Pellegrini and Gerlagh \(2004\)](#) mention that corruption increases the uncertainty of investment returns and reduces investment spending. Moreover, [Mauro \(1995\)](#) maintains that by changing the relative prices of goods and services, corruption changes the private investor's assessment of the relative merits of investment projects, leading to a misallocation of resources among sectors of the economy. [Tanzi and Davoodi \(1997\)](#) contend that corruption increases the number of government projects undertaken; changes the design; enlarges the size of such projects; and increases their complexity, resulting in reduced productivity in public investments. Some authors have also noted that corruption causes individuals to invest in political capital instead of human capital, reducing the returns from the accumulation of human capital, skills and knowledge ([Krueger, 1974](#); [Ehrlich and Lui, 1999](#); [Tanzi, 1998](#); [Mo, 2001](#)). In support, [Mauro \(1995\)](#), as well as [Tanzi and Davoodi \(1997\)](#), maintain that corruption lowers governments' ability to raise revenues, which can be used to fund education. Corruption combines two diverging forces for capital leakages: (1) corruption-led money leaves the country because of the fear of being caught by tax and judiciary establishments, and (2) money leaves a country because of the fear that a corrupt government will not provide a conducive environment for safe savings and profitable investment ([Bouchet and Gros Lambert, 2006](#)). Therefore, the theoretical debate on corruption's impact on economic growth remains unsettled, making it an empirical question.

Pioneered by [Rose-Ackerman \(1975\)](#), the empirical analysis of the growth-corruption nexus has resulted in mixed conclusions depending on estimation strategies and sample data distribution. Focussing on cross-country evidence, most studies emphasise corruption's negative impact on economic growth ([Mauro, 1995](#); [Mo, 2001](#); [Pellegrini and Gerlagh, 2004](#); [Meon and Sekkat, 2005](#); [Omoteso and Mobolaji, 2014](#); [Gründler and Potrafke, 2019](#); [Mohammed *et al.*, 2022](#); [Nguyen and Bui, 2022](#); [Afonso and Longras, 2022](#)). Several studies also endeavoured to identify the transmission channels through which corruption affects economic growth. Accordingly, [Kunieda *et al.* \(2014\)](#) found that financial openness tends to aggravate the negative growth impact of corruption. [Park \(2012\)](#) contends that corruption distorts the allocation of bank funds, which magnifies bad loans and decreases the quality of private investment and, ultimately, economic growth. Moreover, [d'Agostino *et al.* \(2016\)](#) documented the complementarities between corruption and military spending, with its negative impact on economic growth, while [Ibrahim \(2020\)](#) and [Urbina and Rodriguez \(2022\)](#)

point to the direct and indirect dampening growth effect of corruption through public debt and human capital development, respectively. Other contributions focus on growth-enhancing strategies through a reduction in corruption. For instance, [Mouna et al. \(2020\)](#) emphasise the efficiency of technology adoption in controlling corruption, with growth-enhancing consequences. This view is consistent with [Erum and Hussain \(2019\)](#), who conclusively reported on Information and Communication Technology (ICT) diffusion's significant role in mitigating the detrimental growth impact of corruption.

Conversely, evidence of corruption's growth-enhancing effect and its contributing factors have been reported by various scholars. [Erum and Hussain \(2019\)](#) established corruption has a positive effect and promotes economic growth in the presence of natural resources. [Song et al. \(2021\)](#) documented that financial development has a boosting effect on economic growth in developing countries, but curbing corruption is detrimental to financial development. Similarly, [Huang \(2016\)](#) reports either no causal linkages or a positive unidirectional causality between corruption and growth in selected Asia-pacific countries; concluding that the common perception of corruption's low growth effect might not hold for the Asia-pacific. This conclusion equally applies to sub-Saharan Africa, with [Shittu et al. \(2018\)](#) mentioning a positive and rather bi-directional causality between corruption and economic growth. In addition, [Ramoni-Perazzi and Romero \(2022\)](#) determined that exchange rate volatility has a negative growth effect, which tends to be lower in high-corruption countries, implying corruption has a growth effect.

Though less prominent, selected inconclusive contributions have also been reported. [Urbina and Rodríguez \(2022\)](#) provide support for the "sand the wheels" hypothesis and "grease the wheels" hypothesis and no growth impact of corruption across Latin American countries. They further show that corruption stimulates natural resources in Latin American countries but dampens the natural resource sector in Nordic countries. Likewise, [Malanski and Santos Póvoa \(2021\)](#) found corruption damages countries with greater economic freedom in Latin America but improves economic growth in countries with lower economic freedom. Ultimately, corruption had a purely negative effect on economic growth in Asian countries with less economic freedom. Furthermore, [Sharma and Mishra \(2022\)](#) confirm the resource-curse hypothesis in fuel-export countries but report corruption's tendency to mitigate the negative growth effect of natural resources in low-middle-income countries.

Since most of these studies relied on a linear modelling framework, one explanation for the conflicting findings from the empirical literature relates to the failure to account for the level effect of corruption. This rationale has fuelled several threshold regression-based contributions aimed at identifying the cut-off level where corruption might have a positive, negative or neutral economic impact. Selected illustrations include the study by [Trabelsi and Trabelsi \(2021\)](#), and the references therein. However, one important underlying assumption of threshold regression is the absence of measurement errors in the threshold variable. This is very unlikely with corruption studies since most corruption perception indices used in the literature are known to be a poor reflection of real corruption experience ([Olken, 2009](#); [González et al., 2007](#)).

This study followed a combined approach, modelling growth as a dynamic linear-quadratic function of corruption, thus accounting for the level effect in the growth impact of corruption. In addition, contrary to previous cross-country studies with relatively large sample sizes and time series, this study's focus on BRICS countries resulted in a short panel data structure given the limited number of countries, which fails to meet the asymptotic requirements of the standard dynamic panel model estimators. Therefore, the study implemented bias-corrected estimators to help control for heterogeneity, cross-sectional dependence and endogeneity in short dynamic panels. Moreover, following Kaufmann's criticism of individual corruption perception indices, a composite estimate of the corruption score was used, which aggregates individual perception indices from various types of corruption across different economic agents.

Various corruption measures exist in the literature, mostly based on a single source of corruption or suitable to a specific context (Golden and Picci, 2005; Knack, 2006). In addition, international corruption proxies that are composite indexes are subject to several biases inherent to the risk of selection, longitudinal sensitivity and measurement errors (Ko and Samajdar, 2010). Despite these shortcomings and given the progressive improvement of composite corruption indexes across time (Ko and Samajdar, 2010), this study used the World Bank's control of corruption index. It is a composite corruption index expressed in terms of standard error, thus reflecting the uncertainty of the estimates. According to Desbordes and Koop (2016), controlling for such uncertainty has a substantial influence on both the size and significance of the estimates.

3. Method

This study investigated corruption's effect on economic growth in BRICS countries using panel data techniques suitable for short dynamic panel data models. The major attraction of panel data techniques stems from such models' ability to address severe econometric issues like heterogeneity, endogeneity and the persistence of shocks in dynamic models, which cannot be efficiently handled in pure time series and pure cross-sectional models.

3.1 Research design and analytical procedure

Based on the theoretical framework presented above, the linear panel quadratic growth model takes the following dynamic specification:

$$PCGDP_{it} = \alpha_i + \lambda_t + \gamma PCGDP_{it-1} + \beta_1 CORR_{it} + \beta_2 CORRSQ_{it} + \delta' \chi_{it} + \varepsilon_{it} \quad (6)$$

$$i = 1, \dots, N; t = 1, \dots, T$$

where PCGDP is the logarithm of per capita gross domestic product, α_i and λ_t denote country- and time-specific fixed effects, respectively, $CORR_{it}$ and $CORRSQ_{it}$ are the corruption variable and the square of the corruption variable; χ_{it} is a vector of control variables, including investment, trade openness, population growth, government expenditure, literacy rate, inflation, political stability, the rule of law and literacy rate. Finally, ε_{it} is the error term.

Due to the fixed effects and the lagged dependent variable among the regressors, equation (6) cannot be estimated using the conventional ordinary least squares (OLS) technique. As a standard in panel data analysis, unobserved heterogeneities can be dealt with using fixed effect (FE) or random effect (RE) estimators; the Hausman test is used to determine the most appropriate model. However, these estimators are inconsistent or biased for dynamic panel models, and their standard errors are not robust in terms of cross-sectional dependence. We used FE/RE regression with Driscoll-Kraay standard errors, which control for the general form of cross-sectional dependence by assuming a heteroscedastic and auto-correlated error structure with some lag, possibly correlated between panels (countries in this case). The validity of these estimators depends on the existence of spatial effects. The study used Pesaran's (2004) cross-sectional dependence test, which tests the null hypothesis of cross-sections' independence against the alternative hypothesis of cross-sectional dependence; the rejection of the null concludes the relevance of spatial effects.

As evidenced in the empirical results section, the test result could not reject the relevance of cross-sectional dependence. Besides heterogeneity and cross-sectional dependence, the estimation of equation (6) is also subject to endogeneity. Endogeneity refers to the correlation between explanatory variables and the disturbances in a model. One source of endogeneity in the corruption and economic growth literature is simultaneity bias. Simultaneity refers to the dual causality between the dependent and one or more of the explanatory variables. In other

words, random shocks that affect economic growth may simultaneously affect corruption and other explanatory covariates (Gyimah-Brempong, 2002; Swaleheen, 2011).

A second source of endogeneity is omitted variable bias since some relevant determinants of economic growth might not be included in the model. A third source of endogeneity is measurement error, which arises from poor variable proxies. In this instance, the corruption data used in the present study is known to be biased based on economic development, religious beliefs and democratic institutions (Donchev and Ujhelyi, 2014). Further, they are known to be a poor reflection of the corruption experience (Kaufmann *et al.*, 2006). Another source of endogeneity in the corruption and economic growth literature is attributed to the dynamic structure of economic growth models. Economic growth models include, as an additional explanatory variable, a lag of the dependent variable (that is, economic growth in previous periods) to account for the persistence of economic growth. However, the addition of the lag-dependent variable causes a correlation between the lag-dependent variable and the error term, resulting in biased estimates of parameters (Hsiao, 2003; Judson and Owen, 1999).

Endogeneity is commonly addressed using IV-GMM estimators. However, these estimators are biased for small panels and require a bias-corrected alternative. This study used the bias-corrected least square dummy variable (LSDVC) estimator proposed by Bruno (2005), which has proven to outperform IV-GMM estimators in dynamic panel models with small cross-sections (Bruno, 2005). Two variants of these estimators exist, namely AH-LSDVC and AB-LSDVC, corresponding respectively, to Anderson and Hsiao (1981, 1982) and Arellano and Bond (1991) first differenced estimators from which they are derived. Accordingly, LSDVC estimators are built from the following specification:

$$\Delta PCGDP_{it} = \lambda_t + \gamma \Delta PCGDP_{i(t-1)} + \beta_1 \Delta CORR_{it} + \beta_2 \Delta CORRSQ_{it} + \delta \Delta^{x_{it}} + \Delta \varepsilon_{it} \quad (7)$$

$$i = 1, \dots, N; t = 1, \dots, T$$

All the variables and parameters are as previously defined.

3.2 Data

This study compiled annual data of the five BRICS countries from 1996 to 2020 ($T = 25$ and $N = 5$). Based on the available data and following the existing literature, we proxied economic growth by real per capita GDP (pcgdp), investment by gross fixed capital formation (gfcf), human capital by population growth (pop) and adult literacy rate (liter), and controlled for demand-side factors such as government consumption expenditure (govexp), trade openness (trade) and consumer price inflation (inf). Finally, political and governance factors were also accounted for, namely political stability (polsta), the rule of law (rulaw) and the corruption proxied by a control of the corruption score (corr). Control of corruption measures perceptions of the extent to which public power is exercised for private gain, comprising petty and grand forms of corruption, state “capture” by elites and private interests. It reflects the country’s score of the aggregate indicator, estimated in units of a standard normal distribution ranging from -2.5 to 2.5 (Kaufmann *et al.*, 2010). Except for the rule of law and corruption obtained from the World Governance Indicators (WGI) database and political stability sourced from the Polity IV database, data for the remaining variables were drawn from the World Development Indicators (WDI) database, all of which are hosted by the World Bank.

Historically, the trend in corruption perception scores (see Figure 1) is a dissimilar but consistent picture across these countries. Russia and South Africa face the highest standard deviation of corruption perception score relative to other BRICS-member countries. Brazil, India and China also started with moderate corruption perception scores, but these have

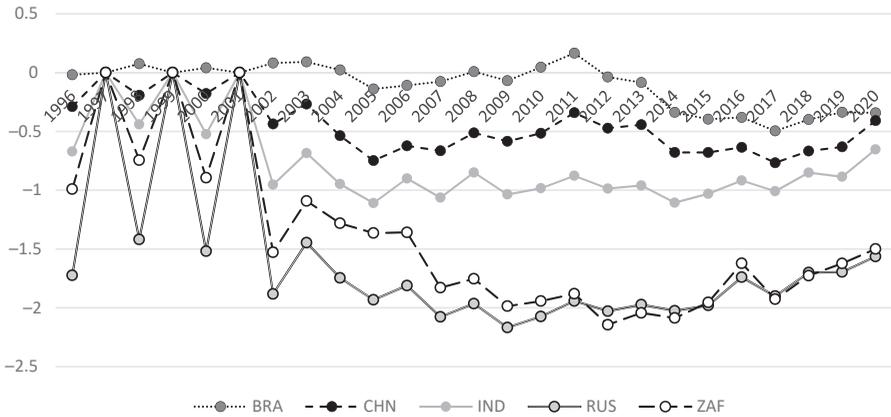


Figure 1.
Corruption perceptions
in BRICS countries

Source(s): The Worldwide Governance Indicators. Country's score of the aggregate corruption indicator, estimated in units of a standard normal distribution ranging from -2.5 to 2.5 (Kaufmann *et al.*, 2010)

progressively been zero-mean reverting over the sample period. The observed trend in corruption score across BRICS tends to be negatively associated with real per capita GDP at real per capita GDP levels below \$1,000 (see [Figure 2](#)). However, this inference ignores the effect of confounding factors, which requires an adequate analytical framework.

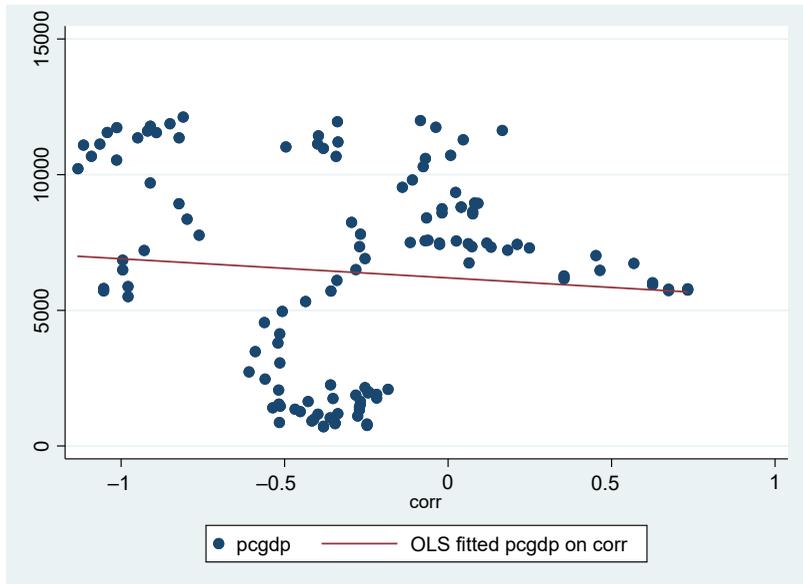


Figure 2.
Real per capita GDP
and corruption
perceptions

Source(s): World Bank's World Development Indicators and Worldwide Governance Indicators (WGI)

4. Results

The empirical analysis starts with pretesting requirement (see Table 1) consisting of heteroscedasticity and the cross-sectional dependence test, which are conditions for the panel regression estimator with Driscoll-Kraay standard errors.

The heteroscedasticity test statistic of 3.98 has a probability of 0.046, less than the conventional significance level, rejecting the null hypothesis of homoscedasticity. Likewise, the cross-sectional dependence test statistics (-3.520) display a probability of 0.0004, which is less than 5%. We thus conclude that BRICS countries exhibit some form of cross-sectional dependence.

4.1 Panel regression with Driscoll-Kraay standard errors

Against the pooled benchmark specification, the fixed and random effects results, with corrected standard errors, are summarised in Table 2.

Across the three estimators, the lag per capita GDP is consistently positive and significant, justifying the persistence of the economic output. From the pooled model, corruption and literacy rates have positive and significant coefficients, while the rule of law exhibits a negative growth effect. In addition, the interaction between corruption and the rule of law exhibits a positive and significant growth effect. However, inference from these estimates could be misleading as pooled regression overlooks the presence of individual-specific effects. Controlling for individual heterogeneities results in significant coefficients of quadratic corruption, while the coefficient of government consumption expenditure remains consistently negative and significant across different specifications. This corroborates the conventional wisdom that corruption dampens economic performance while government consumption expenditure lowers savings and growth through the distorting effects of taxation or government expenditure programmes. Population growth appears to have a negative growth effect, while investment exhibits the expected growth-enhancing effect, but only in the RE model, which appears to be the best model over the FE alternative. The Hausman test statistics display a P -value of 0.9998, indicating a failure to reject the null hypothesis that RE is valid. While these models produce very high R-squared (0.99), the consistency of the estimates, though robust for cross-sectional dependence, remains problematic due to endogeneity.

4.2 Bias-corrected IV-GMM estimators

Table 3 displays the estimates of IV-GMM corrected for small sample bias, known as corrected LSDV (LSDVC). To a large extent, the bias-corrected LSDV estimates corroborate the cross-sectional dependence consistent RE/FE estimates in terms of signs and significance but not the magnitude of the estimates. Lag per capita growth, quadratic corruption and government expenditure are significant drivers of GDP growth. As shown in Table 3, AH-LSDVC and AB-LSDVC estimators follow each other closely; most control variables exhibit marginal growth effects as their coefficients are insignificant. One standard deviation increase in corruption score leads to a 6.2% decrease in per capita GDP growth.

	Statistics	P value
Heteroskedasticity test	3.98	0.046
Cross sectional dependence test	-3.52	0.0004

Source(s): Author's calculations, STATA

Table 1.
Pretesting
requirements

Variables	Model 1 Pooled	Model 2 FE	Model 3 RE
lagpcgdp	0.995*** (0.00652)	0.982*** (0.0229)	0.992*** (0.00783)
corr	0.0542*** (0.0140)	0.0135 (0.0182)	0.0240 (0.0215)
corrsg	-0.0686*** (0.0131)	-0.0612*** (0.0283)	-0.0672** (0.0258)
gfcf	0.00144** (0.000638)	0.000809 (0.00205)	0.00125*** (0.000479)
govexp	-0.00840*** (0.00226)	-0.00944** (0.00364)	-0.00408* (0.00229)
pop	0.00172 (0.0176)	-0.0203 (0.0187)	-0.0284** (0.0124)
trade	5.21e-05 (0.000188)	-6.31e-05 (0.000460)	0.000117 (0.000396)
inf	-0.000179 (0.000373)	-0.000393 (0.000503)	-0.000344 (0.000581)
polsta	0.0138 (0.0105)	-0.00927 (0.0121)	0.00423 (0.00768)
rulaw	-0.0452** (0.0211)	0.00949 (0.0228)	-0.00550 (0.0131)
corr*rulaw	0.134*** (0.0342)	0.0839 (0.0691)	0.0748 (0.0703)
liter	0.000599** (0.000236)	-0.000130 (0.000179)	-4.66e-05 (0.000200)
Constant	0.182** (0.0792)	0 (0)	0 (0)
Hausman test		2.02 (<i>P</i> value = 0.9998)	
Observations	119	119	119
R-squared	0.999	0.9975	0.9996

Table 2. Panel regression with Driscoll-Kraay standard errors

Note(s): (*, **, ***) denotes statistical significance at 10%, 5% and 1%. RE and FE estimates controls for both individual and time effects
Source(s): Author's calculations – robust standard errors reported

Similarly, a one-unit increase in the government consumption expenditure ratio of GDP decreases the per capita growth rate by 0.9%. Important to note is the uniformity between cross-sectional dependence consistent FE and the bias-corrected LSDV estimators (AH-LSDVC and AB-LSDVC). Unlike these specifications, a spatial effect consistent RE produces more significant control variables, such as investment and population growth. Still, it delivers lower growth percentage changes following a unit increase in the ratio of government expenditure to GDP.

The empirical findings support the emphatic conclusion that corruption harms economic growth in BRICS countries. This may suggest the relative importance of economic freedom in these countries, in line with [Malanski and Santos Póvoa's \(2021\)](#) claim that the low growth effect of corruption is characteristic of countries with greater economic freedom. Considering that the rule of law can be assimilated into economic freedom, which defines the rights of people and their property ownership, government efficiency and the integrity of the economic system, one would expect a significant coefficient of the interaction between the corruption variable and the rule of law. This was, however, not the case with the robust estimators, possibly revealing rather restrictive economic freedom in some BRICS countries. Under such conditions and according to [Urbina and Rodríguez \(2022\)](#), it is plausible to contend that

Variables	AH-LSDVC	AB-LSDVC
lagpcgdp	0.995*** (0.0202)	0.995*** (0.0291)
corr	0.00748 (0.0244)	0.00896 (0.0358)
corrsq	-0.0629*** (0.0236)	-0.0626* (0.0333)
gfcf	0.000179 (0.00143)	0.000260 (0.00229)
govexp	-0.00981*** (0.00326)	-0.00973*** (0.00447)
pop	-0.0173 (0.0191)	-0.0147 (0.0295)
trade	4.22e-05 (0.000611)	4.03e-05 (0.000900)
inf	-0.000470 (0.000403)	-0.000442 (0.000567)
polsta	-0.00974 (0.0127)	-0.00954 (0.0200)
rulaw	0.0109 (0.0280)	0.00810 (0.0421)
Corr*rulaw	0.0802 (0.0587)	0.0776 (0.0836)
liter	-0.000113 (0.000202)	-0.000113 (0.000294)
Observations	119	119

Note(s): (*, **, ***) denotes statistical significance at 10%, 5% and 1%. AH-LSDVC refers to the bias corrected [Anderson and Hsiao \(1981, 1982\)](#) estimator while AB-LSDVC denotes the bias corrected [Arellano-Bond \(1991\)](#) estimator that control for both individual and time effects

Source(s): Author's calculations – robust standard errors reported

Table 3.
Bias corrected LSDV

corruption may dampen the natural resource sector of BRICS economies with a restrictive rule of law, resulting in a negative growth impact. This inference emerges from the consistent cross-section and IV-GMM bias-corrected estimators in contrast to the benchmark pooled OLS, which ignores critical econometric issues such as heterogeneity, endogeneity, cross-section dependence and small sample bias. Therefore, some positive growth effects attributed to corruption – as evidenced in the pooled results – could potentially be credited to methodological flaws.

5. Discussion

5.1 Theoretical implications

Consistent with [Nguyen and Bui's \(2022\)](#) views, the estimation results show that government expenditure and corruption scores negatively impact economic growth. While corruption's negative growth effect may occur through various mechanisms, our findings agree with [Tanzi and Davoodi's \(1997\)](#) proposition that corruption raises the number, alters the design, enlarges the size and increases the complexity of government projects, which results in the productivity decline of public investment. This is illustrated by the negative and significant coefficient of government spending, implying that corruption in BRICS economies aggravates the misallocation of resources, reducing economic performance. The misallocation of resources may channel through inefficient bureaucracy ([Leite and Weidmann, 1999](#)), rent-seeking behaviour ([Yaw Broni et al., 2019](#); [Baumol, 1990](#);

Shleifer and Vishny, 1993), changes in the relative price of goods and services (Mauro, 1995) and uncertainty (Pellegrini and Gerlagh, 2004).

5.2 Managerial and policy implications

From a policy perspective, embarking on anti-corruption policies will likely boost BRICS countries' economic performance. According to the World Bank (2021), combating corruption starts with establishing different competencies to implement policies and practices that improve outcomes and reinforce public integrity. In addition, corruption prevention remedies address transgressions, promote behavioural adjustment and improve norms and standards to assist anti-corruption efforts. According to Mpofu and Hlatywayo (2015), effective training for municipal employees and development systems and processes in South Africa will likely discourage corruption while improving the provision of basic services to the communities. Similarly, development aid recipient countries are expected to improve good governance since accountability and control of corruption have become critical in the aid allocation decision (In'airat, 2014). Finally, considering that corruption is a global problem requiring a global solution (World Bank, 2021), Afonso and Longras (2022) advocate for implementing corruption-reducing policies across all countries. These authors conclusively reported that such policies could advance all countries' positions in international trade, labour markets and economic growth while simultaneously increasing institutions' quality and offshoring attractiveness.

5.3 Limitations and future research agenda

Corruption might exhibit different growth effects depending on the time horizon, the modelling framework and the type of corruption. This study hypothesised and tested the linear impact of corruption scores on economic growth in BRICS countries. Additional tests of the mechanisms through which corruption scores affect economic growth should be the subject of future study. Similarly, non-linear modelling frameworks and alternative corruption measures could provide further insight into the corruption-growth nexus. Another area of future research may entail comparing corruption's and economic growth's short- and long-term dynamics.

6. Conclusions

This study sought to determine corruption's impact on economic growth in the BRICS country bloc from 1996 to 2020. Mainly, the level or magnitude of the impact was analysed. To this end, panel data techniques were used based on their adequacy in addressing problems inherent in short dynamic panel economic growth modelling, namely cross-section dependence, heterogeneity, endogeneity and slight sample bias.

Our results confirm the mixed conclusions reported in the empirical literature, depending on the estimation techniques. Specifically, ignoring the above econometric issues leads to a positive association between output growth and corruption score. However, bias-corrected and cross-sectionally consistent estimators that account for heterogeneity and endogeneity indicate that corruption scores negatively and significantly affect economic growth. Our finding supports the hypothesis of corruption's low growth impact on BRICS countries, implying that anti-corruption policies will likely promote growth performance in these economies.

While a few studies found corruption to have a positive impact on economic growth, this study's conclusion is consistent with a large body of empirical evidence, stating the corruption-growth nexus remains subject to several factors, including the corruption indicator, the context and time horizon of the study, thus requiring further investigation.

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