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## Article

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## GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

# The impact of corruption on economic growth in developing countries and a comparative analysis of corruption measurement indicators

Eleftherios Spyromitros<sup>1\*</sup> and Minas Panagiotidis<sup>1</sup>

**Abstract:** Although corruption has attracted researchers' attention for more than 30 years, it remains one of the most significant political challenges all countries face. Even though corruption measures have improved, they lack reliability and clarity. Two aspects of corruption are examined in this paper: a) its measurement and b) its effects on the economic performance of 83 developing countries in the period 2012–2018 with AR (1) and FM-OLS data processing techniques. It provides an extensive reference for and critical assessment of different corruption index approaches, focusing on the already known and widespread indicators. Furthermore, it refers to the measures most suited for statistical analyses regarding perceptions and experiences. In addition, the study's empirical results show that corruption hinders the economic growth of those developing countries. Different levels of corruption impact economic growth in different regions; specifically in Latin American countries, corruption impacts positively on economic growth or vice versa; in the other regions, it is negative. Finally, investment, human development, government growth, and institutional quality play essential roles in economic growth.

**Subjects:** Economics; Macroeconomics; Econometrics

**Keywords:** Corruption indexes; governance; perception; economic growth; regional analysis

**JEL classification:** D73; E60; O4; C23; R11.

## 1. Introduction

The last wave of democratisation and the creation of new countries has resulted in the appearance of new democracies. In these, corruption is widespread and is one of the most severe threats to democratisation, and combating it has been one of the initial goals of politics and government. At the same time, corruption is high in autocracies, and it is impedimental to development in autocratic countries.

Besides, the relation of corruption with different macroeconomic environment measures is intense. Corruption reduces innovative strategies (Anokhin & Schulze, 2009), discourages instant foreign direct and total investment (Mauro, 1995), reduces the emergence rate of new workplaces, and increases the prices of products and services (Nwabuzor, 2005). Furthermore, it appears corruption causes significant problems to the distribution of wealth in the economy (Mauro, 1995). Also, foreign and private donors and organisations that intend to invest in different countries prefer to give their sources to governments that will use them more effectively. In many surveys, it is evident that corruption cumbers state expenditures and revenue and worsens the quality of services. Also, it is positively correlated with the informal economy size (Schneider,

1994) and is a taxation burden. Corruption is strongly connected with governance, and it is crucial to know its value quantitatively in different countries.

These facts led to the first part of this research, designed to address the most challenging problem: the measure of this phenomenon. Therefore, through disagreements on definitions that have been developing over time emerged the first composite measurement indexes: Transparency International's (TI) Corruption Perceptions Index (CPI) and Bribe Payers Index (BPI), the World Bank's Control of Corruption Index (CCI), the International Country Risk Guide (ICRG) and others. The following new topics arose:

- 1) which measures are more suitable: perceptions or experiences?
- 2) Are the results of academic research on corruption taken into account by those who plan government actions and make political decisions to tackle it?

In the second part of the research, we study the effect of corruption on economic performance. Although there is a growing empirical literature dealing with the impact of corruption on the economy and economic growth, in some respects, the literature is still limited. Most empirical studies focus on the influence of corruption on a small group of variables, such as economic growth, inflation, and investment.

As per empirical research, a one-unit increase in corruption reduces GDPpc by 0.15% to 1.5%. Improved investment and the level of secondary education are known to cause a significant improvement in per capita GDP and reduce the harmful effects of corruption on economic growth. Beyond a threshold, the impact of corruption also reverses in some regions (Latin America and Caribbean Countries-LAC and MENA). This threshold varies when AR (1) and FM-OLS econometric methods are used but remains significant. These findings reiterate the need to fight corruption. Policymakers should pursue administrative reforms to promote transparency, efficiency, and fair competition.

This study contributes to the literature in various ways. First, the consequences of corruption are presented through the analysis of the impact of corruption on GDPpc in a large sample where reliable measurements exist: 83 developing countries in the period 2012–2018. The period was chosen due to its post-crisis years, and reliable data were presented on corruption indicators. It is to mention that we utilised the control of corruption index (CCI), the international country risk guide (ICRG), and the corruption perception index (CPI), along with other macro variables. The research focuses on the effect of variables at the macro level as, on the one hand, it investigates the general interactions of the variables at the country level. On the other hand, it uses corruption measurements related to general trends (perceptions). Robustness checks were also carried out, dividing our general model into regions, drawing geographical consistency conclusions, and reducing the estimation bias. We have studied the hypothesis: If there are regions of countries where the negative impact of corruption on GDPpc is reversed, why does this happen, and what other variables play an essential role in this process?

Secondly, the analysis examines the effects of investment, the quality and quantity of the labour force, foreign direct investment, the size of the government, trade openness, and the amount of money on production. Finally, we use the AR (1) econometric methodology, which deals with the problem of autocorrelation and heteroskedasticity. In addition, we use the Fully Modified Ordinary Least Squares (FMOLS) method following Pedroni (2001), which effectively addresses the problem of both endogenous and omitted variables (Roodman, 2009) and cross-sectional dependence (Baltagi, 2006).

The second section of this paper deals with the bibliography. The studies that lead to the “grease” and “sand the wheels” hypotheses are separated and presented. The third section details the study's primary consolidated indexes: the CPI, the CCI (of Worldwide Governance Indicators [WGI]), the ICRG, and the third-generation indexes. At the same time, we assess the composite

indexes of perception (subjective) and experiences (objective). The fourth section discusses research methodology and data and presents the econometric tests, the empirical results, the consequent discussion, and the last section concludes. In the appendix, the second and third-generation corruption indicators are critically presented with simultaneous comparisons and a presentation of their advantages and disadvantages.

## 2. Literature review

### 2.1. Definitions and categorisations of corruption

In the 1990s, a period of rapid globalisation, international enterprises had become less tolerant of the costs and uncertainties associated with corruption, as reflected in Organisation for Economic Co-operation and Development (OECD) recommendations (Jain, 2001). Various organisations were involved—including Transparency International, which concluded that bribery, embezzlement, and confidential information were common problems that sometimes worsened during economic globalisation. This definition of corruption appears relatively narrow, limiting it only to the public sector (Tanzi, 1998). Hence, it is imperative to move toward a relationship-centered approach where the phenomenon is disconnected from specific types of organisations, behaviour, or even standards. This approach defines corruption as the abuse of entrusted power (Heywood, 1997). Transparency International approached this definition through the CPI. There are several categorisations of corruption, but the most important one refers to grand and petty corruption (Bohn, 2013).

On the one hand, grand corruption involves high-ranking officials at the policy formulation end of politics. It pervades national governments' highest levels, leading to a broad erosion of confidence in good governance, the rule of law, and economic stability (Rose-Ackerman, 2000). It refers not so much to the amount of money involved as to the level at which it occurs. On the other hand, petty corruption is defined as street-level everyday corruption and involves civil servants. It occurs when citizens interact with low- to mid-level public officials in hospitals, schools, police departments, and other bureaucratic agencies, and the monetary transaction scale is small.

### 2.2. Macroeconomic effects of corruption

Although some opine that corruption as a phenomenon can positively affect the economy, such as in strong bureaucratic regimes, it is a common view that it undermines institutions and democracy. Corruption can be found in several domains: in the public sector, in the private sector, and in public-private relations, where large-scale political corruption exists (military spending, health sector, etc.).

#### 2.2.1. Corruption, economic growth, and Governance

Two theories describe the relationship between corruption and economic growth: “sand the wheels” and “grease the wheels.” According to the first theory, corruption can negatively impact economic growth. Rose-Ackerman (1978) opined that reducing corruption in areas where the economic conditions are favourable is difficult. According to Shleifer and Vishny (1993), corruption is a deterrent to economic growth. On the other hand, according to the “grease the wheels” theory, corruption can positively impact economic growth. Summers (1977) posited that corruption positively affects economic growth since 1) it bypasses bureaucracy and 2) it encourages corrupt government officials to work more efficiently.

Many researchers have theoretically confirmed the negative effect of corruption on economic growth, thereby confirming the harmfulness of such an influence (Ivanyna et al., 2016). Blackburn et al. (2006) discuss how corruption can negatively affect a country's productivity. The authors also argue that different countries have different productivity levels, which could explain the difference in the effects of corruption on the economies of different countries. In addition, these studies determine the limit of corruption levels. Several researchers contend that, before reaching this limit, the hypothesis of “grease the wheels” is possible. On the other hand, several empirical

studies confirm the validity of the “sand the wheels” hypothesis. Mauro (1995) used data from 67 countries and identified a negative correlation between corruption and the average annual economic growth rate. He used the Business International (BI) index, an index created by Economist Intelligent Unit, as a proxy for corruption. Tanzi and Davoodi (1998) also investigated the effects of corruption on the economic size of countries. They found that corruption prioritises public investment over private investment by strongly substituting productive capital for the economy. They use indices of corruption data from two sources: BI and the International Country Risk Guide (ICRG) index by Political Risk Services, Inc. (PRS).

Empirical research also links corruption to governance or political structures and economic growth. Méndez and Sepúlveda (2006) use three corruption indicators: the ICRG index, the IMD (Institute for Management Development) index, and the Corruption Perceptions Index (CPI) compiled by Transparency International (TI). They concluded that corruption significantly negatively impacts the development of countries with high-quality “political institutions.” The same results were reached by Aidt et al. (2008), who used the CPI and Control of Corruption (CCI) indices. Méon and Sekkat (2005) propose a test for the “grease the wheels” and “sand in the wheels” hypotheses. Using correlations between indicators that measure the quality of institutions and corruption has shown that corruption is more inhibitory in the presence of low governance quality. They used the BI, the CPI, the CCI indices, and an index provided in the World Economic Forum’s Global Competitiveness Report, which was also used by Wei (2000). Fayissa and Nsiah (2013) concluded that income level plays an essential role in studying the impact of governance on economic growth. Spector (2016) affirms that corruption can be combated with a combination of solid institutions, a solid legal body, and a clear political will. Malanski and Póvoa (2021), using the CPI index, acknowledge that institutional quality affects corrupt activities concluding that transparent and credible institutions discourage such activities.

The “grease the wheels” hypothesis suggests a positive effect of corruption on economic growth under certain conditions (Acemoglu & Verdier, 2000). The same conclusion was reached by Y. Huang (2015), who used the perception indices for corruption and data from Asian and Pacific countries for the period 1997–2013 and showed a positive correlation between the two variables.

#### *2.2.2. The effect of corruption on income inequality, total investment, foreign direct investment (FDI) and government expenses*

In general, corruption exacerbates economic inequality, which can be calculated using the Gini variable (income inequality). This view argues that the rich are more likely to sway various decisions in their favour, undermining the legitimacy and principle of equal opportunity and further promoting their interests. Many empirical studies have concluded that corruption causes income inequality (Gupta et al., 2002; Li et al., 2000). Corruption can prove to be a deterrent to individuals or organisations investing in new products or distribution and promotion channels. This logic is also reflected in empirical research studying this relationship (Mauro, 1995). It has been observed that when corruption is predictable, the impact on investment is less than when it is not.

Foreign direct investment is calculated from the total foreign investment in the country as a percentage of GDP. When the economic environment is fraught with corruption, companies and governments are looking to invest in less corruptive regions or sectors and seek other more secure areas. Corruption must therefore be negatively correlated with FDI. This finding is reflected in empirical research (Wei, 2000). During a crisis, the funds mentioned above are withdrawn immediately and cannot be replenished by the lending institution. This process makes countries vulnerable in terms of funding. It should be noted that foreign direct investment is a small part of a country’s capital inflows. If we evaluate all of them with bonds, promissory notes, etc., it reveals a strong negative correlation with the level of corruption.

Economic theory suggests that high levels of corruption are associated with lower quality goods and services the government provides. The main reason is that resources are consumed by their

administrators for their benefit and do not reach the end-user (Tanzi & Davoodi, 1998). In specialised studies, the effect can be seen in individual areas such as education (Mauro, 1998), health (Gupta et al., 2001a), infrastructure (Tanzi & Davoodi, 1998), and military spending (Gupta et al., 2001b). We present Table 1 with various economic growth models used by researchers with their variables and primary results.

### 2.2.3. Other corruption effects

A slight negative correlation can be observed between corruption and exports (Beck et al., 1991). The willingness of exporters to provide their products and services in countries with high levels of corruption is essential, although this differs depending on the country. For example, the US does not prefer to export to countries with high corruption (Lambsdorff, 2000), which is not the case in Japan, Germany, Italy, and China. In terms of sending aid, various countries such as the Scandinavian countries and Australia have been found to avoid sending supplies to countries with high levels of corruption. Corruption seems to impact inflation in a specific direction, as several authors have shown the corresponding positive correlation (Ali & Sassi, 2016). Research has also linked corruption and economic growth to factors such as public debt, taxes, and e-government effectiveness. For example, Kunieda et al. (2014), using the ICRG corruption indicator as an interaction term with the capital account liberalisation, demonstrated a negative impact of corruption on economic growth because highly corrupt countries impose higher tax rates than their less corrupt counterparts.

Shittu et al. (2018) investigated the long-term relationship between debt, economic growth, and corruption. According to their findings, there is a negative relationship and bi-directional causality between debt and economic growth. Meanwhile, Khan and Krishnan (2021) explored corruption and e-government maturity, highlighting corruption in business systems.

As can be seen, without making an exhaustive reference to the indicators used by each author, many different indexes have been used to depict the extent of corruption. The present research uses a critical presentation of the indicators and a widely recognised empirical model to shed light on the “grease or sand the wheels” hypothesis in various developing countries by region.

## 2.3. Measurement indexes of corruption

Various indexes measure corruption—the most important of which is the Business International index, which is compiled by the Economist Intelligence Unit and includes an estimate of the level of corruption in various countries; the ICRG, which is published annually by Political Risk Services Inc.; WGI and especially its dimension on corruption CCI, which is published annually by the World Bank (WB); the Global Corruption Barometer (GCB), which is a public inquiry and the CPI, which measures the level of perceived corruption in the public sector and is published by TI. There are also modern measurement trials such as the Corruption Reflection Index (CRI) and the Corruption Conviction Index, which are calculated by the Institute for Corruption Studies (Dincer, 2020) for the United States, and the news flow indices of corruption (NIC) of the IMF (Hlatshwayo et al., 2018).

### 2.3.1. Categorisation and index analysis

Most views about corruption in the second half of the 20th century were general and without a specific framework for defining and measuring the phenomenon. Corruption data was derived from fieldwork and occasional interviews from legal and other primary sources and often from scandals published in the media (Galtung, 2006). The general view on corruption was that “events cannot be discovered or if they can, cannot be proved” (Leys, 1965). Also, comparisons between countries and periods were considered “impossible” or “meaningless” (Scott, 1969). Initial attempts to measure the phenomenon was made shortly before the 1990s but were fragmented and lacked any satisfactory database. From that point on, corruption research became more systematic and streamlined.



Table 1. Studies that find positive/negative /no relation with alternative indicators on corruption-economic growth models					
Author	Countries	Period	Main objective	Corruption	Major Findings
Mo, 2001	54 Countries	1970–1985	The impact of corruption on the growth and the transmission channels	CPI	A 1% increase in the corruption level reduces the growth rate by about 0.72%.
Li et al., 2000	46 Countries	1980–1992	Corruption and how it affects income destitution and economic growth	ICRG	Corruption retard economic growth. But the effect is less pronounced than the one found in Mauro (1995).
Gupta et al., 2002	38 Countries	1980–1997	The effect of corruption on income, income inequality, and poverty	ICRG	A one-sd increase in the growth rate of corruption reduces income growth by 4,7 %s per year.
Méon & Sekkat, 2005.	63–71 Countries	1970–1998	The relationship between the impact of corruption on growth and investment	CPI, CCI	Corruption harms growth. These impacts are different depending on the quality of governance.
Méndez & Sepúlveda, 2006.	40–85 Developing Countries	1960–2000	Corruption, growth, and political regimes	ICRG, CPI	Corruption benefits economic growth at low levels of political freedom and is detrimental at high.
Aidt et al., 2008	120 Countries	1970–2000	Governance regimes, corruption, and growth.	CPI, CCI	Corruption improves efficiency by allowing individuals to circumvent the worst institutional deficiencies.
Mocan, 2008	49 Countries	1975–1995	Does corruption have a direct impact on growth?	CPI, CCI, ICRG	The corruption indexes were not significant determinants of growth.
Anokhin & Schulze, 2009	64 Countries	1996–2002	Entrepreneurship, innovation, corruption, and productivity	CCI	Better control of corruption is associated with rising productivity through innovation and entrepreneurship.

(Continued)



**Table 1. (Continued)**

<b>Author</b>	<b>Countries</b>	<b>Period</b>	<b>Main objective</b>	<b>Corruption</b>	<b>Major Findings</b>
Kunieda et al., 2014	109 Countries	1985–2009	Corruption, capital account liberalisation, and economic growth	ICRG	Government corruption and financial openness significantly and negatively impact economic growth.
Menard & Weill, 2016	71 Developing Countries	1996–2009	Understanding the link between aid and corruption through economic growth	CCI	There is no significant causal relationship between the variables.
Cieslik & Goczek, 2018	142 Countries	1994–2014	Control of corruption, international investment, and economic growth.	CPI, ICRG	The empirical results confirm that corruption hinders growth by limiting investment.
Shittu et al., 2018	5 SSA Developing Countries	1990–2015	The nexus between external debt, corruption and economic growth	ICRG	Corruption in these countries rather increases the level of production.
Chakravorty, 2019	91–98 Countries	2000–2011	The effect of financial development on renewable energy consumption	ICRG, CPI	CPI, in some cases significant and negative correlated with economic growth, ICRG insignificant.
Gründler & Potrafke, 2019	175 Countries	2012–2018	The nexus between corruption and economic growth	CPI, ICRG	The effect of corruption on growth is that real pc GDP decreased by 17% when it increased by one sd.
Song et al., 2020	142 Countries	2002–2016	Corruption, economic growth, and financial development	CCI	Corruption deteriorates economic growth and financial development.
Cao et al., 2021	111 Countries	2005–2018	A Sentiment-Enhanced CPI and the correlation with economic growth	SE-CPI	The SECPI is negatively correlated with the business environment, institutional quality, and econ. growth.
Malanski & Póvoa, 2021	30 Developing Countries	2000–2017	The effects of corruption on growth for different levels of economic freedom	CPI	Corruption damages countries with greater ec freedom in LA and Asia and favours less liberal countries.

**Table 2. Categorisation of the processes of corruption measurement**

	<b>FIRST-GENERATION INDICATORS</b>	<b>SECOND-GENERATION INDICATORS</b>	<b>THIRD-GENERATION INDICATORS</b>
MEASUREMENT CHARACTERISTICS	Local investigations Individual domains Nonmeasurable and noncomparable sizes	General surveys Wide range of countries Averages or weighted averages (aggregate indicators)	A) Field surveys, individual domains, Analytical measurements of financial flows, etc. B) Media surveys
INDICATOR NAMES	—	CPI, CCI (part of WGI), ICRG, GCB, and NIS	A) DAC index, PEFA, BEEPS, PETS, QSDS, and BPI B) CRI, Corruption Conviction Index and NIC
PERIOD	1950–1990	1990–	2001–
BASIC AUTHORS	Wraith and Simpkins (1963), Leys (1965), Scott (1969), Heidenheimer et al. (1989)	Kaufmann et al. (1999), Lambsdorff (2002), Treisman (2000), Kaufmann and Kraay (2007)	Reinikka and Svensson (2006), Seligson (2006), Olken (2007), Hlatshwayo et al. (2018), Dincer (2020)

Note: CPI: Corruption Perceptions Index, CCI: Control of Corruption Index, WGI: World Governance Index, ICRG: International Country Risk Guide, GCB: Global Corruption Barometer, NIS: The National Integrity System, DAC: Development Assistance Committee index, PEFA: Public Expenditure and Financial Accountability, BEEPS: Business Environment and Enterprise Performance Survey, PETS: Public Expenditure Tracking Surveys, QSDS: Quantitative Service Delivery Survey, BPI: Bribe Payers Index, CRI: Corruption Reflection Index, NIC: News flow Indices of Corruption.

The primary distinction of indexes, which is the essence of corruption, is defined as objective and subjective indexes. The main difference lies in measuring perceptions with subjective indicators and the precise hard data of proven corruption with objective indicators. This controversy led to the so-called problem of perception. This view follows social scientists' research on well-being indicators (Land & Michalos, 2018; Veenhoven, 2002). The above researchers distinguish measurable quantities in subjective and objective and the corresponding measurement methodologies in objective and subjective. In Table 2, the Categorisation of the processes of corruption measurement can be observed.

From the evolutionary process, second-generation indexes representing a more systematic process of collecting data from different sources and, in some cases creating composite indicators, better known as “aggregate indicators,” are developed (Kaufmann et al., 1999). Researchers arrived at these new indicators through the first ones' strong criticisms, as they relied on fragmentary measurements.

The nature of corruption and its causes and consequences have been the subject of studies by many researchers in the past. Many attempts have been made to measure the phenomenon, but three access indicators have prevailed in the literature today: The CPI, which TI has been publishing since 1995; the CCI, which the WB has been publishing since 1999 and is a dimension of the WGI; the ICRG, which seems to measure business risk from corruption and is used mainly for robustness procedures. This public recognition of the indicators mentioned above from the world literature has led to a new boom with the central corruption theme (Treisman, 2000). Due to their nature, these indices are called composite or aggregate indicators. A detailed reference to them regarding their creation and evaluation is given in Appendix A. Although various corruption indicators have been used in the empirical literature, their comparative presentation in identical samples is extremely limited in economic growth models. The present study aims to fill this gap.

### 3. Basic Second and Third-Generation Indexes

#### 3.1. Second-generation composite indexes

##### 3.1.1. The structure of the CPI

The CPI has measured experts' perceptions of corruption since 1995 through In-depth interviews, focus groups, and Studies based on national quotas. The main characteristics are: 1)the CPI initially rated and ranked countries on a numerical scale from 0 to 10, with 0 meaning high corruption, while today, the scale is 0–100, 2)it consists of 13 independent sources for 180 countries, where each source must meet specific requirements for reliability, recognition, and scalability, 3)independent investigations used two-year data to avoid problems from ephemeral events, such as corruption scandals that received publicity and 4)to be included, a country must meet the basic requirement of having at least three independent sources of measurement.<sup>1</sup>

##### 3.1.2. The WGI (CCI) structure

The structure of the WGI, created by World Bank researchers, has some similarities with that of the CPI and tried to improve it at some points (Kaufmann et al., 1999).

It refers to 212 countries and territories and is divided into the six dimensions: 1) control of corruption, 2) voice and accountability, 3) political stability and absence of violence, 4) government effectiveness, 5) regulatory quality, and 6) Rule of Law. One of the above dimensions of the index concerns the measurement of corruption exclusively with the CCI (Control of Corruption Index) sub-index, which in 2019 came from 40 indicators through 25 independent sources. It measures both small and large corruption and extends to the private sector. The main goal of the World Bank in measuring corruption is to identify governance failures, and for this, the emphasis is on calculating the WGI and not the CCI. A significant disadvantage of the weighting method is that strongly correlated bases are intensely weighed. So, the solely sources have minimal impact on the final results. Finally, the variation of data and the confidence intervals provide enough information about the measurements' accuracy. Comparing the score from year to year and drawing conclusions about the phenomenon's trends is not recommended.

##### 3.1.3. The ICRG structure

In 1992, the ICRG was absorbed by the PRS Group. According to PRS, corruption threatens foreign investment: it distorts the economic and financial environment, reduces the efficiency of the private and public sectors, and, ultimately, introduces an inherent instability in political and economic functions. For the clients' needs regarding the potential risks for international business activities, the authors of ICRG created a statistical model for calculating the risks. The result is a system that allows the measurement and comparison of different types of risks between countries (ICRG model). The ICRG model, used by institutional investors, banks, multinational companies, importers, exporters, foreign exchange traders, shipping companies, etc., allows users to make their own risk assessments. The methodology is based on a set of 22 elements grouped into three risk categories: political (12—one element is corruption), financial (5), and economic (5). Despite the widespread use of the index, it is considered to measure investment risk from corruption, and the scope of the countries is relatively limited (Gründler & Potrafke, 2019).<sup>2</sup>

#### 3.2. Third generation indexes—new research methods

The gap between corruption's subjective and realistic elements has led research into a new field—creating third-generation, more tangible, and specialised indicators. These indicators are highly technical and are characterised as actionable, directly linked to countermeasure policies, and combined with relevant policies (Johnston, 2006).

Each researcher applies a different method of measuring corruption with actual data, using a different dimension. Some researchers use the cost-benefit method to calculate the cost difference of public works and get data from independent appraisers to measure corruption

(Olken, 2007). Others measure the phenomenon using the frequency of corruption cases per public operation and the amount paid as a bribe to civil servants (Svensson, 2003). Others measure the percentage of employees prone to bribery, calculating the data from questionnaires administered to civil servants (Çule & Fulton, 2005). Several attempts have been made to create mathematical models that could measure corruption. The essential third-generation indicators are the BPI which calculates corruption on the supply side, the PETS, and QSDS, which assess corruption by processes of financial resources flow from higher administrative levels to lower ones; the indicators, which record corruption as a percentage of convictions related to it (International Crime Victim Survey, etc.) and the new indicators CRI and NIC which estimate corruption by the frequency of announcements in the mass media (New York Times, Associated Press, etc.).<sup>3</sup>

It is clear that objective and subjective indicators are required to describe a social variable, but two trends refer to their evolution and how they must be used. One supports using composite indicators created from a set of simple indicators, which measure each different aspect of corruption. At the same time, the other helps list many individual indicators (objective and subjective; Veenhoven, 2002). Corruption is a social variable (León et al., 2013). From the list of all the advantages and disadvantages, it seems that, at this point, the creation of objective indicators is challenging, let alone the creation of a set of indicators. New technologies can help create new objective indicators with less complex processes. Up to this point, composite indicators seem more appropriate for the general assessment and comparison of corruption in different countries.

#### 4. The Impact of Corruption on Economic Growth in Developing Countries

##### 4.1. Econometric methodologies and models

One of the main advantages of second-generation composite indicators over the third-generation is their use in econometric analyses due to their feature for calculating marginal errors. Researchers have introduced these corruption variables into various economic models using this attribute to analyse their relationship with different economic variables, especially with economic growth, as mentioned in the bibliography section (Mauro, 1995; Tanzi & Davoodi, 1998; Aidt, 2009; Gründler & Potrafke, 2019). It was used especially because many models have been developed that study it due to the great interest from researchers, economists, politicians, and citizens.

We will use the augmented Solow-Swan model to explore the effect of corruption indicators on economic growth through an identical sample of countries. We adopt: 1) the simple dynamic fixed effect AR (1) model and due to the problems of endogeneity and omitted variable, 2) the Fully Modified OLS cointegration method. A basic model derived from the Solow-Swan model will be used, with the equations of the production functions:

$$Y_t = F(K_t, A_t L_t) \quad (1)$$

and

$$Y_t = F(K_t, H_t, A_t L_t), \quad (2)$$

$Y_t$ : GDP,  $K_t$ : capital,  $H_t$ : human capital and the factor ( $A_t L_t$ ) is labour multiplied by the rate of technology improvement, constituting labour productivity. These equations using the production function of the transformed Cobb-Douglas equation by Mankiw et al. (1992) give:

$$Y(t) = K(t)^\alpha (A(t)L(t))^{1-\alpha} \quad 0 < \alpha < 1 \quad (3)$$

We apply the FMOLS methodology, which considers the temporal effects of the past on the variables. The equation of the base model is transformed from (1), (2), and (3) and is derived indirectly from the Solow-Swan model. The equation of the complete integrated OLS system (FMOLS) is the following:

**Table 3. Variables, symbols, period, price scale, sources, and literature**

Symbols	Variables	Time	Data Sources	Literature
<b>LGDP</b>	GDP per capita at fixed \$US prices, 2011 (PPP)	2012–2018	World Bank, 2019	Aidt, 2009; Cieřlik & Goczek, 2018
<b>CPI</b>	Corruption Perception Index	2012–2018	Transparency International	Gründler & Potrafke, 2019
<b>CCI</b>	Control of Corruption Index	2012–2018	World Bank	Menard & Weill, 2016
<b>ICRG</b>	International Country Risk Guide (Corruption Index)	2012–2018 (0 – 6)	Transparency International	Tanzi & Davoodi, 1998
<b>INVT</b>	Total Investments (% GDP)	2012–2018	World Bank, Gl. Economy	Mauro, 1995; Méon & Sekkat, 2005
<b>FDI</b>	Foreign Direct Investment, inflows (% GDP)	2012–2018	World Bank UNCTAD	Anokhin & Schulze, 2009
<b>POP</b>	Population growth (annual %)	2012–2018	World Bank	Barro & Sala-i-Martin, 2004
<b>SEDU</b>	Percentage of citizens who participated in Sec Education	2012–2018	Global Economy	Méndez & Sepúlveda, 2006
<b>GEXP</b>	General government final cons. expenditure (% GDP)	2012–2018	World Bank	Easterly & Rebelo, 1993
<b>TROP</b>	Total exports and imports (% GDP), at constant prices	2012–2018	Global Economy	Méon & Sekkat, 2005; Chakravorty, 2019
<b>BRM</b>	Broad Money (M3/GDP)	2012–2018	WB, IMF, OECD	Li et al., 2000; Song et al., 2020

$$y_{it} = \beta_0 + \beta_1 C_{it} + \sum_{j=2}^m \beta_j x_{it}^j + \eta_t + \mu_i + v_{it} \quad (4)$$

where  $y_{it}$  is GDP per capita (natural logarithm, LGDP),  $x_{it}^j$  are  $m-1$  explanatory variables. These are the investments in private, public, and human capital (INVT), the percentage of the population that participates in secondary education (SEDU), trade openness (TROPEN), population growth rate—a proxy for labour (POP), foreign direct investment (FDI), broad money (BRM) and, the size of public sector-government expenditure (GEXP),  $\mu_i$ : constant individual effect of the characteristics of each country,  $\eta_t$ : time effects (shocks such as natural disasters, wars, economic or other crises, etc.) and,  $v_{it}$ : time-dependent error.

#### 4.2. Data and summary statistics

Table 3 presents the variables from the number of countries and the correlations we check. A sample of 83 developing countries is used for all variables, and the period is between 2012–2018 for the reasons mentioned in previous sections.

LGDP: logarithm of GDP, CPI: Corruption Perception Index, CCI: Control of Corruption Index, ICRG: International Country Risk Guide (Corruption Index), INVT: INvestment Total percent of GDP (proxy for Capital), FDI: Foreign Direct Investment, inflows (% of GDP), POP: Population growth (annual %, proxy for Labour)) SEDU: Secondary EDUcation (proxy for Human Capital), GEXP: Government EXPenditure (% of GDP), TROP: Trade Openness, BRM: Broad Money (M3/GDP), PPP: Power Purchasing Parity.

**Table 4. Minimum, maximum, averages, and standard deviations of the variables**

Variables	Observations	Minimum	Maximum	Average	Standard Deviation
<b>GDP pc, PPP</b>	581 (83 countries)	706,37	28.176,40	8.766,98	6.319,60
<b>LGDP</b>	581 (83 countries)	6,56	10,25	8,73	0,92
<b>CPI</b>	581 (83 countries)	35	89	67,06	9,09
<b>CCI</b>	581 (83 countries)	31,33	83,27	62,51	9,45
<b>ICRG</b>	581 (83 countries)	2,0	5,5	4,01	0,56
<b>FDI</b>	581 (83 countries)	-37,16	84,89	3,91	6,71
<b>POP</b>	581 (83 countries)	-1,79	6,57	1,71	1,15
<b>SEDU</b>	581 (83 countries)	10,00	132,82	69,78	26,65
<b>INVT</b>	581 (83 countries)	5,89	47,08	23,32	7,28
<b>TROP</b>	581 (83 countries)	19,10	208,31	71,42	31,39
<b>BRM</b>	581 (83 countries)	10,75	264,39	54,52	39,92
<b>GEXP</b>	581 (83 countries)	4,40	182,18	16,27	14,84

The variables' descriptive statistics are presented in Table 4, describing the countries' GDP in \$ US. A reversal has been made in CPI so that high values show high corruption. CCI is transformed from a (-)2.5—(+)2.5 scale to a 0–100 and is reversed, too. In the Secondary Education Index, the price can reach over 100% due to re-enrollment and the 2nd opportunity.

Variables are the same as in Table 3. Sources: World Bank, IMF, Global Economy, OECD, UNCTAD, Transparency International, and authors' calculations.

To apply FMOLS, a 1<sup>st</sup> level stationarity of variables and a cointegration vector must be present. This methodology is mainly used when there is cross-sectional dependence.

### 4.3. Econometrics and empirical results and discussion

#### 4.3.1. Fixed effect AR (1) dynamic model

**4.3.1.1. Model.** We investigate the impact of corruption on economic growth, taking into account the dynamics of the model through the impact of time lags on economic growth. To avoid the Nickell bias<sup>4</sup> in our panel, we use a dynamic AR (1) fixed-effect model methodology following Hsiao (2014), who suggested that the first-order difference is a valid instrumental variable in a simple fixed-effect AR (1) model. Our model is described by equation (4) where:

$$v_{it} = \rho v_{it-1} + v_{it} \quad (5)$$

$|\rho| < 1$  and  $v_{it}$  is independent and identically distributed with mean 0 and variance  $\sigma_v^2$  (Papadamou et al., 2017). Next, we use a model transformation that removes the  $\mu_i$  parameters and leaves the parameters in an estimable form. We subtract the group means from (4):

$$y_{it} - \bar{y}_i = \beta_1 (C_{it} - \bar{C}_i) + \sum_{j=2}^m \beta_j (x_{it}^j - \bar{x}_i^j) + (v_{it} - \bar{v}_i) \quad (6)$$

Equation (6) is a linear AR (1) model and can estimate  $\rho$ , with the aforementioned transformations. Testing the hypothesis of  $\rho = 0$  in a first-order autoregressive process produces test statistics for the case of balanced and equally spaced panel datasets (Bhargava et al., 1982) and unbalanced panels with unequally spaced data (Baltagi & Wu, 1999).

**4.3.1.2. Results.** The initial regression with the key variables of the model (Model 1), the Solow augmented model (Model 2), and the full Model (Model 3) with the CPI as a corruption indicator is depicted in Table 5, checking for consistency and robustness in the models. Next, we use the CCI indicator (Models 4, 5, and 6) and the ICRG (Models 7, 8, and 9) instead of CPI so that the robustness check in the results can be seen by using different indicators.

The first column of Table 5 shows the relationship between corruption and economic growth. Our results show a statistically significant correlation using a linear model for GDP dynamics (AR (1) estimators). With an increase of 1% in corruption, the economic growth decreases by about 0.2%. This percentage remains constant in models (2) and (3). Model (2) is the augmented Solow-Swan model as labour (POP), capital (INVT, FDI), and human capital impact (SEDU) have been added. Model (3) also includes the key variables that the literature has identified as total factor productivity.

The negative effect of corruption on economic growth is in line with the recent literature on developing countries (Magbondé et al., 2022; Otusanya, 2011). The prevailing view is that the investment channel through which corruption indirectly affects growth is more important than the rest (human development, trade openness, government expenses). Our research focuses on the post-crisis period, during which developing countries depended on investment to recover, and the negative correlation prevails.<sup>5</sup>

In models 4, 5, and 6, we replace the CPI with the CCI and observe that the effect of corruption on economic growth in the same models and with the same data is not statistically significant. The same goes for models 7 and 8 with the ICRG index. In model 9, the estimators have statistical significance, and the effect is about 0.15% (the ICRG scale is 6 points). All coefficients have been multiplied by 100.

Concerning the remaining explanatory variables and in line with previous literature, the increase of POP by 1% leads to a decrease in the GDPpc by about 2.4% due to the decreasing returns to scale of labour (Barro & Sala-i-Martin, 2004). An increase in investment causes economic growth of about 0.18% (Mauro, 1995), and the growth of the public sector (GEXP) by 1% of GDP decreases GDPpc by about 0.12%. An interpretation is that government consumption does not directly affect private productivity but lowers saving and economic growth through government inefficiencies, crowding-out effects, distorting taxation results, and intervention in the free markets (Barro, 1991). Government spending needs to be financed, and this funding, whether through taxes, public lending, or central bank lending, can severely impact economic growth (Feldstein, 1982).

Our research is limited to the 2012–2018 period for the post-financial crisis era and studies how economies are recovering. We can conclude that the impact is negative in the short run, while this trend can be reversed in the long run. The above analysis suggests that increased government expenditures will reduce economic growth in the short run. Empirical efforts to identify and measure the impact of trade openness on economic growth have had mixed results. The results of the cross-sectional data analysis were positive. Still, when the reverse causality and the endogenous nature of trade were considered in panel data studies, there were mixed results (Frankel & Romer, 1999). In addition, there is no consensus on the effect of FDI on GDPpc in the literature. Positive effects were



**Table 5. Long-term effects of augmented Solow and endogenous models with fixed effect AR (1) dynamic estimation method**

Dependent Variable	Logarithm of GDP per capita: LGDP 581 observations 83 countries								
	CPI			CCI			ICRG		
Corruption	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CPI	-0.23293** (0.038)	-0.21854* (0.052)	-0.19592* (0.078)						
CCI				-0.10594 (0.417)	-0.07846 (0.547)	-0.05782 (0.652)			
ICRG							-1.81072 (0.170)	-2.08848 (0.112)	-2.24973* (0.083)
POP		-2.60624** (0.013)	-2.37028** (0.022)		-2.49238** (0.018)	-2.26099** (0.030)		-2.60938** (0.013)	-2.38609** (0.021)
SEDU		0.10692 (0.220)	0.12725 (0.140)		0.12494 (0.150)	0.14179* (0.097)		0.13434 (0.125)	0.15013* (0.082)
INVT		0.17469** (0.036)	0.19201** (0.020)		0.17785** (0.033)	0.19506** (0.018)		0.18269** (0.030)	0.19782** (0.017)
FDI		0.0141 (0.781)	0.01218 (0.811)		0.01598 (0.753)	0.01194 (0.814)		0.01947 (0.706)	0.01421 (0.783)
BRM			0.06466* (0.086)			0.06143 (0.103)			0.05855 (0.121)
TROP			-0.04438 (0.197)			-0.05082 (0.137)			-0.05535 (0.110)
GEXP			-0.11755** (0.024)			-0.12221** (0.019)			-0.12097* (0.083)
R <sup>2</sup>	0.1265	0.1385	0.3784	0.1322	0.1928	0.4691	0.0427	0.1813	0.5966

\*, \*\* and \*\*\* mean the significance level of 10%, 5%, and 1%, respectively, the numbers in parentheses show the p values following the normal distribution as T and N tend to infinity. Variables are the same as in Table 3. The reported coefficient on all variables is multiplied by 100. Columns 1–3 present results using the CPI indicator. Columns 4–6 present results using the CCI indicator. Columns 7–9 present results using the ICRG indicator. It used the autocorrelation of residuals method. We control for a complete set of country and year fixed effects in all specifications. Sources: World Bank, IMF, Global Economy, OECD, UNCTAD, Transparency International, and authors' calculations.

found, but potential drawbacks exist, including a deterioration of the balance of payments, as profits are repatriated, negatively impacting competition in national markets.

#### 4.3.2. Fully modified OLS cointegration method

Due to endogeneity and omitted variables, we use the Fully Modified OLS methodology (Pedroni, 1996) for robustness check.

*4.3.2.1. Unit roots test, cross-sectional dependence (CSD), and panel cointegration results.* First, we check the variables' degree of stationarity. We use unit root tests introduced by Levin, Lin, and Chu, Breitung and ADF-Fisher. The results suggest that GDP per capita, corruption (all three indicators), total investment, foreign direct investment, human capital, labour, trade openness, broad money, and government size are 1st level stationary. The unit root tests assume that the cross-sectional units of the data panels are not strongly correlated.

Next, we apply the cross-sectional dependence tests proposed and implemented by Pesaran and Frees. The tests are performed on the sample of 83 developing countries, and we find that the null hypothesis of the non-existence of CSD in spatial units is rejected. We conclude the existence of dependence between variables in different countries. The other variables of corruption (CCI, ICRG) will be utilised to ascertain the robustness of the basic model. To apply FMOLS econometrics, we adopt panel cointegration tests proposed by Kao, Pedroni, and Westerlund to determine the possible existence of a cointegrated vector in our essential variables. The results show cointegration between the model's main variables, LGDP as a dependent variable, and CPI (or CCI and ICRG), POP, SEDU, INVT, and FDI as regressors.

*4.3.2.2. Results of panel FMOLS econometrics and policy implications.* The initial regression with the key variables of the raw model (Model 1), the Solow augmented model (Model 2), and the full Model (Model 3) with the CPI as a corruption indicator is depicted in Table 6, checking for consistency and robustness in the models. Next, we use the CCI indicator (Models 4, 5, and 6) and the ICRG (Models 7, 8, and 9) instead of CPI for a robustness check. The above models provide clear-cut conclusions regarding corruption and other macro-variables on economic growth. The negative relationship between corruption and economic growth is straightforward and robust with the gradual completion of the models and the different econometric methodologies applied. These conclusions are in line with the literature and the "sand the wheels" hypothesis (Aidt, 2009; Gründler & Potrafke, 2019; Mauro, 1995; Mo, 2001). Simultaneously, the power of the augmented Solow model is evident (Models 2, 5, and 8), as is the contribution of endogenous models (3, 6 and 9).

The first column of Table 6 shows the relationship between corruption and economic growth with the CPI indicator. Our results show a statistically significant correlation using the FM-OLS estimator, and with an increase in 1% of corruption, the economic growth decreases to about 4%. This percentage remains constant in models (4) and (7). Model (2) is the augmented Solow-Swan model as labour (POP), capital (INVT, FDI), and human capital impact (SEDU) have been added. Model (3) also includes the key variables that the literature has identified as total factor productivity. The effect of corruption on economic growth is reduced in models 2 and 3 of the CPI. A key factor could be the indirect effects of corruption on economic growth through the transmission channels. This overall result is mainly due to the impact of corruption on economic growth through human capital, total investment, and other channels (Gründler & Potrafke, 2019; Mo, 2001). In models 4, 5, and 6, we replace the CPI with the CCI. The effect of corruption on economic growth in precisely the same models 5 and 6 and with the same data is not statistically significant. The same goes for models 8 and 9 with the ICRG index. In model 7, there is statistical significance. All coefficients have been multiplied by 100. Also, the variables' signs and significance align with the international literature in the overall model. Our analysis is robust when using different models with one, five, or eight independent variables. Robustness also exists when we use different econometric methods (AR (1) and FMOLS), but it does not strongly exist when different corruption variables are used.

**Table 6. Long-term effects of augmented Solow and endogenous models with FMOLS estimation method**  
**Logarithm of GDP per capita: LGDP**  
**581 observations 83 countries**

Dependent Variable	CPI			CCI			ICRG		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CPI	-4.76937*** (0.000)	-0.73984* (0.089)	-1.23233*** (0.006)						
CCI				-4.4633*** (0.000)	-0.3428 (0.421)	-0.61251 (0.202)			
ICRG							-4.4587*** (0.001)	-8.05609 (0.370)	-8.0918 (0.348)
POP		-2.5318 (0.524)	-9.27229** (0.024)		-1.81291 (0.649)	-7.23347 (0.105)		-5.15419 (0.328)	-9.33002* (0.065)
SEDU		2.79798*** (0.000)	2.64465*** (0.000)		2.93131*** (0.000)	2.71806*** (0.000)		2.88138*** (0.000)	2.65442*** (0.000)
INVT		0.69893 (0.159)	1.25797** (0.014)		0.43214 (0.389)	1.18041** (0.036)		0.29079 (0.659)	0.64163 (0.309)
FDI		0.69418 (0.194)	1.18685** (0.042)		0.27458 (0.607)	-0.46264 (0.467)		0.09906 (0.889)	0.37128 (0.606)
BRM			0.45376*** (0.000)			0.50907*** (0.000)			0.3669*** (0.003)
TROP			-0.50828*** (0.000)			-0.4945*** (0.000)			-0.25639 (0.103)
GEXP			-0.75458*** (0.003)			-0.53848* (0.053)			-0.1364 (0.664)
R <sup>2</sup>	0.1007	0.4097	0.1418	0.0469	0.3348	0.2450	0.0606	0.6070	0.5618

\*, \*\* and \*\*\* mean the significance level of 10%, 5%, and 1%, respectively, the numbers in parentheses show the p values following the normal distribution as T and N tend to infinity. Variables are the same as in Table 3. The reported coefficient on all variables is multiplied by 100. Columns 1–3 present results using the CPI indicator. Columns 4–6 present results using the CCI indicator. Columns 7–9 present results using the ICRG indicator. In FMOLS, lags 2.00 are used, and the linear and quadratic eqtrend effect is controlled (2). Sources: World Bank, IMF, Global Economy, OECD, UNCTAD, Transparency International, and authors' calculations.

Regarding the issue of the reliability of the composite indicators, it seems that there is no agreement on the statistical significance of our model. This requires an attempt at interpretation. The same sample is used to evaluate the indicator's coefficient. In addition, our model used macro variables for the growth model without others showing freedom, democracy, or government performance. One interpretation that could be given for the significance level is that, as has been seen in sections 2 and 3, an attempt has been made in CPI to measure only corruption by cutting out as many other aspects as possible. This is not the case with the other two indicators. ICRG incorporates the risk investors take in relation to corruption, while CCI considers the governance failures associated with corruption. This argument can be strengthened by the presentation of Table 1 and the literature concerning macroeconomic phenomena. In research where other phenomena of governance or politics intervene in the correlation between corruption and economic growth, then this relationship changes form and becomes a curve, showing turning points or changes in direction (Méon & Sekkat, 2005; Méndez & Sepúlveda, 2006; Aidt et al., 2008; Anokhin & Schulze, 2009; Malanski & Póvoa, 2021). Table 1 shows that there are studies with all the indicators that show different results in the relationship between corruption and economic growth. The results depend on whether the models contain social variables and the sample of countries used. In addition, the findings and the arguments are elements of reflection as to what precisely each composite indicator measures. Further comparative research is therefore needed to determine whether one of the composite indicators can be used more reliably than others and under what conditions.

#### *4.3.3. Regional sub-samples according to the world bank's classification. AR (1) and FMOLS dynamic panel regression models in developing countries*

To further analyse the above and investigate whether the relationship between corruption and economic growth remains linear, we investigate the effects by region (continent). Table 7 displays the correlation of the growth variables, with the addition of corruption, with GDP in five sub-samples. To make this division, the classification proposed by the World Bank was used, such that the criterion is the region to which the country belongs (Fethi & Imamoglu, 2021). This separation aims to reduce the estimation bias and investigate the essential factors affecting the growth in each region. The first region comprises 11 Europe and Central Asia countries, and the second one consists of 19 Latin America and Caribbean countries. The third region includes 13 East Asia and Pacific countries, the fourth of 10 Middle East and North African countries, and the fifth of 30 Sub-Saharan and African countries. Corruption confirms the vital negative sign and its harmful impacts on economic growth except in LAC countries where it boosts economic growth.

Moreover, coherence is indicated in all variables. We observe an agreement in the directions of the variables between the AR (1) and FMOLS methods. Nevertheless, in general, there are also significant differences between the regions. In ECA (European and Central Asia) countries, corruption hinders economic growth. However, it is not a critical factor (0.4% decrease in GDPpc with 1% increase in corruption) such as population growth, investment, and secondary education, which positively affect economic growth. The results can be interpreted in favour of European transition economies capable of tackling the issue of corruption compared to the weaker economies as they have more efficient legal systems, better policies and economic stability, better governance, public services and infrastructure. These estimations align with Fethi and Imamoglu (2021). Consequently, there is a need for labour in ECA countries due to the low birth rates and economic growth following the financial crisis.

In LAC countries, corruption fosters economic growth in the AR (1) model and has a strongly positive effect in the FMOLS model ("grease the wheels" hypothesis). These results are in line with Shittu et al. (2018). As the structures in these countries are weak, corruption accelerates growth by overcoming bureaucratic and other problems. This shows that such countries have been aggravated by weak institutions and a weak rule of law, internal conflicts, high debt, poor regulation and stagnation from economic and political instability. These countries need structural reforms and political stability with processes that could attract financial aid and investment.

**Table 7. Effects of corruption on economic growth with AR (1) and FMOLS (dynamic) estimation method, using CPI Corruption indicator in five regions according to the world bank's classification**

Dependent Variable	Logarithm of GDP per capita: LGDP 581 observations 83 Countries									
	Regions, Count Observations		LAC, 133 obs, 19 countries Latin America and Caribbean		EAP, 91 obs, 13 countries East Asia and the Pacific		MENA, 70 obs, 10 countries Middle East and North Africa		SSA, 210 obs, 30 countries Sub Saharian Africa	
Model	Model 1 AR (1)	Model 2 FM-OLS	Model 3 AR (1)	Model 4 FM-OLS	Model 5 AR (1)	Model 6 FM-OLS	Model 7 AR (1)	Model 8 FM-OLS	Model 9 AR (1)	Model 10 FM-OLS
CPI	-0.21643** (0.030)	-0.39877*** (0.000)	0.7501* (0.061)	1.94965*** (0.001)	-0.46877 (0.132)	-6.48255*** (0.000)	0.52162 (0.293)	4.09648 (0.153)	-0.3942** (0.026)	-1.61215*** (0.001)
POP	24.94453*** (0.000)	9.99586** (0.000)	1.75411*** (0.000)	0.91806 (0.191)	-4.779677*** (0.000)	-4.68768*** (0.000)	-1.36059** (0.022)	-1.682251*** (0.000)	-1.40004 (0.702)	-1.062095 (0.271)
SEDU	0.7945** (0.017)	8.09192*** (0.000)	0.16564 (0.336)	2.18875*** (0.000)	0.30045 (0.790)	0.90513*** (0.000)	0.20015** (0.035)	2.90117*** (0.000)	0.18325** (0.022)	1.91346*** (0.000)
INVT	0.96602*** (0.002)	4.24203*** (0.001)	0.52186*** (0.000)	1.38896** (0.022)	0.4954* (0.076)	8.12644* (0.086)	0.21195 (0.662)	1.36586*** (0.000)	0.00940 (0.923)	2.39979*** (0.000)
FDI	-0.28346 (0.231)	-3.19239*** (0.002)	0.17638 (0.409)	1.14075 (0.524)	-0.11009 (0.880)	-1.352257 (0.153)	0.01212 (0.992)	1.313742*** (0.000)	0.03239 (0.589)	2.07218*** (0.000)
R <sup>2</sup>	0.4764	0.5525	0.6004	0.1437	0.5124	0.8080	0.5376	0.4932	0.3534	0.1856

\*, \*\* and \*\*\* mean the significance level of 10%, 5%, and 1%, respectively, the numbers in parentheses show the p values. All abbreviations and sources are the same as in Table 3 with the authors' calculations. In FMOLS, lags 2.00 are used, and the linear and quadratic cointegration effect is controlled (2). The reported coefficient on all variables is multiplied by 100

EAP and SSA countries show strong similarities. Corruption is a deterrent to growth (6.5% and 1.61% decrease in GDPpc, respectively, for a 1% increase in corruption), and investment remains a potent stimulus. Asian and African countries are experiencing large-scale corruption due to political instability that undermines economic performance, while investment can lead to growth. In addition, population growth reduces productivity as these economies are underdeveloped, and there is a shortage of new jobs, which may lead to immigration. These findings align with Shittu et al. (2018) for the SSA countries and with C. J. Huang (2016), who found mixed results in Asia and the Pacific countries.

In the MENA region, corruption has an insignificant effect on GDPpc. Other vital factors are population growth (1.8% decrease in GDPpc with 1% increase in population) and increasing influence of investment, SEDU, and FDI. The empirical analysis revealed that the impact of institutional variables is vital in the MENA region. The same applies to the indirect effects of corruption on growth through investment and human capital. Thus, better-performing institutions are likely to improve development by increasing the efficiency of investment and human capital. These institutions are essential for growth and productivity because they mainly influence the incentives of growth performance through cost-effective investment.

## 5. Conclusions

We used a model of growth that depends on corruption based on theoretical underpinnings. The main empirical result is that corruption is an obstacle to development (“sand the wheels” effect). Still, this relationship can be reversed in some countries (“grease the wheels” effect), confirming the predictions of the developing countries’ political economy theory developed in the last decades. In this context, the empirical literature that reports a linear relationship between corruption and economic growth does not fully explain the effect of corruption in countries when distinguished according to the regions studied.

High levels of corruption and bureaucratic inefficiency are likely to hinder investment and growth, and action should be taken against corruption directly and indirectly through other transmission channels. But corruption does not necessarily impede economic growth when other factors favour it. For panel data, corruption positively affects economic growth in Latin American and MENA countries. Of course, the policy implications cannot be the increase in corruption but the study of the remaining factors that intervene in the analysis. Specifically, improving education and investments would be essential growth factors in these countries. Also, the panel data analysis for these countries strongly supports the proposition that the quality of public institutions plays a critical role in the development performance of any country. This is evident in the high statistical significance of the estimated parameters for the institutional variables and their robustness to changes in model specification.

Several channels are identified in this study through which corruption impedes economic growth. They include domestic investment, foreign direct investment, government spending, skewed government spending allocation away from education, health and infrastructure maintenance, and less efficient public projects that provide more scope for manipulation and bribery. Many countries have been shown to have significantly reduced corruption. Encouraging research in this path can provide valuable direction for policymakers to improve the conditions for development.

At the same time, many corruption indicators appeared to be calculated in some cases, and various problems reported (individual samples, cost, reliability, etc.) did not last. However, it is clear that in other cases, significant efforts have been made, through the evolution of indicators, to measure them impartially, consistently, and effectively to create indicators that assess reality. This is especially true of CPIs, CCIs, and ICRGs; the introduction and formulation date back to the 1980s and, in some cases, continue today.



However, although measurement tools are abundant, they have been applied to systematic policy-making against corruption in very few cases. One key reason is that academic research has struggled to develop methods of measuring corruption that recognise the complexity of the concept, its causes, its channels of expression, and its relationship to politics and social and economic operations. Also, those responsible for the policy-making and the business people did not substantially use academic research in seeking solutions to corruption. Many have resorted to politicising corruption, which jeopardises the process of dealing with it and distracts everyone from the real problem.

This paper has made a detailed record and comparative evaluation of the indicators for measuring corruption. The ongoing analyses show that each indicator can estimate different dimensions of corruption. But it also seems that: a) composite indicators provide more advantages in analyses than simple ones or objective indicators by capturing more dimensions of this complex phenomenon, especially by comparing countries, and b) empirical analyses through econometric methodologies offer a lot of information regarding the correlations of corruption with economic, political and social phenomena, contributing to the processes of understanding and dealing with their consequences.

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#### Notes

1. A detailed description of the CPI index with its disadvantages and advantages is given in Appendix B.
2. A comparison of the above basic indicators and a detailed listing of the criticism of second-generation indicators are provided in Appendix C.
3. Detailed information about them and a presentation of the advantages and disadvantages of the 2nd and 3rd generation indicators, in contrast, are given in Appendix D.
4. According to Nickell (1981) when panel data models with fixed effects and lagged dependent variables are estimated by the standard within estimator if the time dimension,  $T$ , is small, bias depends on the  $1/T$  and disappears as  $T$  grows large.
5. This picture is slightly different in regions such as Sub-Saharan Africa (SSA), where the negative relationship is weak, as well as in Latin American countries (AME), where the relationship turns positive (grease the wheels).

#### References

- Acemoglu, D., & Verdier, T. (2000). The choice between market failures and corruption. *American Economic Review*, 90(1), 194–211. <https://doi.org/10.1257/aer.90.1.194>
- Aidt, T. S. (2009). Corruption, institutions, and economic development. *Oxford Review of Economic Policy*, 25 (2), 271–291. <https://doi.org/10.1093/oxrep/grp012>
- Aidt, T., Dutta, J., & Sena, V. (2008). Governance regimes, corruption, and growth: Theory and evidence. *Journal of Comparative Economics*, 36(2), 195–220. <https://doi.org/10.1016/j.jce.2007.11.004>
- Ali, M. S. B., & Sassi, S. (2016). The corruption-inflation nexus: Evidence from developed and developing countries. *The BE Journal of Macroeconomics*, 16(1), 125–144. <https://doi.org/10.1515/bejm-2014-0080>
- Anokhin, S., & Schulze, W. S. (2009). Entrepreneurship, innovation, and corruption. *Journal of Business Venturing*, 24(5), 465–476. <https://doi.org/10.1016/j.jbusvent.2008.06.001>
- Baltagi, B. H., Ed. 2006. Panel data econometrics: Theoretical contributions and empirical applications. In *Emerald Group Publishing* (pp. 241–275).
- Baltagi, B. H., & Wu, P. X. (1999). Unequally spaced panel data regressions with AR (1) disturbances. *Econometric Theory*, 15(6), 814–823. <https://doi.org/10.1017/S0266466699156020>
- Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407–443. <https://doi.org/10.2307/2937943>
- Barro, R., & Sala-i-Martin, X. (2004). Economic growth. In *second edition MIT Press* (pp. 383–428).
- Beck, P. J., Maher, M. W., & Tschoegl, A. E. (1991). The impact of the foreign corrupt practices act on US exports. *Managerial and Decision Economics*, 12(4), 295–303. <https://doi.org/10.1002/mde.4090120404>
- Bhargava, A., Franzini, L., & Narendranathan, W. (1982). Serial correlation and the fixed effects model. *The Review of Economic Studies*, 49(4), 533–549. <https://doi.org/10.2307/2297285>
- Blackburn, K., Bose, N., & Haque, M. E. (2006). The incidence and persistence of corruption in economic development. *Journal of Economic Dynamics and Control*, 30(12), 2447–2467. <https://doi.org/10.1016/j.jedc.2005.07.007>
- Bohn, F. (2013). Grand corruption instead of commitment? Reconsidering time-inconsistency of monetary policy. *Journal of International Money and Finance*, 32(1), 478–490. <https://doi.org/10.1016/j.jimonfin.2012.05.021>
- Cao, Y., Hlatshwayo, S., Petrescu, M., & Zhan, Z. (2021). A sentiment-enhanced corruption perception index. *IMF Working Papers*.
- Chakravorty, N. N. (2019). How does corruption affect economic growth? An econometric analysis. *Journal*



- of *Leadership, Accountability & Ethics*, 16(4), 27–60. <https://doi.org/10.33423/jlae.v16i4.2368>
- Chaudhury, N., & Hammer, J. S. (2003). Ghost doctors: Absenteeism in Bangladeshi health facilities. *WB Policy Research Working Paper 3065*, Washington, DC: World Bank.
- Cieřlik, A., & Goczek, L. (2018). Control of corruption, international investment, and economic growth—Evidence from panel data. *World Development*, 103(1), 323–335. <https://doi.org/10.1016/j.worlddev.2017.10.028>
- Çule, M., & Fulton, M. (2005). Some Implications of the unofficial economy-bureaucratic corruption relationship in Transition Countries. *Economics Letters*, 89(2), 207–211. <https://doi.org/10.1016/j.econlet.2005.05.027>
- DFID (n.d.). Public expenditure tracking surveys. <http://www.dfid.gov.uk/aboutdfid/organisation/pfma/pfma-pets.pdf>
- Dincer, O. (2020). If you're corrupt, you'd better be free. *Journal of Economic Studies*, 47(6), 1307–1325. <https://doi.org/10.1108/JES-04-2019-0153>
- Easterly, W., & Rebelo, S. (1993). Fiscal policy and economic growth. *Journal of Monetary Economics*, 32(3), 417–458. [https://doi.org/10.1016/0304-3932\(93\)90025-B](https://doi.org/10.1016/0304-3932(93)90025-B)
- Fayissa, B., & Nsiah, C. (2013). The impact of governance on economic growth in Africa. *The Journal of Developing Areas*, 47(1), 91–108. <https://doi.org/10.1353/jda.2013.0009>
- Feldstein, M. (1982). Inflation, tax rules, and investment: Another look. *Econometrica*, 50(4), 825–862. <https://doi.org/10.2307/1912766>
- Ferraz, C., & Finan, F. (2008). Exposing corrupt politicians: The effects of Brazil's publicly released audits on electoral outcomes. *Quarterly Journal of Economics*, 123(2), 703–745. <https://doi.org/10.1162/qjec.2008.123.2.703>
- Fethi, S., & Imamoglu, H. (2021). The impact of rent-seeking on economic growth in the six geographic regions: Evidence from static and dynamic panel data analysis. *International Journal of Finance & Economics*, 26(4), 5349–5362. <https://doi.org/10.1002/ijfe.2069>
- Frankel, J. A., & Romer, D. H. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379–399. <https://doi.org/10.1257/aer.89.3.379>
- Galtung, F. (2006). Measuring the immeasurable: Boundaries and functions of (macro) corruption indices. In C. Sampford & F. Galtung (Eds.), *Measuring corruption* (pp. 101–130). Burlington: Ashgate.
- Golden, M. A., & Picci, L. (2005). Proposal for a new measure of corruption, illustrated with Italian data. *Economics & Politics*, 17(1), 37–75. <https://doi.org/10.1111/j.1468-0343.2005.00146.x>
- Gründler, K., & Potrafke, N. (2019). Corruption and economic growth: New empirical evidence. *European Journal of Political Economy*, 60(1), 101810. <https://doi.org/10.1016/j.ejpoleco.2019.08.001>
- Gupta, S., Davoodi, H., & Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance*, 3(1), 23–45. <https://doi.org/10.1007/s101010100039>
- Gupta, S., Davoodi, H., & Tiongson, E. (2001a). Corruption and the provision of health care and education services. In *The political economy of corruption* (pp. 123–153). Routledge.
- Gupta, S., De Mello, L. R., & Sharan, R. (2001b). Corruption and military spending. *European Journal of Political Economy*, 17(4), 749–777. [https://doi.org/10.1016/S0176-2680\(01\)00054-4](https://doi.org/10.1016/S0176-2680(01)00054-4)
- Hamilton, A., & Hammer, C. (2018). Can we measure the power of the grabbing hand? A comparative analysis of different indicators of corruption. *WB policy research working paper 8299*, Washington, DC, World Bank.
- Heidenheimer, A. J., Johnston, M., & Le Vine, V. T. (1989). Political corruption: A handbook. In *Political corruption* (pp. 138–173). New Brunswick, NJ: Transaction Publishers.
- Heywood, P. M. (1997). Political corruption: Problems and perspectives. *Political Studies*, 45(3), 417–435. <https://doi.org/10.1111/1467-9248.00089>
- Hlatshwayo, S., Oeking, A., Ghazanchyan, M. M., Corvino, D., Shukla, A., & Leigh, M. L. Y. (2018). The measurement and macro-relevance of corruption: A big data approach. In *The measurement of corruption* (pp. 1–38). Washington, DC: International Monetary Fund.
- Hsiao, C. (2014). *Analysis of panel data* (No. 54). Cambridge University Press.
- Huang, Y. (2015, March). *Arresting corruption in China*. The Diplomat.
- Huang, C. J. (2016). Is corruption bad for economic growth? Evidence from Asia-Pacific countries. *The North American Journal of Economics and Finance*, 35(C), 247–256. <https://doi.org/10.1016/j.najef.2015.10.013>
- Ivanyina, M., Moumouras, A., & Rangazas, P. (2016). The culture of corruption, tax evasion, and economic growth. *Economic Inquiry*, 54(1), 520–542. <https://doi.org/10.1111/ecin.12228>
- Jain, A. K. (2001). Corruption: A review. *Journal of Economic Surveys*, 15(1), 71–121. <https://doi.org/10.1111/1467-6419.00133>
- Johnston, M. (2006). *Assessing the progress of anti-corruption efforts: 'Actionable' indicators of reform*. Colgate University.
- Kaufmann, D. (1997). Corruption: The Facts. *Foreign Policy*, 107, 114–131. <https://doi.org/10.2307/1149337>
- Kaufmann, D., & Kraay, A. (2007). *On measuring governance: Framing issues for debate. Issues paper for roundtable on measuring governance*. World Bank Institute.
- Kaufmann, D., Kraay, A., & Zoido-Lobaton, P. (1999). Aggregating governance indicators. In *The world bank WB policy research WP 2195*. World Bank.
- Khan, A., & Krishnan, S. (2021). Moderating effects of business-systems corruption on corruption in basic national institutions and electronic government maturity: Insights from a dynamic panel data analysis. *International Journal of Information Management*, 59(1), 102349. <https://doi.org/10.1016/j.ijinfomgt.2021.102349>
- Kunieda, T., Okada, K., & Shibata, A. (2014). Corruption, capital account liberalization, and economic growth: Theory and evidence. *International Economics*, 139(1), 80–108. <https://doi.org/10.1016/j.inteco.2014.03.001>
- Lambsdorff, J. G. (2000). *The precision and regional comparison of perceived levels of corruption—interpreting the results*. Transparency International and Göttingen: Göttingen University.
- Lambsdorff, J. G. (2002). *Background paper to the 2002 corruption perceptions index – framework document 2002*. Transparency International.
- Lancaster, T. D., & Montinola, G. R. (1997). Toward a methodology for the comparative study of political corruption. *Crime, Law, and Social Change*, 27(3–4), 185–206. <https://doi.org/10.1023/A:1008274416350>

- Land, K. C., & Michalos, A. C. (2018). Fifty years after the social indicators movement: Has the promise been fulfilled? *Social Indicators Research*, 135(3), 835–868. <https://doi.org/10.1007/s11205-017-1571-y>
- León, C. J., Arana, J. E., & de León, J. (2013). Correcting for scale perception bias in measuring corruption: An application to Chile and Spain. *Social Indicators Research*, 114(3), 977–995. <https://doi.org/10.1007/s11205-012-0185-7>
- Leys, C. (1965). What is the problem about corruption? *The Journal of Modern African Studies*, 3(2), 215–230. <https://doi.org/10.1017/S0022278X00023636>
- Li, H., Xu, L. C., & Zou, H. F. (2000). Corruption, income distribution, and growth. *Economics & Politics*, 12(2), 155–182. <https://doi.org/10.1111/1468-0343.00073>
- Magbongé, G. K., Konté, M. A., & Shafiullah, M. (2022). Developing countries' economic fundamentals and FDI inflows: The moderating role of institutions. *Cogent Economics & Finance*, 10(1), 2028976. <https://doi.org/10.1080/23322039.2022.2028976>
- Malanski, L. K., & Póvoa, A. C. S. (2021). Economic growth and corruption in emerging markets: Does economic freedom matter? *International Economics*, 166(1), 58–70. <https://doi.org/10.1016/j.inteco.2021.02.001>
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407–437. <https://doi.org/10.2307/2118477>
- Mauro, P. (1995). Corruption and growth. *The Quarterly Journal of Economics*, 110(3), 681–712. <https://doi.org/10.2307/2946696>
- Mauro, P. (1998). Corruption and the composition of government expenditure. *Journal of Public Economics*, 69(2), 263–279. [https://doi.org/10.1016/S0047-2727\(98\)00025-5](https://doi.org/10.1016/S0047-2727(98)00025-5)
- Menard, A. R., & Weill, L. (2016). Understanding the link between aid and corruption: A causality analysis. *Economic Systems*, 40(2), 260–272. <https://doi.org/10.1016/j.ecosys.2016.01.001>
- Méndez, F., & Sepúlveda, F. (2006). Corruption, growth and political regimes: Cross country evidence. *European Journal of Political Economy*, 22(1), 82–98. <https://doi.org/10.1016/j.ejpoleco.2005.04.005>
- Méon, P. G., & Sekkat, K. (2005). Does corruption grease or sand the wheels of growth? *Public Choice*, 122(1–2), 69–97. <https://doi.org/10.1007/s11127-005-3988-0>
- Mo, P. H. (2001). Corruption and economic growth. *Journal of Comparative Economics*, 29(1), 66–79. <https://doi.org/10.1006/jcec.2000.1703>
- Mocan, N. (2008). What determines corruption? International evidence from microdata. *Economic Inquiry*, 46(4), 493–510. <https://doi.org/10.1111/j.1465-7295.2007.00107.x>
- Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49(6), 1417–1426. <https://doi.org/10.2307/1911408>
- Nwabuzor, A. (2005). Corruption and development: New initiatives in economic openness and strengthened rule of law. *Journal of Business Ethics*, 59(1), 121–138. <https://doi.org/10.1007/s10551-005-3402-3>
- OECD. (2008). Constructing a composite indicator. In *Handbook on constructing composite indicators. Methodology and user guide* (pp. 12–28). Paris: Organisation for economic co-operation and development.
- Olken, B. A. (2007). Monitoring corruption: Evidence from a field experiment in Indonesia. *Journal of Political Economy*, 115(2), 200–249. <https://doi.org/10.1086/517935>
- Otusanya, O. J. (2011). Corruption as an obstacle to development in developing countries: A review of literature. *Journal of Money Laundering Control*, 14(4), 387–422. <https://doi.org/10.1108/13685201111173857>
- Papadamou, S., Spyromitros, E., & Tsintzos, P. (2017). Public investment, inflation persistence and central bank independence. *Journal of Economic Studies*, 44(6), 976–986. <https://doi.org/10.1108/JES-10-2016-0214>
- Pedroni, P. (1996). Fully modified OLS for heterogeneous cointegrated panels and the case of purchasing power parity. *Department of Economics, Indiana University*, 5(1), 1–45. <https://web.williams.edu/Economics/pedroni/WP-96-20.pdf>
- Pedroni, P. (2001). Fully modified OLS for heterogeneous cointegrated panels. In nonstationary panels, panel cointegration, and dynamic panels. In *Nonstationary panels, panel cointegration, and dynamic panels* (pp. 93–130). Emerald group publishing limited.
- Reinikka, R., & Svensson, J. (2006). Using micro-surveys to measure and explain corruption. *World Development*, 34(2), 359–370. <https://doi.org/10.1016/j.worlddev.2005.03.009>
- Roodman, D. M. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Econometrics and Statistics*, 71(1), 135–158. <https://doi.org/10.1111/j.1468-0084.2008.00542.x>
- Rose-Ackerman, S. (1978). Corruption: A study in political economy. In *Corruption* (pp. 417–427). New York: Academic Press.
- Rose-Ackerman, S. (2000). Democracy and grand corruption, reprinted. In R. Williams (Ed.), *Explaining corruption* (pp. 321–336). Elgar Reference Collection.
- Saisana, M., & Saltelli, A. (2012). *Corruption perceptions index 2012 statistical assessment*. JRC Scientific and Policy Reports, European Commission.
- Saisana, M., & Tarantola, S. (2002). *State-of-the-art report on current methodologies and practices for composite indicator development*. EUR 20408 EN. European Commission-JRC.
- Schneider, F. (1994). Measuring the size and development of the shadow economy. Can the causes be found and the obstacles be overcome? In H. Brandstatter & W. Güth (Eds.), *Essays on economic psychology* (pp. 193–212). Springer.
- Scott, J. C. (1969). The analysis of corruption in developing nations. *Comparative Studies in Society and History*, 11(3), 315–341. <https://doi.org/10.1017/S0010417500005363>
- Seligson, M. A. (2006). The measurement and impact of corruption victimization: Survey evidence from Latin America. *World Development*, 34(2), 381–404. <https://doi.org/10.1016/j.worlddev.2005.03.012>
- Sharpe, A. (2004). *Literature review of frameworks for macro-indicators*. Centre for the study of living standards.
- Shittu, W. O., Hassan, S., & Nawaz, M. A. (2018). The nexus between external debt, corruption and economic growth: Evidence from five SSA countries. *African Journal of Economic and Management Studies*, 9(3), 319–334. <https://doi.org/10.1108/AJEMS-07-2017-0171>
- Shleifer, A., & Vishny, R. W. (1993). Corruption. *The Quarterly Journal of Economics*, 108(3), 599–617. <https://doi.org/10.2307/2118402>
- Song, C. Q., Chang, C. P., & Gong, Q. (2020). Economic growth, corruption, and financial development: Global evidence. *Economic Modelling*, 94(1), 822–830. <https://doi.org/10.1016/j.econmod.2020.02.022>

- Spector, B. I. (2016). The benefits of anti-corruption programming: Implications for low to lower middle income countries. *Crime, Law, and Social Change*, 65(4), 423–442. <https://doi.org/10.1007/s10611-016-9606-x>
- Summers, L. (1977). *Speech to the summit of eight*.
- Svensson, J. (2003). Who must pay bribes and how much? Evidence from a cross section of firms. *Quarterly Journal of Economics*, 118(1), 207–230. <https://doi.org/10.1162/00335530360535180>
- Tanzi, V. (1998). Corruption around the world: Causes, consequences, scope, and cures. *IMF Economic Review*, 45(4), 559–594. <https://doi.org/10.2307/3867585>
- Tanzi, V., & Davoodi, H. (1998). Corruption, public investment, and growth. In H. Shibata, & T. Ihori (eds). *The welfare state, public investment, and growth* (pp. 41–60). Springer. [https://doi.org/10.1007/978-4-431-67939-4\\_4](https://doi.org/10.1007/978-4-431-67939-4_4)
- Terzi, S., Otoi, A., Grimaccia, E., Mazziotta, M., & Pareto, A. (2021). *Open issues in composite indicators: A starting point and a reference on some state-of-the-art issues*. Roma TrE-Press.
- Transparency International. (2006). [https://www.transparency.org/files/content/tool/2006\\_CPI\\_LongMethodology\\_EN.pdf](https://www.transparency.org/files/content/tool/2006_CPI_LongMethodology_EN.pdf), Accessed Dec, 29, 2019
- Treisman, D. (2000). The causes of corruption: A cross-national study. *Journal of Public Economics*, 76(3), 399–457. [https://doi.org/10.1016/S0047-2727\(99\)00092-4](https://doi.org/10.1016/S0047-2727(99)00092-4)
- UNDP. (2001) *Human development report 2001* (<http://hdr.undp.org/>)
- UNDP. (2008). A users guide to measuring corruption. In *United nations development program* (pp. 1–30). United Nations Development Programme (UNDP).
- (2010). *Human development report 2010 – the real wealth of nations: Pathways to human development*. <http://hdr.undp.org/en/content/human-development-report-2010>
- Veenhoven, R. (2002). Why social policy needs subjective indicators. *Social Indicators Research*, 58(1), 33–46. <https://doi.org/10.1023/A:1015723614574>
- Wei, S. J. (2000). How taxing is corruption on international investors? *Review of Economics and Statistics*, 82(1), 1–11. <https://doi.org/10.1162/003465300558533>
- World Bank. (2019). *Worldwide Governance Indicators*, Accessed Dec, 29, 2019.
- Wraith, R., & Simpkins, E. (1963). *Corruption in developing countries*. Allen and Unwin.

## APPENDIX A: Construction and comparative evaluation of composite indicators

This research uses many composite indicators (CCI, CPI, ICRG) to assess the extent of corruption and its impact on the economy and society. Therefore, before proceeding, we will present how to build such indicators and a methodology for using them for assessment.

Composite indicators comparing countries' performance are increasingly recognized as helpful for presenting relationships between complex macroeconomic phenomena and policy analysis. They help in making comparisons that can illustrate complex and elusive issues in various fields, such as the environment, economy, or society. These indicators are easier to interpret than finding a common trend in many separate indicators (OECD, 2008; Terzi et al., 2021). In policy analysis, indicators help identify trends and focus on specific issues. They can also help set policy priorities or monitor performance (OECD, 2008). A composite index is formed when individual indices are grouped into a single index. The composite index should ideally measure multidimensional concepts that cannot be captured by a single index, such as sustainability and corruption (Saisana & Tarantola, 2002). The main disadvantages are that they can lead to simplistic and misleading policy conclusions. There are two schools of thought on this. The aggregators believe that such a summary statistic can capture reality and is meaningful. In contrast, the non-aggregators think one should stop once an appropriate set of indicators has been created (Sharpe, 2004). They believe that all sub-indicators should be presented individually and simultaneously.

Constructing a complex index is complicated and full of pitfalls, ranging from the theoretical background, the barriers to data availability, and the selection of individual indicators to dealing with them for comparison (normalisation) and aggregation (weighting and aggregation). One of the main objectives of the current research is to present the leading indicators for measuring corruption and highlight its advantages and disadvantages. In this process, and as some of the indicators are composite, the stages of construction and their specific features can help significantly in the evaluation process.

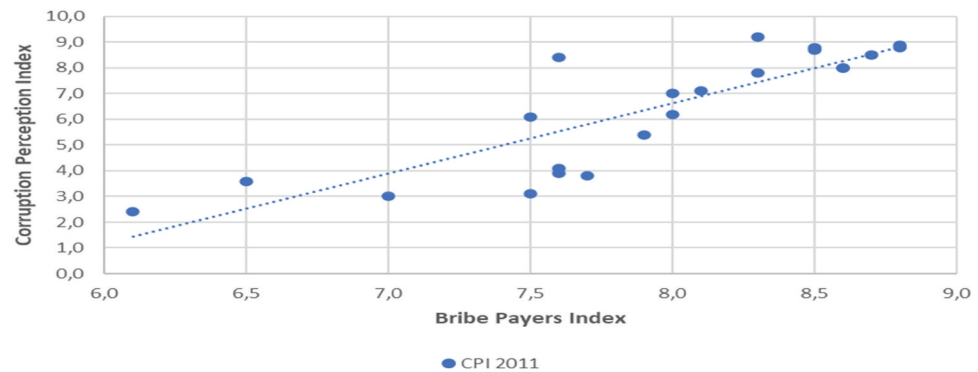
According to Terzi et al. (2021), in order to be measured, phenomena such as growth, progress, prosperity, quality of life, poverty, and social inequality require a "combination" of different dimensions which must be considered together as components of the phenomenon. A composite indicator is called a mathematical combination (aggregation) of a set of indicators that represent the different dimensions of a phenomenon to be measured. The result is called an "index" and is used to create a ranking or summarise the data. Well-known indicators that have been created in this way are the United Nations Human Development Index (HDI; United Nations Development Programme (UNDP), 2010), the Technology Achievement Index (TAI; UNDP, 2001), and the Transparency International CPI (Saisana & Saltelli, 2012).

## APPENDIX B: Characteristics of CPI index

According to a comparative study by Lancaster and Montinola (1997), the most significant advantage of the CPI is the new avenues provided that opened up research to measure the concept of corruption. The second advantage was the broad comparative scope of the index. TI, having at its disposal measurements of perception (the CPI) and experience (the BPI), correlated with one another and found that the correlation is quite strong (Pearson correlation 0,9). Figure 1 shows the countries where the two indexes were counted in 2011.

Figure 1 shows the correlation between CPI and BPI in 2011.

**Figure 1. Dispersion chart between countries for Corruption Perceptions Index–Bribe Payers Index for 2011.**  
 Source: Transparency International ([www.transparency.org](http://www.transparency.org)).



A criticism of the CPI was that the foreign residents involved were often Western businessmen. The view of less-developed countries seemed underrepresented. To solve this problem, TI divided its sources into three categories: a) Nonresidents' perceptions, utilizing their experience concerning foreign countries (respondents from developed countries). b) Nonresidents' perceptions, but these respondents are mainly from less-developed countries. c) Ratings from residents regarding the performance of their country of origin.

Since 2012, the index has significantly improved. The research has been used for only one year and has been more reliable and comparable since 2012 and henceforth. The European Commission Joint Research Center (JRC) evaluated the new methodology used to develop CPI 2012 and found it acceptable (Saisana & Saltelli, 2012). This evaluation considered CPI a reliable composite index that meets all the primary conditions for building the specific indicators defined by the OECD (2008). Finally, a significant advantage is that it is an entirely transparent indicator because all its data are accessible.

#### APPENDIX C: Comparison of the CPI to the CCI and the ICRG

- By systematically comparing the three leading indicators, we can show their differences that translate into advantages and disadvantages, depending on what we want to measure.
- The definition used by TI for corruption is clear and relates to the public sector, while WB also refers to the private sector and mixes the two phenomena. At the same time, the PRS Group mainly measures the private sector.
- The data used by the CPI comes only from reliable databases by experts (business people and country risk analysts), residents, nonresidents, expatriates, and nationals. CCI data comes from experts, and the ICRG data from associates of the organisation.
- CPI and CCI are a concentration of other indicators (composite), but ICRG provides a single measure of corruption.
- The weighting method of CPI is simple, but the CCI uses a complex process with many drawbacks. On the ICRG, the weights are unknown.
- All calculate corruption through the measurement of perceptions.
- The CPI only measures corruption, the CCI calculates governance failures from corruption, and the ICRG counts the investment risk from corruption.
- Different methodologies are used to calculate statistical uncertainty.

### **Criticism of second-generation indicators**

As the use of second-generation indicators expanded, the criticism of them increased:

- A big issue is what they really measure, as the types of corruption and its significance vary from country to country.
- Each source can calculate something different. For example, WB seeks ineffective control, conflict of interest, and public resources appropriated for its benefit. In contrast, World Economic Forum seeks the amount of bribes paid.
- Each indicator has different sources, which can give different results for the country.
- The indicators are based on surveys of experts, professionals, and managers in multinational companies and less on public surveys. This means that the views on the phenomenon of a large mass of people are ignored.
- Finally, it has been reported that based on the structure of the initial indicators, it is not possible to compare them over time (problem solved for the CPI from 2012 onwards).

According to social scientists, the most critical disadvantage of subjective indicators is that they are based on general impressions about the measured quantity (Veenhoven, 2002). However, it is evident from the above analysis that organisations try to reduce this error when measuring corruption. They do not consider the public's views but of the experts with the greatest possible dispersion. At the same time, efforts are made to incorporate subjective elements (culture, religion, ages, education, etc.) into the procedure to which an objective character is given.

### **APPENDIX D: 3<sup>rd</sup> Generation indexes, Criticism and Comparison between 2<sup>nd</sup> and 3<sup>rd</sup> Generation Indicators.**

#### **The BPI**

To provide a comprehensive picture of corruption and the fight against it globally, TI calculated and published the BPI, which is included in the third-generation indicators category. This index consists of leading countries exporting products and services and whom their companies are bribing in developing countries. The main characteristics:

- The BPI is TI's response to the criticism of the lack of information on the behavior of the Western business community.
- This index was a list of top exporting countries of products and services, according to data where their companies bribe abroad, in developing countries.
- It is based on surveys of business executives, which record, based on facts, foreign companies' business practices in their country.
- It is a complex effort recorded in 1999, 2002, 2006, 2008, and 2011. It essentially examines corruption from the perspective of supply through questionnaires.
- The worst performances are recorded by: Russia, China, Mexico, India, and Italy.

#### **PETS and QSDS**



One of the most critical objective efforts to measure corruption at the micro-level are PETS, which seek to measure corruption by comparing available resources and those that reach the end recipient of the service or product (i.e., an indirect and comparative method with really measurable data). PETS acknowledge that a provider (e.g., a public official) may be motivated to compile misleading reports related to corrupt behaviors. In cases where resources are used for corruption, the provider involved will likely present constructed data.

The first successful implementation of this methodology was in Uganda in 1996. The study was prompted by the observation that there was no increase in primary education enrollment despite the significant increase in spending on education. The PETS were conducted by comparing budget allocations with actual expenditures through the various government levels, including the frontline of service (i.e., primary schools). It was found that many schools didn't receive any money, and the capital outflow was 97% in 1991 and 78% in 1995 when some findings of the research began to leak out in the national press. Leakage fell sharply (after the publication) and ended at 18% in 2001 (Reinikka & Svensson, 2006).

A slightly different methodology, QSDS, was implemented, emphasizing the quantitative data on finances, inputs, results, pricing, quality, supervision, and other aspects of services. A QSDS requires significant effort, cost, and time compared to some alternatives, especially understanding user perceptions. This methodology was initially applied effectively to Bangladesh and the health system, not as much as PETS in Uganda (Chaudhury & Hammer, 2003). Similar surveys have been conducted in other countries—such as Ghana (1998), Peru (2001), Tanzania (1998), and Zambia (2001). Such surveys provide a wealth of information on how things “work.” Many PETS lack analyses of leaks or have poor estimates either because they cannot help conduct research at the service provider site, as insufficient information is disclosed.

### Other indicators and criticisms

Numerous similar objective tools have been developed, and most aim at the detailed control of the expenses and of the course of the money flow. Today, it is better to use subjective and objective indicators in combination when conclusions that can hardly be drawn at the national and supra-national levels must be removed at the local level (Golden & Picci, 2005).

Whether reliable data can be gathered at the micro-level (business) regarding corruption arises. It has been a common view that it is almost impossible to gather reliable quantitative information about corruption, given the secrecy of corrupt activities. However, as Kaufmann (1997) argued, this view is wrong. Business managers are willing to discuss corruption with remarkable honesty with proper research methods and interview techniques. Seligson (2006) collected corruption data using investigations into corruption victims through complaints about services or employees involved in similar proceedings and called on victims to report cases of corrupt transactions. Other researchers have used external controls ordered by the Brazilian government to build an objective measure of corruption based on the number of corruption-related violations (Ferraz & Finan, 2008).

A study carried out by the United Nations' Commission on Crime Prevention, and Criminal Justice gathered annual data on the impact of different types of crimes on UN member states (UNDP, 2008). It calls on the relevant public services of each Member State to provide data on the convictions for the crimes of corruption. It also includes questions about the number of bribery prosecutions per 100,000 population (Hamilton & Hammer, 2018). This measurement of corruption is part of another set of indicators (those involving the counting of convictions), as well as the International Crime Victim Survey, and is mainly related to the administration of justice. The main criticism is that they measure a country's penal system's performance and not corruption itself.

Several researchers have criticized these indicators, demystifying their impressive initial results and considering them to be quite costly in the first place. Improvements have also been proposed



in support of an effective policy tool. For that purpose, according to the Department for International Development (DFID), the following are needed:

- A clear commitment from the authorities, with wide dissemination of data and results.
- Activation of all levels of government to change how regional policies are developed.
- A commitment to transparency in the allocation and use of resources.

The challenge is gathering information on distributed resources and implementing effective reforms. This challenge is primarily political.

### **New measurement trends-Big data approach**

Recently, several new indicators with access to large databases—big data approach from media reports on corruption and how to tackle it—have been developed. According to this methodology, the CRI and the Corruption Conviction Index (CCI) calculated by the Institute for Corruption Studies have been structured for the US. The CRI is structured using a collection of data from *the New York Times*, local media, and articles on corruption in the *Associated Press*, as they have been available in electronic form since 1977. The publications cover corruption stories for all significant government levels, and coverage is not limited to beliefs—covering complaints, lawsuits, and appeals (Dincer, 2020).

The NIC works similarly. This indicator calculates the corruption from the announcements in mass media using modern mathematical tools with a big data approach, accessing over 665 million international reports. The NIC was created using search algorithms for each country, through a vast database, with articles dating back to the mid-1980s' media. The sample covers 30 countries from 1995 to 2017 (Hlatshwayo et al., 2018). Recent research constructs a new non-survey-based perceptions index for 111 countries by applying sentiment analysis to Financial Times articles over 2005–18 (sentiment-enhanced corruption perception index-SECPI; Cao et al., 2021).

There was negative criticism in the first phase of their creation, and we present their disadvantages in table A. Today, however, there are methods to address or normalize these disadvantages with technological improvements. For example, the NIC doesn't include national media for measuring corruption in a country. It only includes articles from abroad and mathematical tools to identify anti-corruption campaigns and remove them.

Table A: The major advantages and disadvantages of Second and Third Generation indexes

	<b>Second Generation Indexes</b>	<b>Third Generation Indexes</b>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>(1) They cover a wide range of countries</li> <li>(2) They are a collection of several datasets and individual indicators</li> <li>(3) They allow for calculating marginal errors and econometric calculations (Kaufmann &amp; Kraay, 2007).</li> </ul>	<ul style="list-style-type: none"> <li>(1) They measure the facts and the experiences</li> <li>(2) They use plenty of data</li> <li>(3) They measure many different aspects of the phenomenon</li> </ul>
<b>Disadvantages</b>	<ul style="list-style-type: none"> <li>(1) They measure the perceptions</li> <li>(2) As a measurement of a social and hidden phenomenon, there are errors</li> <li>(3) They measure different types of corruption and consist of different sources for each country</li> <li>(4) There is a lack of systematic anti-corruption reaction processes based on perceptual indicators</li> </ul>	<ul style="list-style-type: none"> <li>(1) They are field research in individual sectors (local)</li> <li>(2) In a lot of cases, they don't measure corruption, but the judiciary performance, or the freedom of the media</li> <li>(3) they are volatile in corruption crises</li> <li>(4) they are very costly methods</li> </ul>



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