



Comparative Study between Corruption Indicators: an Analysis with Panel Data

Estudo Comparativo entre Indicadores de Corrupção: uma Análise com Dados em Painel

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Abstract: Corruption is an ancient phenomenon, widespread in different national contexts throughout history. Despite its relevance, its definition in literature remains ambiguous and multifaceted. Corruption indicators, although widely used to support political decisions, business strategies, and research on sustainable development and governance, can, by aggregating disparate classifications, accentuate biases and distortions in country assessments. This study aims to determine to what extent the selection of different indicators (CPI, CC, C) influences conclusions about the determinants of corruption. To this end, two articles were selected that analyze the relationship between corruption and Gross Domestic Product (GDP), using the same database and the same analytical technique (panel data), differing only in the corruption indicator adopted. The CPI was replaced by the CC and C indicators, keeping the other variables and analytical procedures constant. The results indicate a tendency towards convergence between the indicators in the classification of countries, based on the effects on the same set of variables, although with limitations that are carefully discussed in this study.

Keywords: Corruption; Corruption Indicators; Gross Domestic Product; Panel Data.

Resumo: A corrupção é um fenômeno antigo e amplamente disseminado em diferentes contextos nacionais ao longo da história. Apesar de sua relevância, sua definição na literatura permanece ambígua e multifacetada. Os indicadores de corrupção, embora amplamente utilizados para embasar decisões políticas,

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estratégias empresariais e pesquisas sobre desenvolvimento sustentável e governança, podem, na verdade, ao agregar classificações díspares, acentuar vieses e distorções na avaliação dos países. Este estudo tem como objetivo determinar em que medida a seleção de diferentes indicadores (IPC, CC, C) influencia as conclusões sobre os determinantes da corrupção. Para isso, foram selecionados dois artigos que analisam a relação entre corrupção e Produto Interno Bruto (PIB), utilizando a mesma base de dados e a mesma técnica de análise (Dados em Painel), diferenciando-se apenas pelo indicador de corrupção adotado. O IPC foi substituído pelos indicadores CC e C, mantendo-se constantes as demais variáveis e procedimentos analíticos. Os resultados indicam uma tendência à convergência entre os indicadores na classificação dos países, com base nos efeitos sobre o mesmo conjunto de variáveis, embora com limitações que são cuidadosamente discutidas neste estudo.

Palavras-chave: Corrupção; Indicadores de Corrupção; Produto Interno Bruto; Dados em Painel.

1. INTRODUCTION

Corruption is not a recent phenomenon (Tanzi, 1988; Shleifer & Vishny, 1993; Mauro, 1997; Rohwer, 2009). However, earlier studies on the topic were mostly confined to the fields of History, Philosophy, and Sociology. In recent decades, economists have devoted greater effort to deepening the economic study of corruption, combining theoretical and statistical analyses to better understand it as an influential element of the economy and a necessary consideration in the design of public policies (Paldam, 2002; Bjørnskov, 2012; Cooray & Schneider, 2018).

At present, there is no consensus in the literature on the definition of corruption. The many studies on the subject present different semantic conceptions of the term. For Brei (1996), it represents the abuse of power by public officials. Svenson (2005) defines it as the violation of a rule morally accepted by a group, while for Banerjee et al. (2012), beyond the moral bias, a corrupt act also constitutes a violation of legal norms.

Another relevant aspect is the widespread negative perception that corruption carries in society at large, since it encompasses numerous meanings such as nepotism, bribery, usurpation, misconduct, immorality, and dishonesty, forming an almost endless scale of negative connotations. This, in turn, creates

obstacles that complicate research on the subject, especially in terms of measurement. Because corruption is a hidden and multifaceted phenomenon, strongly influenced by cultural and institutional perceptions, constructing objective and comparable indicators across national contexts is a particularly difficult task (Brooks, 2013).

In contrast, a small group of authors, particularly from an economic perspective, argue against the idea that corruption is inherently and absolutely negative. Some describe it as a “grease for the wheels” of the economy, especially in highly bureaucratic states (Huang, 2015). Nonetheless, many empirical studies emphasize that corruption negatively affects economic growth. Research by Mauro (1995), Mo (2001), and Ugur and Dasgupta (2011) shows that corruption tends to reduce efficiency, discourage investment, and undermine national development. While a minority of scholars highlight possible positive effects in overly bureaucratic contexts (Huang, 2015), most evidence reinforces the understanding that corruption is, in most cases, detrimental to the economy.

Overall, literature conceptualizes corruption as a political and social phenomenon that distorts the context in which it operates, undermining social structures and relationships (Johnston, 2005; Rothstein & Uslaner, 2005). One of the main challenges highlighted in corruption research is the difficulty of measuring it objectively (Brooks et al., 2013). Corruption is inherently subjective and, at the same time, widely condemned by society (Treisman, 2000). As a result, those engaged in corrupt practices are often reluctant to admit their involvement, making it difficult to obtain reliable records of its occurrence (Lambsdorff, 2007). This limitation affects not only the measurement of the frequency of corrupt acts but also the estimation of the volume of resources involved (Olken & Pande, 2012).

Corruption permeates different social contexts, a fact that can only be verified through rigorous studies capable of measuring both its occurrence and its effects across sectors. Yet, as Mauro (1995) points out, measurement remains one of the greatest challenges in the field. Building on this clearly

identified gap in the literature regarding the accuracy of corruption indicators, this study seeks to answer the following question: To what extent are different corruption indicators, the Corruption Perceptions Index (CPI), Control of Corruption (CC), and Corruption (C), consistent with one another in assessing and ranking countries' corruption levels?

Although these indicators are widely used in literature and in cross-country analyses, they continue to face the central challenge of capturing, with precision, a complex and elusive phenomenon. Corruption is both perceived and practiced differently across national contexts, which directly affects its assessment. Many indicators rely on multiple data sources, yet there is no consensus that simply averaging such information produces greater accuracy, a claim often made by proponents of aggregate indices.

On the contrary, combining heterogeneous assessments may amplify biases and distortions (Thompson & Shah, 2005; Knack, 2007). Some studies have compared corruption indices across countries, but most have done so only at a general level, without probing into their specific convergences or divergences (Ahmad & Aziz, 2001; Abramo, 2008; Rohwer, 2009; Donchev & Ujhelyi, 2014; Charron, 2016; Gutmann, Padovano & Voigt, 2019; Bello y Villarino, 2021).

This study aims to determine the extent to which the choice of different indicators (CPI, CC, C) influences conclusions about the determinants of corruption by applying the same statistical technique to a common set of variables. By analyzing and comparing the indices under identical dependent variables and over the same time frame, the study seeks to identify whether a consistent pattern emerges among the three measures or, instead, whether significant discrepancies arise. This approach also highlights potential weaknesses or limitations in each of the indices examined.

The investigation addresses a critical gap in the literature on corruption measurement, where systematic studies comparing the validity and convergence of the main indicators (CPI, CC, C) under controlled methodological conditions are still scarce. By using the same dataset, analytical

method, and control variables, while varying only the corruption indicator, the study offers three original contributions: i) empirical evidence on the interchangeability of these indices in applied research; ii) a replicable protocol for critical evaluation of governance metrics; and iii) insights into which indicators are more suitable for analyzing specific relationships (e.g., corruption and economic growth). Such contributions are particularly important given the growing use of these indices in public policy decisions and country risk assessments, often without a proper understanding of their comparative limitations. The findings are expected to guide both researchers in selecting analytical tools and policymakers in designing more accurate indicators.

2. LITERATURE REVIEW

2.1. Corruption

Corruption is a highly complex political and socioeconomic phenomenon, present to a greater or lesser extent in virtually all countries. Despite its global scope, there is no consensus in the literature regarding its definition, as different interpretations and theoretical approaches allow it to be analyzed from distinct perspectives (Brooks, 2013).

Corruption can be examined through different theoretical and conceptual lenses. Some studies adopt a market-oriented logic, using economic theories to explain it; others interpret it through the perspective of public interest, grounded in ethical and moral concepts. There are also approaches that focus on public opinion, emphasizing the attitudes and behaviors of public officials, as well as perspectives based on formal regulations that define corruption as the inducement to improper conduct (Brei, 1996). Tanzi (1988), in turn, describes corruption as an ancient and recurrent phenomenon that cuts across different contexts (political, economic, and literary). For the author, corrupt acts represent the violation of a rule (legal, moral, or social) driven by the individual interests of those who commit them.

From a public-interest perspective, Friedrich (1966) defines corruption as a pattern of behavior that deviates from conventional norms in each context,

usually motivated by individual interests that prevail over collective ones. According to Brei (1996), corruption may serve as a tool for the abuse of power by public officials, who exploit their legal authority to extort money from service users in exchange for favors that contradict collective interests. Svenson (2005) regards corruption as the violation of a rule that is morally accepted by a community, while Banerjee et al. (2012) argue that, beyond the moral dimension, corruption only exists when an official rule is violated.

In addition to the multiplicity of conceptions, another challenge, highlighted by Abramo (2008), lies in the difficulty of measuring corruption. These practices are hidden, and their extent is usually captured through perception-based indices. For Huang (2015), corruption cannot be universally classified as harmful to society. Based on an analysis of economic development in thirteen Asian countries, the author contends that, in certain contexts, corruption may have contributed to benefits for some nations, such as South Korea. This interpretation reinforces the view of corruption as a potential “lubricant” for the bureaucratic machinery of the state, in which practices like bribery may expedite processes otherwise hindered by excessive regulation, such as customs clearance of taxed goods or traffic management on privatized highways.

In contrast, Lambsdorff (2008) asserts that corruption is typically associated with policy distortions, income inequality, and lack of competition. Thus, there can be no genuine benefits from corrupt practices, as they are intrinsically linked to social barriers that suppress any potential positive effects.

Corruption is particularly prevalent in public service, where officials deviate from their duties for personal gain (Shleifer & Vishny, 1993; Blackburn, 2012). Other contributing factors include low wages paid to civil servants (Mauro, 1995) and excessive state bureaucracy (Blackburn, Bose & Haque, 2010). Two important points emerge from this debate. First, while literature presents divergent views, the prevailing conception is that corruption compromises collective relations and undermines social functioning. Second, its

analysis is further complicated by the fact that measurement largely depends on individuals' perceptions.

2.2. Corruption Indicators

The literature presents several indices designed to measure corruption. Transparency International (TI) developed the Corruption Perceptions Index (CPI), which ranks countries based on experts' perceptions of corruption in the public sector. The International Country Risk Guide (ICRG) proposes the Corruption Index, which assesses corruption in the political system, with an emphasis on risks to public finances and the economy (Rohwer, 2009). Another widely used measure is the Control of Corruption (CC) indicator from the Worldwide Governance Indicators (WGI), which focuses on governance-related aspects such as control mechanisms, investments, expenditures, and bureaucracy.

2.2.1. Corruption Perceptions Index

The Corruption Perceptions Index (CPI), created in 1995 by Transparency International (TI), is a scale ranging from 0 to 100 points, where 0 represents the highest level of perceived corruption and 100 indicates the lowest. The CPI ranks 180 countries based on perceptions of corruption in the public sector, including both government officials and public servants. The index is composed of 13 data sources from reputable institutions in different countries, aggregating expert opinions on the subject (Transparency International, 2021). Lambsdorff (2008) highlights that the CPI provides a snapshot measure of corruption at the time of its calculation, without capturing long-term or year-to-year trends. However, according to Álvarez-Díaz et al. (2018), the updated CPI methodology allows for cross-country comparisons through the standardization of averages and source scores.

It is worth noting that there are differences in the samples used to build the index. Some sources base their calculations on the perceptions of influential foreign actors, such as large business leaders and experts who, while not nationals, maintain significant ties with the country, for instance, by residing

there or working in multinational firms. Although methodologies differ across sources, the data are considered reliable due to the high correlation observed among the various indicators (Lambsdorff, 2008; Koeswayo, Handoyo & Hasyir, 2024).

All sources that compose the CPI contribute to the final index, ensuring that no single source has significant dominance (Álvarez-Díaz et al., 2018). According to Lambsdorff (2008), the strength of the index lies precisely in the combination of diverse data sources into a single corruption indicator, where the shortcomings of one source are balanced by the others.

2.2.2. Corruption Index

The Corruption Index (C) is one of the components of political risk, which, according to the International Country Risk Guide (ICRG), falls within three main risk categories: political, economic, and financial. This indicator ranges from 0, representing the country with the highest level of corruption, to 6, corresponding to the country with the lowest level. Its measurement considers practices such as excessive patronage, nepotism, reserved positions, the granting of favors, campaign financing, and possible connections between politicians and business interests (Shukhova & Nisnevich, 2017; Hartwig & Sturm, 2025).

According to Howell (2011), the ICRG model classifies countries in terms of country risk, based on 22 variables divided into three subcategories: political, economic, and financial risk. The author argues that the main purpose of the ICRG is to create a comparable basis across the countries included in its ranking. Hoti (2003) emphasizes the importance of examining the classification in depth, as it provides relevant details on each country, which guide decision-making processes, especially for investors.

Political risk encompasses elements from multiple sectors of society, receiving scores ranging from 0 to 100 points, where higher scores represent lower risk, and lower scores indicate higher risk. Economic risk evaluates the strengths and weaknesses of a country's economy, with scores ranging from 0 to 50 points, where, likewise, higher scores reflect lower risk. Each component

is determined by the assessment of various factors that shape its individual score. Finally, Financial risk, following the same methodological approach as the other two categories, assesses a country's ability to meet its obligations, that is, its payment capacity (Hartwig & Sturm, 2025).

2.2.3. Control of Corruption

The Control of Corruption (CC) indicator, proposed by the World Bank, is based on surveys that combine multiple variables from 35 data sources provided by 33 organizations. These sources include non-governmental organizations, private institutions, and public sector bodies, all dedicated to collecting perceptions of governance in the public sector (Kaufmann, Kraay & Mastruzzi, 2009). The index ranges from -2.5, indicating the most corrupt countries, to 2.5, representing the least corrupt. One of its advantages, as noted by Kaufmann, Kraay, and Mastruzzi (2003), lies in the incorporation of margins of error inherent to its construction, which allows for a more cautious interpretation of results. The CC seeks to measure the extent to which state power is used for private gain.

Vasylieva et al. (2019), in analyzing the economic, environmental, and social aspects of sustainable development in European Union (EU) countries and Ukraine, identified the CC as the main indicator of the Worldwide Governance Indicators (WGI). The authors observed that anti-corruption policies play a relevant role in achieving economic growth, promoting renewable energy adoption, and reducing greenhouse gas emissions in Ukraine. Another aspect highlighting the importance of CC was noted in the study by Bohara et al. (2004), which found that increases in democratic governance elements improve control of corruption scores.

According to Meyer, Luiz, and Fedderke (2024), the CC reflects not only perceptions of the use of public power for private gains but is also directly linked to the credibility of institutions in implementing and maintaining the "rules of the game" that guide anti-corruption efforts. The authors stress that the mere establishment of anti-corruption regulations is insufficient to curb illicit practices; it is essential that social actors perceive the existence of a solid and reliable

institutional environment capable of effectively enforcing such rules. In this sense, the CC, by capturing perceptions of institutional effectiveness and integrity, provides a relevant measure for understanding the degree of confidence in the state's ability to control corrupt practices.

Both the Control of Corruption (CC) from the Worldwide Governance Indicators and the Corruption Perceptions Index (CPI) from Transparency International are the most widely used in current research (Shukhova & Nisnevich, 2017). A key difference between them lies in the fact that the CC incorporates public opinion surveys, an important element in capturing everyday perceptions of corruption, while the CPI draws on surveys based on expert opinions, as also highlighted by Rohwer (2009).

3. METHODOLOGY

This study carried out a theoretical review with the purpose of understanding the variations in the definition of the term "corruption" in both classical and contemporary literature, as well as identifying the main approaches adopted by the most cited authors on the subject (Brei, 1996; Friedrich, 1966; Svenson, 2005; Abramo, 2008; Mauro, 2017; Bjørnskov, 2012; Kaufmann, Kraay & Mastruzzi, 2003, 2009; Shleifer & Vishny, 1993; Cohn et al., 2019). It is worth noting that this review does not characterize the article as a systematic or integrative review but rather fulfills the role of providing the theoretical foundation for the proposed analysis.

The research adopts a quantitative approach, which, according to Creswell (2014), serves as a tool for testing objective theories and examining relationships among variables. The author further points out that such an approach is frequently used in descriptive-explanatory studies aimed at identifying and classifying variables.

The study is characterized as descriptive-explanatory, in which the descriptive stage involves building the database and conducting statistical analyses. According to Gil (1987), this type of research makes it possible to present the characteristics of the population or phenomenon under study, as

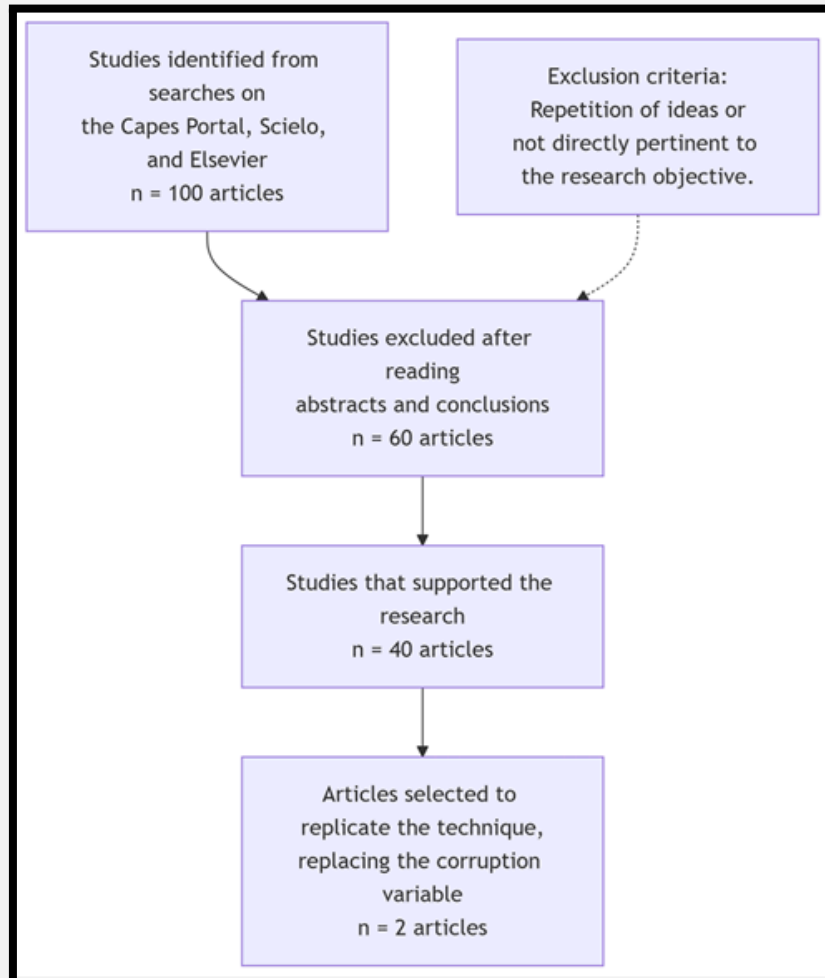
well as to establish relationships between variables. In the explanatory stage, interpretations and analyses derived from the employed variables are proposed.

The research was conducted in two complementary stages. The first involved searching and selecting academic articles on corruption, focusing on international literature and without temporal delimitation, to capture different approaches and interpretations of the concept over time, as well as its observed effects in distinct contexts. The second stage consisted of replicating the statistical techniques used in the selected articles, applying them to the same database with the aim of comparing the results through the substitution of corruption indicators.

In the initial searches, 100 relevant articles were identified. However, there was a significant concentration of citations of certain authors recognized for their contributions to the conceptualization of corruption, which reinforces one of the study's objectives: to understand the phenomenon of corruption from both classical and contemporary literature, while identifying possible variations in how the subject is perceived and addressed depending on the research focus. Among the main authors identified were Mauro, Vishny, Wei, Shleifer, Bjørnskov, Brei, Svensson, Leff, Huang, Huntington, Tanzi, Davoodi, Abramo, Banerjee, among others.

Subsequently, all abstracts were read, complemented in some cases by the analysis of final considerations, with the purpose of selecting the most relevant studies. From this process, a set of keywords was defined to guide the filtering: Corruption, GDP, GDP per capita, Corruption Perceptions Index, Control of Corruption, Corruption, World Governance Indicators, and International Country Risk Guide. After this screening, 40 articles were selected for detailed analysis (Figure 01).

Figure 01: Flowchart of the selection stages of the studies guiding the research



A further filtering process was conducted with the objective of selecting the most cited articles addressing the relationship between corruption and GDP. The choice of GDP as the focus of analysis is justified by its role as one of the main macroeconomic indicators used in the literature to measure a country's economic performance and to assess the potential adverse effects of corruption on economic growth.

From this process, two studies were selected: Impact of Corruption on GDP per Capita through International Migration: An Empirical Investigation and Determinants of Corruption and its Relation to GDP: A Panel Study. In the first study, GDP per capita was used as the dependent variable, whereas in the second, the dependent variable was the corruption indicator itself. In both cases, corruption was represented by the Corruption Perceptions Index (CPI).

Based on the selection of these works, the same datasets and variables used in the original articles were employed, except for the corruption variable. In this study, the Control of Corruption (CC) and Corruption (C) indicators were incorporated as alternatives to the CPI used in the previous studies. For data treatment, the Doornik-Hansen normality test was applied to verify whether the variables followed a normal distribution in the sample. A winsorization technique was also employed to reduce outliers. All data treatment and statistical analysis steps were performed using STATA.

The Doornik-Hansen normality test was chosen for its robustness and wide recommendation for moderate to large samples, as it combines skewness and kurtosis information into a single statistic, making it more efficient than traditional tests such as Shapiro-Wilk in the context of macroeconomic and panel data. This choice is particularly relevant given that residual normality is a central assumption to ensure the inferential validity of linear models. According to Malá, Sládek, and Bílková (2021), this test performs better at detecting deviations from normality in larger samples, making it suitable for this study, which involves time series and widely dispersed economic variables.

The same methodology (Panel Data) was applied, allowing the analysis of variables over time. This quantitative method enables the examination of variables across periods, which can be balanced (all values available for all periods) or unbalanced (some periods with missing values). Marques (2000) highlights the advantages of this technique for heterogeneous data, as it measures the effects of differences separately, facilitating data visualization for inference.

Results were analyzed in terms of variable significance and the direction of the relationship (positive or negative) between the independent and dependent variables, comparing the findings obtained in this study with those reported in reference articles. It is worth noting that the original data treatment procedures for Ahmad and Arjumand (2016) and Ur Rehman and Naveed (2007) were not fully detailed by the authors, which limited this study to applying the normality test and winsorization, as well as analyzing the significance of

corruption indicators, given that they are constructed from multiple sources across different countries.

4. RESULTS

In this section, the research results are presented following the substitution of each corruption indicator in the analyzed articles. Each table displays the study variables in the first column, the results from the reference study in the second column, and the results obtained using the corruption indicator proposed in this study in the third column, allowing for direct comparisons.

4.1. Article 1: Determinants of Corruption and its Relation to GDP: A panel study

The study by Ur Rehman and Naveed (2007) investigates the determinants of corruption and highlights its relationship with economic growth. The corruption index was obtained from Transparency International, using data from 1995 to 2005. By employing different combinations of economic and cultural variables, the study demonstrated that real GDP per capita is an important determinant of corruption. Two education-related variables were found to strongly affect the corruption index: secondary school enrollment and public expenditure on education. Higher levels of education foster a sense of nationalism, self-importance, and civic duty within the community, while also increasing public awareness of citizens' rights to services provided by bureaucrats.

4.1.1. Control of Corruption – CC

In the study by Ur Rehman and Naveed (2007), the Panel Data technique with fixed effects was used, which assumes that individual effects are correlated with the independent variables. For comparative purposes, the corruption indicator CPI was replaced with the Control of Corruption (CC) (Table 01).

Table 01: Comparison of results from Ur Rehman and Naveed (2007) using the Control of Corruption indicator

Variables	Ur Rehman & Naveed (2007) (CPI)	This Study (CC)
LnGDP	0.137**	0.0381801***
GDPgr	0.176	- 0.0076242***
SED	0.008 ***	0.0004488
PUBSED	0.612*	0.0002079
FDI	0.078*	0.009496***
GEXP	0.014	0.000907
INV	0.032	- 0.0009186
OPEN	0.004	- 0.0002016
INFL	0.038	0.0042303***
POP	0.138	0.0367562 ***
UNEMP	- 0.053***	0.0012073

Note: (significance levels: * = 1%, ** = 5%, *** = 10%) The variables are listed in column 1, where LnGDP (Real GDP level), GDPgr (GDP growth), SED (Secondary School Enrollment), PUBSED (Public Expenditure on Education), FDI (Foreign Direct Investment), GEXP (Public Expenditure), INV (Investment), OPEN (Market Openness), INFL (Inflation), POP (Total Population) and UNEMP (Unemployment). Data were collected from 1995 to 2005.

Contrary to the original study, which used the CPI, when adopting the Control of Corruption (CC) indicator, the variables in this study did not show significance for the same number of independent variables analyzed by Ur Rehman and Naveed (2007). However, similarities were observed in two variables across both studies: GDP level and Foreign Direct Investment (FDI).

Consistent with the empirical results of Ur Rehman and Naveed (2007), this study also found that the economic indicator, represented by the logarithm of GDP, had a positive and significant coefficient, indicating that higher GDP is associated with lower corruption, as measured by the CC index. The literature corroborates this relationship, noting that more developed countries tend to present lower levels of corruption and its associated impacts (Silva, 1995; Brunetti & Weder, 2003; Paldam, 2002). Thus, in both studies, GDP level is significant in determining the degree of corruption.

In the reference study, GDP growth was not significant in explaining corruption levels when measured by the CPI. However, when the CPI was replaced by the CC indicator, a negative coefficient was observed, suggesting

that higher economic growth is associated with higher levels of corruption, as also noted by Ahmad and Brookins (2007).

Secondary school enrollment showed a positive sign in both models, indicating that higher enrollment is associated with a higher value of the corruption indicator, i.e., lower perceived corruption in the country. However, in the model using the CC indicator, this variable did not reach statistical significance. It is noteworthy that education, particularly at the secondary level, plays a fundamental role in societal development by fostering critical thinking and valuing ethical principles aimed at the common good. Mauro (2017) previously highlighted that lack of investment in education contributes to higher corruption levels. Regarding public expenditure on education, another difference emerges, as this variable was significant only when the CPI was used as the corruption indicator.

Foreign Direct Investment (FDI) was significant in both results. Wei (2000) demonstrated that high levels of corruption, based on public perception, hinder foreign investment, a finding confirmed by the CC indicator as well. In the reference study, the investment variable refers to the country's fixed capital formation. Although this variable showed a positive relationship, indicating that higher investment in fixed capital formation is associated with lower perceived corruption, it was not a determinant factor for corruption in either index analyzed. Recently, Idris, Usman, and Koko (2020) highlighted the importance of government attention to improving policies for fixed capital formation. Hence, the State emerges as a key agent in promoting actions that encourage investment. Treisman (2000) also recognizes the benefits of state intervention in combating corruption.

Inflation was significant only in the model using the CC and had a positive coefficient, suggesting that higher inflation levels are associated with lower perceived corruption in the country. However, this variable was not significant in the reference study. It is important to note that this relationship is likely spurious, as current literature consistently maintains that high inflation is

exacerbated by corruption, rather than the other way around (Braun, 2004; Al-Marhubi, 2000).

Market openness showed a positive coefficient. Considering that trade openness can influence economic development and be subject to public policies involving government expenditure, Ahmad and Brookins (2007) highlighted the relevance of accounting for government spending, although it was not significant in their study. On the other hand, Ahrend (2002) found that countries with greater trade openness experienced considerable levels of corruption.

The unemployment rate was significant in the reference model, showing a negative coefficient when CPI was used as the dependent variable. This indicates that lower unemployment is associated with higher values of the corruption indicator, i.e., the country is perceived as less corrupt. When the CPI was replaced by the CC, this relationship became insignificant. Lim (2019) explains that corruption negatively affects unemployment because it is an indirect outcome of effects such as poor-quality human capital investment and inefficient public spending, which aligns with Mauro's studies on the lack of investment in education.

4.1.2. Corruption

In Table 02, the corruption indicator CPI was replaced by the Corruption (C) index. The results using the C indicator show substantial differences compared to the CPI, particularly regarding which variables are significant determinants of corruption. Concerning GDP, both models presented a positive sign, suggesting a direct relationship between GDP and corruption; however, the result in the model using the C indicator was not statistically significant.

Table 02: Comparison of results from Ur Rehman and Naveed (2007) using the Corruption (C) indicator

Variables	Ur Rehman & Naveed (2007) (CPI)	This Study (C)
LnGDP	0.137**	0.000524
GDPgr	0.176	-.0047268**
SED	0.008 ***	-0.0004138

PUBSED	0.612*	- 0.0043613
FDI	0.078*	- 0.0030615
GEXP	0.014	0.0156936
INV	0.032	- 0.001371
OPEN	0.004	- 0.0000311
INFL	0.038	0.0014571
POP	0.138	0.0568839**
UNEMP	-0.053***	0.0047502

Note: (significance levels: * = 1%, ** = 5%, *** = 10%) The variables are listed in column 1, where LnGDP (Real GDP level), GDPgr (GDP growth), SED (Secondary School Enrollment), PUBSED (Public Expenditure on Education), FDI (Foreign Direct Investment), GEXP (Public Expenditure), INV (Investment), OPEN (Market Openness), INFL (Inflation), POP (Total Population) and UNEMP (Unemployment). Data were collected from 1995 to 2005.

The analysis of the indicators reveals an inverse relationship between GDP and corruption: the higher a country's GDP, the lower its corruption index (i.e., higher values in the indicator reflect lower corruption). This negative association aligns with the predominant literature, which generally identifies corruption as a factor inhibiting economic growth (Mauro, 1995; Tanzi, 1998; Barreto, 2000). However, as highlighted by Gründler and Potrafke (2019), this relationship is not universal, showing significant variations across countries and institutional contexts.

Regarding GDP growth, the results using the Corruption (C) indicator suggest that lower levels of corruption are associated with lower economic growth. This finding contradicts conventional literature, which typically links lower corruption to better economic performance (Mauro, 1995; Tanzi, 1998). In contrast, the CPI did not show statistical significance for this variable.

The model using the C indicator presented a negative coefficient (though not significant) for secondary school enrollment, suggesting, counterintuitively, that lower education levels are associated with lower levels of corruption (higher indicator values). This result diverges from both the reference study, which found a positive and significant relationship, and established findings in the literature (e.g., Dridi, 2014; Glaeser et al., 2004), possibly reflecting methodological particularities of the C indicator, such as its emphasis on behavioral dimensions of corruption (Coppedge et al., 2022) or unmodeled institutional mediation effects.

Public expenditure on education, significant in Ur Rehman and Naveed (2007), showed a positive coefficient, indicating that higher investment in education is associated with lower levels of corruption (higher indicator values). However, in the model using the Corruption variable, the coefficient was negative but not significant. This difference may reflect the multidimensional nature of the Corruption indicator, which, by capturing behavioral and institutional aspects of corruption (Coppedge et al., 2022), may be less sensitive to variations in educational spending in contexts where these resources do not translate into effective improvements in teaching quality or school governance.

Foreign Direct Investment (FDI) showed a positive and statistically significant relationship only in the model using the CPI, indicating that higher FDI flows are associated with better scores on the indicator (i.e., lower perceived corruption). This result aligns with Wei (2000), who demonstrated that countries with less corrupt institutional environments tend to attract more foreign investment.

The results indicate that investment and market openness were not statistically significant in either model (CPI or C), although they exhibited opposite signs in their relationships with corruption. While in the CPI model the coefficients suggest that greater trade openness and investment are associated with lower corruption levels (higher index values), in the Corruption model the relationship was reversed. In contrast, both inflation and public expenditure maintained a positive but statistically insignificant relationship in both models.

This divergence may reflect fundamental methodological differences between the indicators: while the CPI predominantly captures expert and business perceptions of corrupt practices (Transparency International, 2021), the Corruption indicator also incorporates behavioral and institutional dimensions (Coppedge et al., 2022), potentially responding differently to economic variables.

For the population and unemployment variables, the results reveal distinct patterns. In the Corruption model, population showed a positive and statistically significant relationship, suggesting that higher demographic

pressures are associated with better scores on this indicator (lower levels of corruption). In the CPI model, unemployment had a negative and significant coefficient, indicating that higher unemployment rates correlate with worse index scores (higher perceived corruption). This dichotomy highlights that different dimensions of corruption (institutional/behavioral captured by C versus perceptions measured by CPI) respond differently to socioeconomic variables, reinforcing the need for multivariate analyses that account for these methodological specificities (Treisman, 2000; Coppedge et al., 2022).

The comparative analysis between the indicators revealed that the model using the Control of Corruption (CC) variable showed greater convergence with the CPI in terms of statistical significance and coefficient direction when applied to the same set of variables and methodology from the reference study, suggesting that both capture similar dimensions of corruption, possibly related to institutional perceptions (Kaufmann, Kraay & Mastruzzi, 2009). In contrast, the model using the Corruption (C) indicator showed distinct patterns, especially for socioeconomic and demographic variables, likely due to its multidimensional nature, incorporating behavioral and contextual aspects not present in the other indices (Coppedge et al., 2022).

4.2. Article 2: Impact of Corruption on GDP per capita through international migration: an empirical investigation

The study by Ahmad and Arjumand (2016) examined the impact of corruption on GDP per capita through a migration channel for a sample of 94 developed and developing countries from 1996 to 2010. The results indicate that corruption reduces GDP per capita through the migration channel after controlling for other variables. The authors suggest that if emigration is increasing due to rampant corruption, this would not have a significant macroeconomic impact on GDP per capita.

4.2.1. Control of Corruption

Ahmad and Arjumand (2016) employed the Panel Data technique, and for comparison purposes, the CPI corruption indicator was replaced by Control of Corruption (CC) (Table 03).

Table 03: Comparison of results from Ahmad and Arjumand (2016) using the Control of Corruption (CC) indicator

Variable	Ahmad & Arjumand (2016) (IPC)	This Study (CC)
Corruption	626.9495*	7991.402 ***
Migration	0.0047849**	- 0.091706 ***
Political Stability	- 284.478*	125.443 **
FDI	2.573968	0,0000000352
EXP	- 81.063***	- 591.5843 ***
AGEDEP	- 228.445 ***	- 318.1398***
POP	0.0000183	-0,0000000959
GDP Growth	- 375.32***	4076.519***

Nota: (significance levels: * = 1%, ** = 5%, *** = 10%). The variables are listed in column 1: Corruption, Migration, Political Stability, FDI (Foreign Direct Investment), EXP (Public Expenditure), Age Dependency (Dependency Ratio), POP (Total Population), and GDP Growth. Data were collected from 1996 to 2010.

Initially, some similarities can be observed regarding the significance of the independent variables on the dependent variable, such as Corruption, FDI, Government Expenditure, and Age Dependency. The corruption variable, adopted by Ahmad and Brookins (2007) as the main independent variable, was also significant. The positive sign of this variable indicates a positive relationship, where a higher corruption indicator (less corrupt country) implies a higher GDP per capita, which may be related to the attraction of better human capital to developed countries.

Migration was also significant in the study, with a positive relationship. However, the author does not provide detailed explanations of this result, as migration should be interpreted in two concepts: immigration (arrival of new individuals) and emigration (departure of residents). Nevertheless, it is argued that an increase in emigration reduces per capita income. It is noteworthy that the variable was also significant in the model using the CC indicator, although with a negative coefficient.

Political Rights and Civil Liberties serve as proxies for political stability, which were significant in both models. However, there was a divergence regarding the positive sign in the model using the CC indicator, contrary to the reference study. The literature does not reach a consensus on the relationship between political instability and GDP per capita. Therefore, for this variable, preference is given to the results of Ahmad and Arjumand (2016) to explain the relationship between the variables (Alesina et al., 1996; Aisen & Veiga, 2013). GDP per capita is highlighted as the most commonly adopted indicator for economic growth, although the focus of the study is not economic growth. Aisen and Veiga (2013) point out the main divergences found in empirical studies analyzing this relationship. It is important to note that political stability is a proxy and can be analyzed using various indicators (Political Rights and Civil Liberties, Democracy, Regulatory Quality).

Another difference observed is in the Total Population variable, which was negative and significant in the model with the CC variable, contrary to Article 2, where the result was positive but insignificant. Foreign Direct Investment (FDI) was insignificant in both results. Government expenditure and the age dependency ratio, which measure the resources allocated to general government spending and the ratio of people aged 15 to 64 relative to the economically active population per 100 individuals (World Bank, 2023), were significant and negatively related to GDP per capita in both studies.

4.2.2. Corruption

Considering the Corruption indicator as the main dependent variable (Table 04), a notable similarity was observed between the results obtained in Ahmad and Arjumand (2016) and the present study. The corruption variable was also significant and positively signed in both models. This implies that a higher index value (less corrupt country) corresponds to a higher GDP per capita.

Table 04: Comparison of results from Ahmad and Arjumand (2016) using the Corruption (C) indicator

Variables	Ahmad & Arjumand (2016) (IPC)	This Study (C)
Corruption	626.9495*	1904.344***
Migration	0.0047849**	0.0114113 ***
Political Stability	- 284.478*	- 384.3752 ***
FDI	2.573968	0,0000000138
EXP	- 81.063***	- 381.2992 ***
AGEDEP	- 228.445 ***	- 413.5995***
POP	0.0000183	-0,000015***
GDP Growth	- 375.32***	-114.8034

Nota: (significance levels: * = 1%, ** = 5%, *** = 10%). The variables are listed in column 1: Corruption, Migration, Political Stability, FDI (Foreign Direct Investment), EXP (Government Expenditure), Age Dependency (Dependency Ratio), POP (Total Population), and GDP Growth. Data were collected from 1996 to 2010.

The migration variable was also significant and positively signed (a similarity not observed with the Control of Corruption). From this perspective, all results for the corruption indicators, using the same set of variables proposed in Ahmad and Arjumand (2016), were significant. This aligns with another study by the same authors, which sought to compare the correlation between corruption indicators, although using different metrics than those proposed in the present research (Ahmad & Aziz, 2001).

The results revealed significant divergences compared to Ahmad and Arjumand (2016), particularly regarding the total population variable: while in our models with Corruption (C) and Control of Corruption (CC) this variable exhibited negative and statistically significant coefficients, in the reference study it was insignificant and positively signed. The divergences observed among the IPC, CC, and C indicators may reflect their distinct methodological natures: whereas IPC and CC prioritize institutional perceptions, C incorporates behavioral and contextual dimensions (Kaufmann, Kraay & Mastruzzi, 2009; Coppedge et al., 2022).

The results for GDP growth also showed divergence between the models analyzed. While the model using the Corruption indicator revealed a negative and statistically insignificant relationship, Ahmad and Arjumand (2016) identified

a positive and significant effect. This discrepancy can be attributed to fundamental differences in indicator construction: by incorporating specific behavioral and institutional dimensions (Coppedge et al., 2022), the Corruption indicator may capture distinct relationships between economic development and corrupt practices compared to perception-based indicators, such as those used in the reference study.

Political stability, government expenditure, and age dependency ratio presented negative and statistically significant relationships with GDP per capita in all models analyzed (IPC, CC, and C). This consistent pattern indicates that: (1) political instability reduces per capita economic growth; (2) high public expenditure may compromise economic performance, possibly by crowding out private investment or generating inefficiencies; and (3) a higher proportion of dependents relative to the working-age population limits the economy's productive capacity. The robustness of these results, maintained even with different institutional indicators, reinforces their role as structural determinants of economic development.

In all models analyzed (IPC, CC, and C), Foreign Direct Investment (FDI) did not show statistical significance as a determinant of GDP per capita, contrasting with previous studies that identified such a relationship (Alfaro, 2017). This result may suggest that the impact of FDI on per capita economic growth may be conditional on institutional or structural factors not captured in the models, and that the quality and nature of investment flows (e.g., sectoral allocation, technology transfer) may be more relevant than their absolute volume.

Based on the results obtained from the reference model and those proposed in the present study, it can be observed that, overall, using the same set of variables, the corruption indicators employed showed similarity in the results obtained. The strong correlation between the corruption indicators has also been studied by Ahmad and Brookins (2007).

The study *Impact of Corruption on GDP per Capita through International Migration: An Empirical Investigation* demonstrated strong results regarding the

similarity in measuring corruption based on the three indicators used in this research (IPC, CC, and C). When replacing IPC with Control of Corruption, four of the eight independent variables (government expenditure, age dependency, CC itself, and FDI) maintained the same statistical significance and coefficient direction. More favorable results were obtained with the Corruption indicator, which showed similarity in the behavior of six variables (Corruption, Migration, Political Stability, FDI, EXP, and ADEP), both in terms of significance and coefficient sign.

These findings suggest that, although the indicators capture different dimensions of corruption, their capacity to measure fundamental economic relationships appears partially robust to the choice of metric, particularly in the case of the Corruption indicator.

5. FINAL CONSIDERATIONS

This study conducted a direct comparative analysis among the three main corruption indicators, Corruption Perceptions Index (CPI), Control of Corruption (CC), and Corruption (C), applying them systematically to the same dataset and using identical methodology (fixed-effects panel models). The central objective was to evaluate the degree of convergence among these metrics in measuring corruption, specifically testing whether they produce consistent results when applied to the same explanatory variables and the extent to which the choice of indicator affects conclusions about the determinants of corruption. The results allow not only verification of the robustness of these indicators as analytical tools but also provide valuable methodological guidance for future research that requires selecting among different corruption metrics, particularly in econometric studies on institutional development and economic growth.

The results showed significant convergence among the CPI, CC, and C indicators in their ability to measure corruption, although occasional variations attributable to their distinct methodologies. Comparative analysis, through controlled substitution of indicators within the same statistical model, revealed

that observed differences primarily reflect the diversity of sources and approaches comprising each metric: while the CPI is predominantly based on expert perceptions, the CC and C also incorporate behavioral and institutional indicators (Hartwig & Sturm, 2025; Koeswayo, Handoyo & Hasyir, 2024; Coppedge et al., 2022). This systematic approach mitigates one of the main criticisms in the literature regarding the measurement of corruption, the alleged lack of precision in perception-based indices, by demonstrating that when analyzed alongside other multidimensional metrics, the results exhibit consistent patterns that validate their use in applied research.

Although the CPI is widely used in the literature, possibly due to its breadth of sources and historical tradition, the results of this study show that CC and C have equivalent capabilities as valid corruption indicators. The study contributes significantly to the methodological debate by: (i) providing comparative evidence on the accuracy of these indicators; (ii) validating the alternative use of multidimensional metrics (such as CC and C) in economic and political analyses; and (iii) encouraging future research on corruption measurement, especially in a context where the topic gains increasing relevance in discussions on socioeconomic development and institutional quality.

However, the study faced significant limitations due to the limited methodological transparency in the analyzed articles. Insufficient documentation in the original studies, particularly regarding data treatment and model specification, restricted deeper analyses, highlighting the need for greater transparency in econometric research on corruption to allow replication and valid extensions.

Additional limitations arose from the lack of detailed specification of countries analyzed in the original studies, requiring scenario modeling with assumptions for missing data. Discrepancies in the geographic coverage of corruption indicators necessitated complementary approaches: (i) imputation techniques for missing data to preserve sample representativeness, and (ii) winsorization (replacing extreme values with adjacent percentiles rather than

excluding them), ensuring that outliers did not distort results while retaining potentially relevant information.

Based on the results obtained, the following suggestions are recommended for future studies: (i) expanding comparative studies that evaluate not only the CPI, CC, and C indicators but also other corruption metrics available in the literature, incorporating additional variables such as cultural factors, education levels, and institutional characteristics (democracy, political stability); and (ii) conducting replication studies using the same methodology (panel data) and datasets but with greater rigor in documenting data treatment and analysis procedures, an aspect neglected in the studies underpinning this research.

The findings of this study contribute to both academia and public policy. Theoretically, the convergence among CPI, CC, and C indicators, despite their different methodologies, confirms the robustness of these metrics in measuring corruption and highlights the importance of considering their specificities in comparative analyses. These findings broaden the debate by suggesting that: (i) perception-based indices (CPI) capture complementary dimensions to behavioral metrics (C); and (ii) the choice of indicator should consider the context of the analysis (country, period, variables).

Practically, the identification of consistent links between political stability, public expenditure, and demographic profile with corruption levels provides guidance for anti-corruption policies, emphasizing the importance of strengthening institutions, increasing budget transparency, and investing in human capital. Furthermore, by demonstrating that different indicators can produce similar results, the study expands the range of tools available for corruption diagnostics in various contexts.

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