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Corruption and economic growth: does the size of the government matter?*

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Abstract

Corruption is often a source of contentious debate, covering different areas of knowledge, such as philosophy and sociology. In this paper we assess the effects of corruption on economic activity and highlight the relevance of the size of the government. We use dynamic models and the Generalized Method of Moments (GMM) approach for a panel of 48 countries, from 2012 to 2019. We find an adverse effect of corruption on the level and growth of GDP per capita, but that large governments benefit less from reducing corruption. Furthermore, developing economies, regardless of government size, benefit less from reducing corruption, while government size is not sufficient to explain the influence of corruption on economic activity, although the level of effectiveness of public services is crucial. Finally, our findings suggest that private investment is a potential transmission channel for corruption.

Keywords: Corruption, Economic Growth, Government Size, Generalized Method of Moments, Forward Orthogonal Deviations.
JEL codes: C23, O40, K42, C23.

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1. Introduction

The concept of corruption involves cultural, legal, philosophical, and economic aspects. Accordingly, the definition of corruption can vary depending on the research carried out, in function of the perception and subjectivity of the topic. For Tomaszewski (2018), industrialised and democratic countries have a different approach and perspective than other economies and cultures. However, in this study, we assume that corruption is the act of public agents in infringement of the laws and norms established to serve private interests, to the detriment of society.

In the economic context, a key question is whether high levels of corruption can be partly responsible for the slowdown in economic growth. Furthermore, does the size of government interfere with the level or growth of economic activity? Is there a transmission channel for corruption to affect the economy?

Despite important findings, there is no consensus in the literature regarding the determinants of corruption and its impact on economic activity. In this sense, corruption and its consequences have received considerable attention by international organisations and governments around the world, such as the development of governance indicators and specific laws and regulations to define and guide the conduct of public and private agents (Bação et al., 2019).

Different international organisations, such as the United Nations (UN), have increased their efforts to combat corruption through different programmes. For the UN, corruption not only distorts the decision of individuals and firms, but also constrains investment, inhibits competition, and hinders economic growth. For the World Bank (WB), the identification and control of corruption has assumed priority status in the political and institutional environment and for the need for reform over the last two decades.

> "These reforms build on the idea that corruption is a dysfunction of public administration that emerges in the presence of monopoly and discretion, which in turn can be curbed by promoting accountability and transparency. Corruption undermines policies and programs that aim to reduce poverty, so attacking corruption is critical to the achievement of the Bank's overarching mission of poverty reduction." (The World Bank, 2019).

Despite these arguments, there is no clear convergence of results regarding the effects of corruption on economic activity. Different studies present two hypotheses to understand the relationship between corruption and economic growth. The first hypothesis describes corruption as an obstacle to economic growth. This hypothesis is described as "sanding the wheels" (Aidt, 2009; Nur-tegin and Jakee, 2020).

The other hypothesis shows a positive connection between corruption and economic growth: the "greasing the wheels" hypothesis. This positive relationship occurs in situations where there is excessive bureaucracy and inefficiencies which hinder the development of new businesses. Corruption is therefore seen as a "second best solution", due to the distortions caused by the malfunctioning of public institutions. In other words, corruption can enhance economic growth when economic agents pay bribes to circumvent bureaucracy.

Using a panel of 48 developed and developing countries for the period of 2012 to 2019, our study focusses on the response of economic activity to the effect of corruption, as measured by the corruption perception index (CPI). In addition, we investigate whether the size of the government interferes with this relationship.

Our study thus contributes to the literature in several different ways: i) by offering new findings and filling a gap by reviewing the effects of corruption on economic activity, as many studies use the CPI before the methodological change (2012) and/or combining the data before and after this period. However, the scores are not comparable before 2012 (Gründler and Potrafke, 2019), and hence, ii) we analyse the effect of corruption (CPI) on the level and growth of economic activity, controlling for different configurations.

First, based on dynamic models, we study the effect of corruption on the level and growth of GDP per capita (pc) for the full sample. Subsequently, we classified the countries into medium-big and small governments, the latter having a government spending-to-GDP ratio below 30%. In this way, we examine whether the size of the government matters. Second, we deepen the research and investigate whether the level of economic development makes countries susceptible to the effects of corruption. For this purpose, we initially use the full sample and then control for the level of economic development and government size. Third, for a full sample and, controlling for the size of governments and also the level of development, we examine whether the effectiveness of public services influences the effect of corruption on the level and growth of GDP pc. Finally, we analyse whether private investment is a potential transmission channel for corruption.

Our results indicate that corruption is harmful to the economy and has an adverse effect on the level and growth of GDP pc, regardless of the government size. However, small governments fell more intense effects in reducing corruption than large governments. In addition, in developed economies with small governments, the reduction of corruption has a positive effect on GDP pc. On the other hand, in developing countries with small governments, the increase in corruption is positive or has no significant effect on GDP pc. We also note that, in developed economies with large governments, there is a negative relationship with

corruption, while that is not the case for developing economies. Lastly, we found that private investment declines with increasing corruption and can be a potential channel of transmission of corruption. We therefore found evidence that corruption disrupts firms' decisions, interferes with the innovation process, and decreases both investment and economic activity.

The remainder of the paper is organised as follows. Section 2 is the literature review. Section 3 presents the data and estimation strategy. Section 4 presents the empirical analysis and Section 5 concludes.

2. Literature

Since the late 1990s governments have included combating corruption as one of their government goals, highlighting a phenomenon which for a long time has not received much attention. In the same vein, Abreu (2011) points out that economies have experienced an increase in events where corruption has been evident, after decades of flexibility and modernisation of expanded markets on a global scale.

The literature provides at least two main reasons for associating government size with economic inefficiency and corruption. First, large governments can hinder economic growth. Some researchers point out that the size of the government is negatively related to growth of GDP, as they tend to consume resources from the economy without producing significant effects, while other studies indicate that there is an optimum level for the size of the government (Di Mateo, 2013; Dzumashev, 2014, Afonso and Schuknecht, 2019, and Afonso et al, 2020).

Second, governments with a greater participation in the economy can be inefficient and, by interfering in different areas, they compete with and exclude private activities, which are more efficient in the opinion of some specialists. Such a scenario thus creates an environment which is conducive to corruption and inefficiencies in economic activity. Although many experts defend free markets as being the mechanism for allocating resources, Di Mateo (2013) argues that a considerable proportion of economic inputs is defined outside the market environment, and is therefore influenced by government institutions. For the author, the decision is not a trivial one, but there is a need to investigate why, when, and where resource allocation should take place. Once these questions are answered, we can then proceed to define the participation and role of government in economies.

Due to the multidisciplinary nature of the question, scholars highlight the complexity and challenges which arise from the different perspectives of corruption. Hayashi (2012) highlights three dimensions of this phenomenon: legalist, mercantilist, and the concept of public good. For Bobbio et al. (1998), an aspect of corruption is associated with a transaction or deal between

at least two agents. There must be the corruptor and the corrupted, usually with the offer of a promise that favours the interests of the corruptor. The United Nations (UN) clearly defines the activities which it considers to be directly linked to corruption, such as bribery, fraud, embezzlement, nepotism, extortion, and the use of inside information by a public agent for private benefit (Hayashi, 2012).

For different authors, these practices affect the level of economic activity and welfare (Mo, 2001; Pulock, 2010), through the embezzlement of public funds or practices which acts as barriers to the entry of new firms into the markets, which consequently affects innovation and reduces productivity and economic growth. Ahmad et al. (2012) stress that over the last 30 years, different studies point to corruption as being a factor which is capable of changing the goals of public institutions to benefit agents and private institutions. They emphasise that corruption can also inhibit investments, which in turn makes public administration more expensive for society.

Mauro (1995) also suggests that corruption is negatively associated with economic growth and highlights that the direction of causality starts from corruption, rather than the other way around. This finding contradicts some arguments that there would be a "boomerang effect", or that corruption can influence and be influenced by other variables.

Heckelman and Powell (2010) indicate that the effects of corruption depend on the degree of development of national institutions. Using a different approach, based on regression analysis, and controlling the variable economic freedom, they argue that corruption fosters economic growth when economic freedom is restricted. On the other hand, as economic freedom is more present and robust, this positive effect decreases significantly.

The empirical literature provides important results notably for developed countries, such as the United States and the European Union, although some are not conclusive. To expand the sample and bring new evidence, researchers have examined whether the effect of corruption varies in different regions and whether a country can affect its neighbours through the "spillover effect" of corruption. d'Agostino et al. (2016b) analysed African nations and found that a negative correlation between corruption and economic and economic activity. In the same vein, Huang (2016) found no positive effects of corruption on economic growth.

These findings are in line with the most widely observed argument in newspapers and morally accepted and disseminated by governments and international institutions. Accordingly, these results support the hypothesis "sanding the wheels", or that corruption slows down innovations, distorting the economic system, and it is therefore harmful for economic growth.

However, some studies point to opposite conclusions - where corruption is the driving force of economic growth (Leff, 1964). Kaufman and Wei (2000) considered that corruption can have a lubricating effect on economic gears in certain circumstances, which supports the "greasing the wheels" hypothesis. Their findings support the argument that corruption is beneficial to the economy, due to the excessive set of regulations, rules, and bureaucracies that render the system inefficient. In this sense, corruption acts to overcome these obstacles and stimulate economic growth.

There is still the possibility of a hybrid behaviour between corruption and economic growth. Some economists argue that the relationship between variables has an inverted U shape, such as in countries in the early stages of economic and social development – where there is no fertile environment for corruption. During the intermediate stages of development, the opportunities for corruption increase, whereas corruption declines again in the case of a highly-developed society (Ahmad et al., 2012).

In addition, a frequent association is that governments with a high participation in the economy ("Big Governments") are bureaucratic and inefficient, and are therefore a breeding ground for corruption. Some authors (Egger and Winner, 2005; Dzumashev, 2014) argue that corruption improves economic efficiency when the size of the government is above the ideal level. The choice of government size is a delicate issue and requires a sensitive balance. For Alesina and Angeletos (2005), the choice creates an impasse for policymakers, whereby small governments do not correct inequalities in the economic system, while a large government increases corruption. They also point out that public spending for low-income agents in developing countries is often misdirected, increasing corruption.

In contrast, Kotera et al. (2012) identify a positive association between the size of the government and corruption, for democratic countries. Empirical papers have indicated that large governments can increase participation in the economy and still reduce corruption, as they have a system of checks and balances (Billger and Goel, 2009; La Porta et al., 1999).

Bobbio et al. (1998) advocate that the greater the scope of institutionalisation, the higher the chances for the emergence of corruption. This is the cornerstone of the argument of the authors, who point out that greater government participation in relation to the private sector is harmful. However, Bobbio et al. (1998) also indicate that this is not a sufficient condition, as the pace of expansion as well as the social and cultural characteristics and the maturity of the institutions are crucial factors. Accordingly corruption is less prevalent in countries with institutional stability than in instable societies, as these tend to have less robust and established institutions. In this sense, Méon and Sekkat (2005) take a step further and analyse the quality

of governance associated with corruption. For these authors, the influence of corruption on economic growth is negative (statistically significantly) in countries with low quality political institutions.

Many studies investigate the effects of corruption and their determinants, but fail to define which channels are used by corruption to affect the economy and the welfare of society. Zakharov (2019) examined the relationship between corruption and fixed capital investment in Russian regions. The author argues that corruption slows economic growth through different channels and identifies domestic investment in physical capital as the main channel. In addition, corruption fosters uncertainty (Mauro, 1995), which makes agents more cautious and leads then to postpone or reduce investment. This effect spreads across different sectors, resulting in a reduction of economic activity (Baker et al., 2016; Bernanke, 1993).

Along the same line, Ahmed and Alamdar (2018) measured the impact of corruption and of the budget deficit on private investment in the Pakistani economy. They point out that corruption has an adverse and significant effect on private investment and stress the importance of the transmission channel in developing economies.

Table 1 depicts other studies that confirm the findings described above and provides new information on the effects (positive and negative) of corruption on economic activity. We highlight the isolated effect of corruption and the interaction with public spending, especially military spending in developed countries and in less frequent samples, such as Peru, African countries, and post-communist countries.

The lack of convergence and imprecision of the results is not only due to the complexity and multifaceted nature of corruption, but also to the data and methods used. The first issue is that many studies use the World Bank's Corruption Perception Index (CPI) and ignore the technical recommendation of the World Bank. The problem is that the 2011 CPI scores are not comparable with the 2012 CPI scores, as the methodology used before 2012 means that the CPI scores are not comparable over time.[1] The second issue concerns panel models with fixed effects, where Gründler and Potrafke (2019) identify that "in particular, including fixed period effects in panel data models does not solve the incomparability problem because the CPI in individual years before the year 2012 included data for different components and time periods to measure perceived corruption across continents".

In addition to the problems observed with the CPI, we must also be careful when using the Control of Corruption Index (World Bank) because it this index has been criticised on account

[1]https://www.transparency.org/files/content/pressrelease/2012CPIUpdatedMethodologyEMBARGOEN:pdf

of various methodological issues and the incomparability of a sub-index over time and across countries, as many country classifications come from different sources of information (Gründler and Potrafke, 2019).

Table 1: Corruption and Economic Activity

Study	De Soto (1989)	Cieślik and Goczek (2018b)	D'Agostinoet al. (2016b)	Swaleheen (2011)
Title	Ther other path: The invisible revolution in the third world.	Corruption, Privatisation and Economic Growth in Post-communist Countries	Corruption and growth in Africa	Economic growth with endogenous corruption: an empirical study
Findings	The author presents the Peruvian economy and an absent government, where informality reacts by establishing its own market system. Using illegal invasions and acquisitions, the informal sector expanded its network, opening companies and operating in other activities, such as public services (police).	Based on an empirical study with a panel of 29 post-communist countries (1996–2014), the authors examine the impacts of corruption and privatization on economic growth in post-communist countries in Central Europe, and the findings indicate the negative influence of corruption on the economies analyzed.	The authors point out that there are few studies for the African continent that analyze the effects of corruption and public spending. Using a panel data approach, they suggest that corruption when interacting directly and indirectly with military spending has a strong negative effect on the economy.	Using dynamic panel models (1984–2007) to include the endogeneity of corruption, the article indicates that corruption has an adverse (non-linear) effect on the growth of real income per capita. In addition, the authors justify the choice of the model, because previous studies ignore the time-invariant factors in the investigated economies.

Study	Campos et al (2010)	Mauro (1996)	Levy (2007)
Title	Whither corruption? A quantitative survey of the literature on corruption and growth	The Effects of Corruption on Growth, Investment, and Government Expenditure	Price adjustment under the Table: Evidence on Efficiency-Enhancing Corruption
Findings	The study describes the relationship between corruption and economic growth, based on a sample of 41 different econometric studies. Thus, the authors try to clarify the reasons for the different results, in the light of the chosen econometric methods. In addition to the expected negative effects of corruption, the authors also indicated an impulse for corruption on growth. These results are more present in studies with an academic profile.	The article analyzes the possible causes and consequences of corruption and reviews studies on corruption and the adverse effects on economic performance. In addition, there are indications that corruption reduces investment and economic activity, also interfering in the composition of government expenditure.	The article describes price adjustment mechanisms (black markets) in the Soviet planning and rationing regime (1960-1971) in the Republic of Georgia. The author depicts the strategies used to address an inefficient and distorted price system and the role of economic incentives.

3. Estimation Strategy and Data

3.1 The Magnitude of Corruption

The literature provides different approaches to measure corruption, with one of the measures used as a proxy for the control of corruption being the one developed by the World

Bank. In addition, the Corruption Perception Index (CPI) is widely-used, which was developed by Transparency International and has the advantages of counting on a wide coverage and applies a consistent methodology for cross-country studies. An alternative strategy is to observe corruption directly, as highlighted by Olken and Pande (2012), although these authors clarify that their coverage is restricted and is more specific.

We employ the CPI to measure the effect of corruption on economic activity in this paper. CPI classifies more than 100 countries by perceived levels of corruption in the public sector, ranging from 0 to 100 (0 is perceived as being more corrupt).

3.2 Government Size

There are different alternatives for classifying countries by size of government. To establish the presence or participation of the government in the economy, Afonso et al. (2005) divided the countries into three sizes (Small, Medium, and Big), according to the Public Expenditure-to-GDP ratio (G/GDP). Small governments have a G/GDP ratio of less than 30%, medium ones less than 40%, and big governments more than 50%. The final consumption of the general government can be split into two different categories. To assess the effects of governments' footprint on the economy, we use two classifications available on the World Bank database, namely: 1) General Government Final Consumption (% GDP), and 2) Expenses (% GDP).

We chose these two metrics or indices because they present different aspects of government consumption. The General Government Final Consumption index represents the individual and collective services provided by the government and includes the remuneration of public servants, the final consumption of government goods, and services expenditures on national defence, but it excludes the part of government capital formation. When evaluating this indicator, which does not include expenses such as interest and pensions, we avoid classifying a government as "Big" just because it incorporates interest payments or invests heavily in social projects. On the other hand, and to ensure a broader perspective, the Expenses index includes social benefits, interest and subsidies, grants, and rent and dividends.

In this paper, we divided the sample of the two indicators into two groups: Small and Medium-Big governments. Accordingly, governments with an average annual index (2012-2018) below the 33% lowest results were classified as Small, while values for Medium-Big governments are above 33%. Regardless of the measures used, governments presented the same classifications between 2012 and 2018.

To investigate the influences of corruption on economic activity, we selected 48 developed and emerging countries. Due to the lack of recent data for some countries, we selected a sample

that provided a good diversity of levels of economic activity and CPI scores, using corruption indexes from the World Bank database. Due to the change in methodology of the CPI (2012), the series just range from 2012 to 2019, and used the results of the comparable CPI over time.

The data is provided by the World Bank and Organisation for Economic Cooperation and Development. The series are based on CPI, GDP per capita (international dollar 2017), gross fixed capital formation per capita (constant 2010 US$)[2], and labour force participation rate (% of total population aged 15-64 (which we call 'Labour per capita'). We also used the Government Effectiveness Index (GEFF) to assess the quality of public service, as well as General Government Final Consumption expenditure (% of GDP) and Expenses (% of GDP) to rank the government size.

Tables 2 and 3 and Figure 1 present the averages (GDP per capita and CPI) for the 48 countries, as well as the descriptive statistics and the relation between the variables. We observe that there is a positive relation between the reduction of corruption (increase in the CPI) and an increase in the level of GDP per capita (see Figure 1).

Table 2: CPI and GDP per capita (2012-2019)

Id	Country	CPI (average)	GDP pc (average)	Id	Country	CPI (average)	GDP pc (average)
1	Argentina	35.71	23646.63	25	Italy	45.86	41104.16
2	Australia	79.71	48107.47	26	Japan	73.86	39681.92
3	Austria	73.14	53897.36	27	Korea, Rep.	57.29	38968.36
4	Belgium	75.71	49530.33	28	Latvia	55.14	26602.27
5	Brazil	39.71	15091.41	29	Lithuania	57.86	31133.68
6	Bulgaria	41.71	19821.32	30	Luxembourg	81.57	110403.10
7	Canada	82.00	47737.65	31	Malta	56.14	37919.29
8	Chile	69.43	23485.52	32	Mexico	31.57	19263.85
9	Colombia	36.57	13977.94	33	Netherlands	83.00	53649.63
10	Costa Rica	55.57	18129.25	34	New Zealand	89.86	40393.35
11	Croatia	48.43	25002.53	35	Norway	85.57	61887.29
12	Cyprus	60.57	35636.83	36	Poland	60.57	28123.22
13	Czech Republ	53.57	36107.22	37	Portugal	63.00	31557.44
14	Denmark	90.00	53373.49	38	Romania	45.57	24465.97
15	Estonia	69.29	31702.47	39	Russian Federation	28.29	26053.15
16	Finland	88.14	46166.45	40	Singapore	85.00	89927.41
17	France	70.29	43871.40	41	Slovak Republic	49.29	29319.74
18	Germany	79.86	51464.47	42	Slovenia	59.71	34568.83
19	Greece	43.14	28756.95	43	Spain	59.29	37604.35
20	Hungary	50.43	27560.98	44	Sweden	87.14	51135.96
21	Iceland	78.43	52163.76	45	Switzerland	85.57	66349.49
22	India	38.43	5495.63	46	Turkey	44.00	25759.85
23	Ireland	72.86	67077.85	47	United Kingdom	78.86	44725.23
24	Israel	61.29	37854.11	48	United States	73.71	58327.24

Source: Authors' calculations.

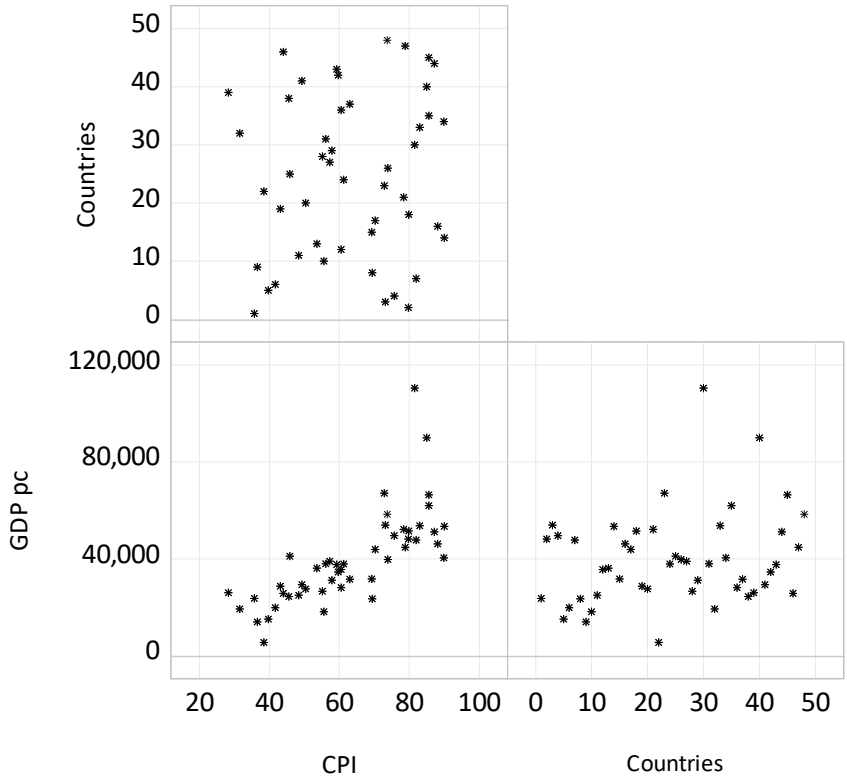
[2] This sample includes four countries with missing data (gaps) in 2019.

Table 3: Descriptive Statistics: Individual Samples (2012-2019)

	GDP pc			CPI			GFC pc			L pc		
	Full Sample	Developed	Developing	Full Sample	Developed	Developing	Full Sample	Developed	Developing	Full Sample	Developed	Developing
Mean	40078.2	44379.1	27175.2	63.1	68.2	47.8	7399.5	8648.0	3653.9	72.5	74.2	67.5
Median	38078.6	41839.4	23556.6	62.0	71.0	41.5	5778.4	7660.5	2441.2	72.8	74.2	68.7
Maximum	114481.5	114481.5	97745.0	92.0	92.0	87.0	34174.1	34174.1	15059.2	89.1	89.1	77.5
Minimum	4574.7	18115.0	4574.7	27.0	36.0	27.0	517.4	1498.0	517.4	52.1	63.4	52.1
Std. Dev.	19256.1	16629.1	20860.8	17.5	14.6	16.5	5523.6	5499.0	3570.4	6.3	5.2	6.8
Skewness	1.3	1.8	2.3	-0.2	-0.2	0.9	1.2	1.1	2.2	-0.6	0.2	-0.9
Kurtosis	5.9	8.2	7.8	1.9	1.8	2.9	4.4	4.4	7.0	4.3	2.8	2.9
Jarque-Bera	243.1	474.9	178.7	21.5	18.7	13.0	121.6	80.4	141.4	49.8	2.1	12.6
Probability	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Observations	384.0	288.0	96.0	384.0	288.0	96.0	380.0	285.0	95.0	384.0	288.0	96.0

Source: Authors' calculations.

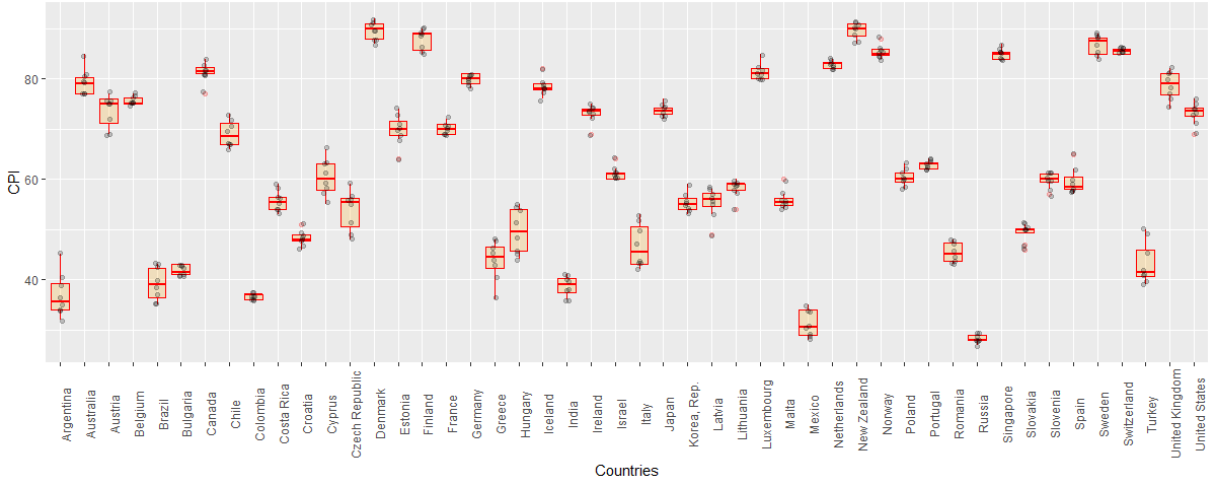
Figure 1: Corruption Perception Index and GDP per capita (average for 2012-2019).



Source: Authors' calculations.

In addition, Figure 2 illustrated the amplitude of the Corruption Perception Index per country throughout the period under analysis.

Figure 2: Amplitude of Corruption Perception Index (2012-2019).



Source: Authors' calculations.

To investigate the transmission channel of corruption, we use the data provided by the International Monetary Fund (IMF) for the Investment Stock and Capital Stock Data (1960-2015). We use the corruption perception index (CPI) with private investment (gross fixed capital formation) and GDP, both in billions of international dollars in 2011. Table 4 indicates the average value of private investment and GDP for the 48 countries (2012-2015).

Table 4: Private Investment and GDP (2012-2015)

Id	Country	Priv Inv (average)	GDP (average)	Id	Country	Priv Inv (average)	GDP (average)
1	Argentina	96.94	862.73	25	Italy	357.58	2011.30
2	Australia	214.30	1035.53	26	Japan	735.23	4535.17
3	Austria	78.36	377.13	27	Korea, Rep.	399.16	1667.54
4	Belgium	111.01	457.09	28	Latvia	10.02	63.23
5	Brazil	591.07	3060.36	29	Lithuania	9.67	67.55
6	Bulgaria	15.03	114.21	30	Luxembourg	9.52	29.70
7	Canada	300.76	1498.88	31	Malta	2.18	10.66
8	Chile	71.99	374.28	32	Mexico	300.43	1958.80
9	Colombia	87.41	608.62	33	Netherlands	123.74	772.89
10	Costa Rica	10.74	63.04	34	New Zealand	21.65	151.03
11	Croatia	13.90	82.90	35	Norway	62.47	327.10
12	Cyprus	3.44	21.44	36	Poland	109.19	886.66
13	Czech Republic	59.10	302.76	37	Portugal	41.34	269.12
14	Denmark	46.04	239.90	38	Romania	59.51	365.27
15	Estonia	6.79	31.63	39	Russian Federation	376.63	3438.16
16	Finland	40.17	212.10	40	Singapore	96.23	348.92
17	France	469.04	2468.60	41	Slovak Republic	20.60	127.58
18	Germany	600.98	3545.47	42	Slovenia	8.64	58.26
19	Greece	20.78	271.21	43	Spain	307.33	1481.72
20	Hungary	30.97	233.65	44	Sweden	80.63	427.25
21	Iceland	1.71	13.54	45	Switzerland	104.03	445.33
22	India	1375.96	6948.44	46	Turkey	201.19	1420.49
23	Ireland	56.10	232.30	47	United Kingdom	373.04	2448.19
24	Israel	47.09	238.69	48	United States	2601.04	16360.93

Source: Authors' calculations.

4. Empirical analysis

4.1. Model Specification

The GMM approach enables us to incorporate a certain superiority of the dynamic estimators, in comparison with the static estimators and it also controls the endogeneity of the lagged dependent variable in a dynamic model, especially when we identify a correlation between the explanatory variables and the error term. In addition, GMM controls omitted variable bias and unobserved panel heterogeneity.

The empirical literature on dynamic models (GMM) tends to use first differences transformation (FD), which is attributed in part to the results of Arellano and Bond (1991). Later on, Arellano and Bover (1995) presented a transformation (forward orthogonal deviations or FOD) as an alternative to the first difference transformation.

On the other hand, Phillips (2019) argues that, initially, there would be no reason to worry about the transformation technique and that the results indicate that two different transformations can lead to the same Generalized Method of Moments (GMM) estimator. However, the same author also points out that in situations where the estimators based on these two transformations differ, the simulations suggest that the estimators obtained by FOD have better properties than those obtained by FD. Hayakawa (2009) suggests a similar result, indicating that, in many simulations, the FOD-GMM estimator performs better than the DF-GMM model. As an additional advantage for studies of panel models with gaps, Roodman (2009) highlights that the use of orthogonal deviations maximizes the sample size.

We use different configurations for the GMM model (FOD) panel, as we examine not only the isolated effect of corruption, but we also control for the size of government, the degree of development of countries, and the effectiveness of public management. Therefore, our standard specification of the dynamic model for GDP pc (y_{it}) can be defined as:

$$Y_{it} = \alpha Y_{i,t-1} + X'_{it}\beta + e_t + u_{it} \qquad (1)$$

where α is a scalar and β is the vector of coefficients (kx1). In this basic structure, Y_{it} is the dependent variable (per capita GDP) and X_{it} represents the explanatory variables. Subscript i indicates the countries across the time periods (t). The terms u_{it} and e_t represent a composite error, where the random component of the variation in our independent variable is derived from the idiosyncratic error (u_{it}) and the time invariant error, e_t. It is this term that we investigate when we analyse fixed and random effects, and also whether it is correlated with X_{it}, or not.

Finally, we introduce the lagged dependent variable $Y_{i,t-1}$ as a determinant for the dynamic panel concept, and take advantage of the time series dimension.

Accordingly, the AR(1) α coefficient represents the persistence or memory of the process that affects Y_{it}. In addition, we have identified an appropriate strategy for instrumental variables to deal with problems such as endogeneity.

In the basic configuration, we assume that the maximum sample period (t) is equal to 8 years with 48 countries (i). To estimate our models based on the GMM approach, we selected the option orthogonal deviations as a transformation method to eliminate the effect of the specification. In addition, the GMM specification is in line with the Arellano-Bond 2-step. Finally, we use the CPI and labour force and gross fixed capital formation lagged variables as instruments (Anderson and Hsiao, 1982).

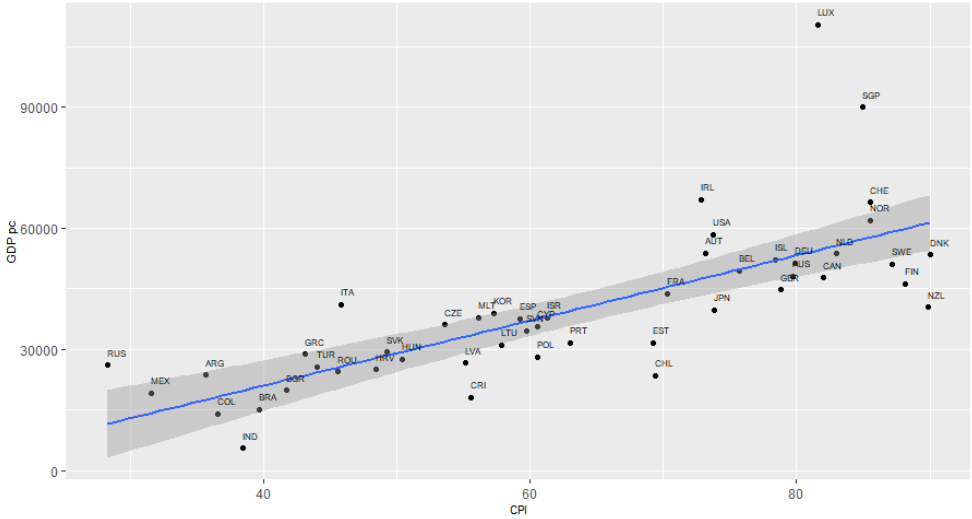
4.2. Results and discussion

In this section, we examine the effects of corruption on economic activity, as well as the assumptions mentioned in the literature. To gain intuition, we start with an analysis of the average results between 2012 and 2019, and subsequently we examine the results in the light of dynamic panel models.

The corruption proxy is represented by the Corruption Perception Index (CPI) and it indicates the level at which corruption is perceived by entrepreneurs and analysts, as described in the previous sections. Using GDP pc (income proxy), as measured by the average between the years 2012 and 2019, the results indicate that the higher the level of corruption, the lower the level of economic activity (see Figure 3). For instance, the Brazilian economy has relatively lower levels of GDP pc and has higher levels of corruption. We also observed that countries such as Portugal (which is situated below the trend line) would expect the level of income (per capita) to be higher.

We initially use three dynamic panel approaches: Fixed Effects, OLS, and GMM. Although the focus of our study is the GMM approach, we also include the two other approaches to compare results and confirm patterns in the relation between variables. Unlike the GMM approach, one of the limitations of the other approaches is that they may not necessarily address issues such as the endogeneity of explanatory variables. Despite the inaccuracies in the estimators of these additional approaches, the results point to similarities with the outputs from the GMM model, especially in the case of the Fixed Effects approach (see Table 5).

Figure 3: GDP per capita and Corruption Perception Index (CPI).



Source: Authors' calculations.

Table 5: Dynamic models (OLS, Fixed Effects and GMM).

	OLS		FE		GMM	
Dependent Variable	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)	(5) GDP pc	(6) D(GDP pc)
GDP pc (-1)	1.012227***		0.837136***		0.852544***	
	(0.0064)		(0.0312)		(0.009959)	
D(GDP pc (-1))		0.415125***		-0.059590		-0.044169***
		(0.056)		(0.0064)		(0.012960)
CPI	-4.094788	4.743301	38.40995*	17.51332	89.62135***	99.80616***
	(5.96)	(6.12)	(21.7058)	(25.5049)	(12.35568)	(27.96605)
GFC pc	0.025478	0.014999	0.194506***	-0.121659***	0.089785***	-0.210185***
	(0.0236)	(0.0172)	(0.0499)	(0.0437)	(0.009845)	(0.008160)
L pc	-7.068224	-8.930793	237.0609***	56.95920	298.6438***	160.3550***
	(11.94)	(12.21)	(51.3879)	(52.3856)	(21.31893)	(43.01206)
c	852.8555	739.9850	-13893.53***	-3455.639		
	(732.48)	(74.64)	(3584.0220)	(4275.1240)		
Adj R sq	0.997201	0.213011	0.998359	0.507300		
DW	1.290723	2.364305	2.369287	2.766775		
Prob F	0.000000	0.0000	0.0000	0.0000		
Prob J					0.221874	0.145418
Countries	48	48	48	48	48	48
Observations	332	284	332	284	284	236

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

We find that an increase in corruption (the CPI ranges from 0 to 100, with 100 being the least corrupt) hinders economic activity (both level and growth). The OLS approach does not

point to significant results, however the GMM and Fixed Effects approaches support the hypothesis that an increase in the CPI score (reduction of corruption) stimulates the level of economic activity. The same can be seen for increases in the labour force and gross fixed capital formation. With regards the growth of GDP pc, only the GMM model indicates significant results. These findings are in line with the "sanding the wheels" hypothesis (Nur-tegin and Jakee, 2020).

Moving forward, we use only the GMM approach and two sets of models[3] to examine the effects of corruption on the level and growth of GDP pc. The first model uses the lagged dependent variable, CPI, and labour force pc as explanatory variables. In turn, the second model includes gross fixed capital formation pc in the list of explanatory variables.

After analysing the full sample, we divided the countries according to the government's spending share of GDP and investigated whether the size of government matters. Table 6 indicates that the participation of the government in the economy interferes in the result (statistically significant). Thus, small governments benefit relatively more from reducing corruption, while countries with larger governments have less benefit. These findings are statistically significant for the level of economic activity and for growth of GDP (Model 2), where the dummy variable for the smaller government size interacts positively with less corruption to foster economic growth.

It appears that the hypothesis that countries with large governments are excessively bureaucratic and inefficient can be accepted. In this sense, corruption would be an alternative for agents to overcome these obstacles and stimulate the economy. Nevertheless, this result could be premature, and three is therefore a need to evaluate this evidence carefully. Maybe the nature of the problem is not necessarily linked to the size of the government, but rather to the maturity or development of countries and institutions.

To further check if the size of the government matters, and to carry out more in-depth research, we asked whether, apart from the size of the government, the degree of development of the economies is a relevant factor. Accordingly we divided the sample into developed and developing economies, according to the World Economic Situation and Prospects (2012 and 2014).[4]

[3] In addition to GMM models with orthogonal forward deviations (FOD), we also analyse the models in terms of difference (DF). We found that the coefficient associated with the CPI followed the same pattern as in the GMM-FOD model. Considering the significance level of 5%, the estimated models did not indicate a second-order correlation problem (AR2), neither problems related with over-identifying restrictions (validity of the instruments).
[4] Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA).

Table 6: GMM – Small and Medium-Big Governments.

Dependent Variable	Model 1		Model 2	
	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)
GDP pc (-1)	0.823485***		0.854384***	
	(0.010887)		(0.010155)	
D(GDP pc (-1))		-0.129336***		-0.026176*
		(0.014194)		(0.014563)
CPI	79.79164***	93.03211***	77.09994***	44.83969
	(14.07795)	(31.41392)	(14.14976)	(28.70622)
CPI x Small	47.20417	61.91680	55.58736*	127.2374**
	(31.86827)	(54.27761)	(29.74361)	(56.30623)
GFC pc			0.082274***	-0.221328***
			(0.007799)	(0.008378)
L pc	371.7121***	79.77400**	289.7802***	162.8279***
	(24.31993)	(39.99011)	(20.87226)	(36.69898)
Prob J	0.092747	0.081525	0.185570	0.158060
Countries	48	48	48	48
Observations	288	240	284	236

Note: small government have a Government spending-to-GDP ratio below 30%.
*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

Table 7. GMM – Small Governments, Developed and Developing Economies

Dependent Variable	Model 1		Model 2	
	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)
GDP pc (-1)	0.802515***		0.885161***	
	(0.006547)		(0.010552)	
D(GDP pc (-1))		-0.253889***		-0.071499***
		(0.012325)		(0.011352)
CPI	85.51594***	82.78075	84.44161**	72.33343
	(20.89061)	(54.23812)	(34.38810)	(44.04185)
CPI x Developed	-10.90265	229.9350***	28.33988	435.8583***
	(37.74435)	(22.28859)	(42.01884)	(123.1881)
GFC pc			0.032525	-0.211399***
			(0.033570)	(0.005281)
L pc	447.7701***	-109.3286	257.1900***	-50.58596
	(34.24708)	(122.3147)	(53.13104)	(71.31235)
Prob J	0.591301	0.411155	0.497829	0.322632
Countries	16	16	16	16
Observations	96	80	95	79

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

From Table 7, from the sub-group of small governments it can be seen that the two sets of models used suggest again that the increase in corruption is harmful to the economic activity (level). In addition, the findings emphasise that in countries with small governments and developed economies, reducing corruption has an additional positive effect on economic growth. The models do not point to robust and definitive evidence with regards the effect of economic development on GDP pc (level).

Table 8 shows that for large governments, the control and reduction of corruption also fosters economic activity. However, we found no significant evidence that economic development interferes with the effect on per capita GDP.

Our results indicate that corruption is an adverse factor for economic activity, as well as for growth of GDP pc. In addition, we find that the size of government matters, especially for developing economies.

Table 8: GMM – Medium-Big Governments, Developed, and Developing Economies

Dependent Variable	Model 1		Model 2	
	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)
GDP pc (-1)	0.885445***		0.714039***	
	(0.017951)		(0.025853)	
D(GDP pc (-1))		0.475149***		0.483091***
		(0.050684)		(0.047082)
CPI	114.4798**	-42.15443	139.7204**	-18.83409
	(52.16143)	(45.94896)	(67.50973)	(47.61579)
CPI x Developed	-54.66990	42.30908	-87.72590	24.58331
	(53.14100)	(45.91683)	(65.44403)	(47.15755)
GFC pc			0.392423***	-0.222837***
			(0.038516)	(0.035004)
L pc	286.9910***	-28.74055	388.0342***	51.91548*
	(29.37415)	(22.30198)	(33.15543)	(28.09346)
Prob J	0.289537	0.215828	0.250312	0.298078
Countries	32	32	32	32
Observations	192	160	189	157

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

The question brings up the dilemma presented by Alesina and Angeletos (2005). For small governments can be less corrupt, which thus creates conditions for an increase of GDP, however, they do not always address the different demands of society, as they fail to adequately

correct market failures, inequalities, and social imbalances. On the other hand, large governments respond to agents' expectations, but they can incur more bureaucracy and corruption. The authors point out that many policymakers accept the cost of corruption – as it is often the only way to reduce inequalities and generate better conditions for an economically-vulnerable population.

Despite the findings, we found no clear evidence that larger governments benefit from corruption because they are less efficient and more bureaucratic. These results are in the same vein as some papers which suggest the possibility of increasing the size of the government and thus reduce corruption (Kotera et al. (2012); Billger and Goel, 2009). In this case, the direct association of government size => ineffective and bureaucratic public management => consequent increase in corruption would not be verified.

If the size of the government does not necessarily lead to the low effectiveness of public management, and therefore to corruption, then what is the correlation of the effectiveness in public management, perception of corruption (CPI), and government size (Gov. size)?

To answer this question, we used another governance indicator, the World Bank Government Effectiveness index (Kraay et al., 2010)[5].

Table 9: Correlation Matrix: Government size, Government Effectiveness (GEFF), and Corruption (CPI)

	Gov. Size	GEFF	CPI
Gov. Size	1.000000	0.340833	0.379332
GEFF	0.340833	1.000000	0.957955
CPI	0.379332	0.957955	1.000000

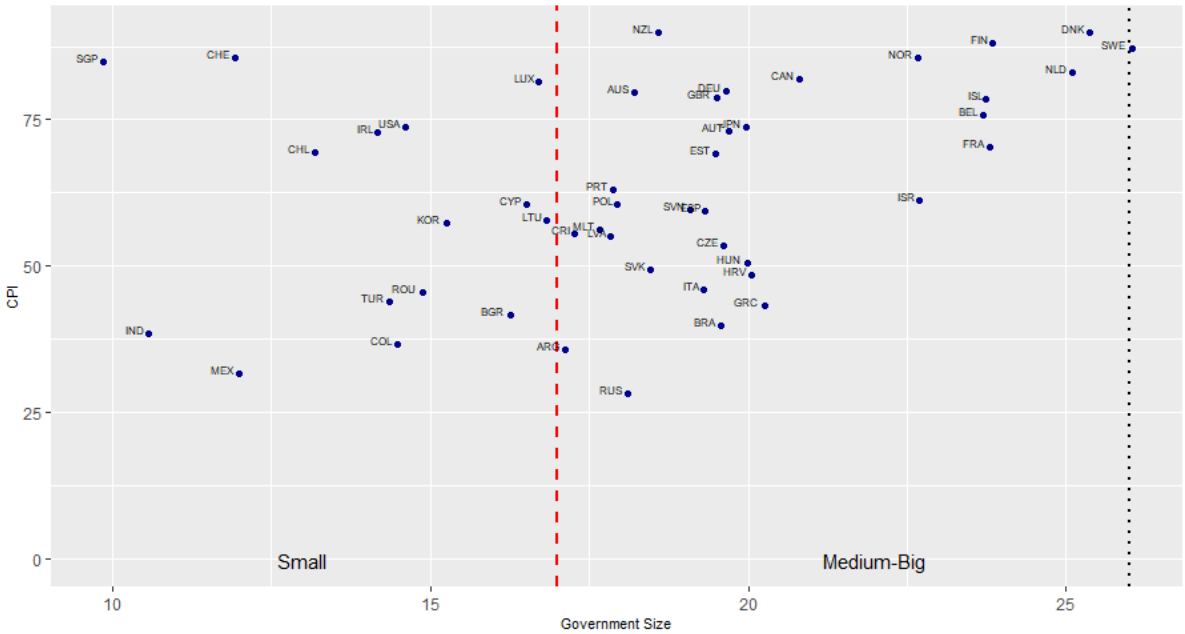
Source: Authors' calculations.

Table 9 shows that the correlation between Government Size, CPI, and GEFF is around 34% and 38%, respectively (an average of 48 countries between 2002 and 2018). The governance and CPI indexes have strong correlations, while government size does not have such a significant correlation.

[5] The index reflects the perceptions of the quality of public services, the quality of the civil service, and the degree of its independence from political pressures, as well as the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (World Bank).

To better understand how corruption relates to the size of the government and the level of effectiveness of public policies, we investigate whether any pattern exists which provides new evidence. Figures 4, 5, and 6 highlight how the effectiveness of public management is related to government size and the CPI, and they support the findings of econometric models. Small and large governments can score high or low for corruption, and thus the size of public administration does not seem to be a sufficient condition.

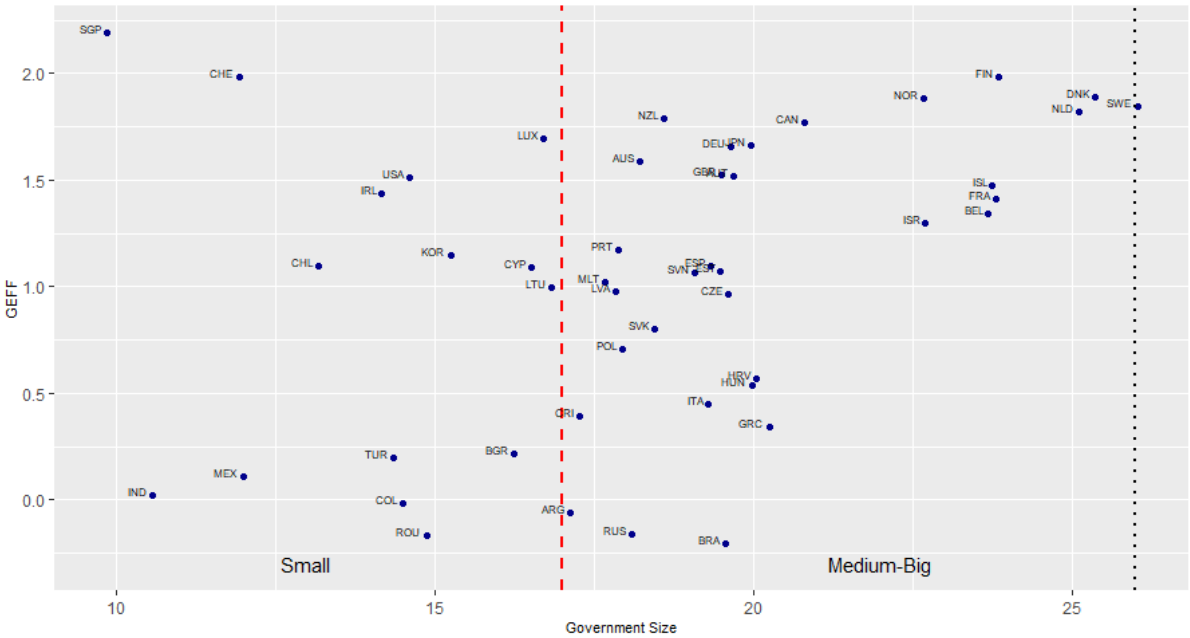
Figure 4: Corruption Perception Index and Government Size (%GDP):
Small and Medium-Big Governments



Source: Authors' calculations.

A similar pattern can be seen when examining the public management effectiveness index (GEFF). In addition to not finding clear evidence that smaller governments are more effective, we note that developing countries perform worse for the CPI, which suggests that the level of economic development could be a determining factor.

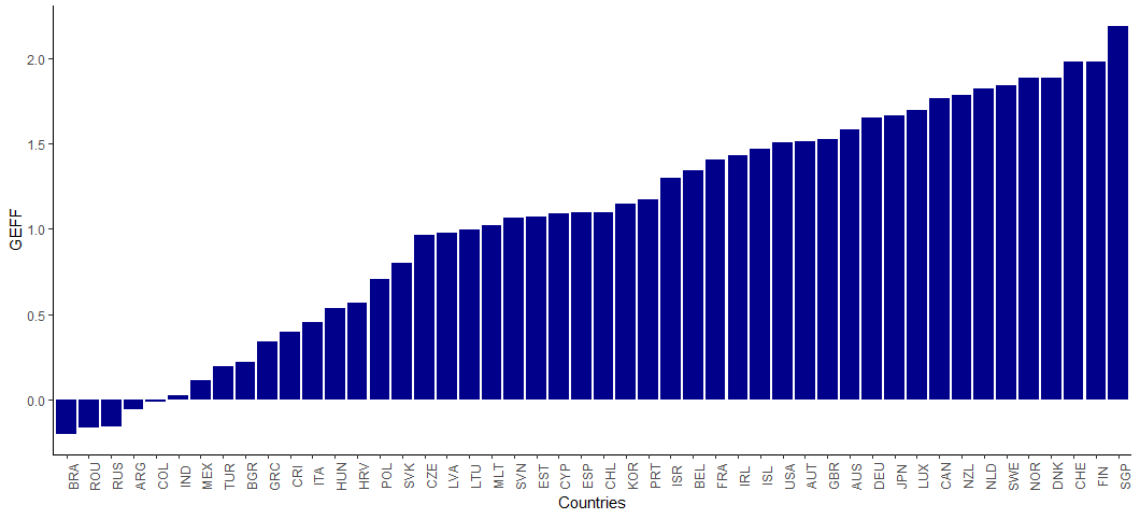
Figure 5: Government Effectiveness and Government Size (%GDP): Small and Medium-Big Governments



Source: Authors' calculations.

In addition, for the 48 countries, out of the 10 lowest scores for effectiveness in public management (2002-2018), 8 of these are developing countries. On the other hand, out of the top 10, a total of 9 are developed economies.

Figure 6: Government Effectiveness



Source: Authors' calculations.

Lastly, to assess whether those countries with higher government effectiveness also benefit more from a decrease in corruption, we classify the models at two levels: low and

medium-high. Therefore, scores below 33% of the lowest results of the sample mean (2012-2019) were classified as low GEFF, with the rest being medium-high GEFF.

Confirming the indications presented, the results suggest that countries with low levels of governance (low GEFF) do not achieve the same benefit in terms of economic growth, when compared to those that stand out in terms of the quality and effectiveness of public services.

One hypothesis that can be considered is that corruption gains ground in countries that are less effective in public management, although not necessarily in those which have high expenditures in relation to GDP. Another hypothesis is that high-income countries benefit from more instruments to increase efficiency and control corruption.

GEFF captures the quality of public services and policy implementation, based on perception or subjective measures which are taken from surveys of firms, households, and specialised analyses produced by different organisations (Kraay et al., 2010). Table 10 highlights the effects of corruption for two groups of countries: low GEFF and medium-high GEFF. CPI captures the impact of corruption in countries with a high perception of the effectiveness of the public sector (base group), while the dummy variable computed by CPI x Low GEFF indicates the differential effect of corruption in countries with low GEFF scores.

Table 10: GMM - Government Effectiveness: Low and Medium-High GEFF.

Dependent Variable	Model 1		Model 2	
	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)
GDP pc (-1)	0.815679***		0.852441***	
	(0.010551)		(0.009318)	
D(GDP pc (-1))		-0.108316***		-0.008391
		(0.011266)		(0.020473)
CPI	70.37886***	205.5502***	74.33032***	164.3753***
	(15.91561)	(35.83368)	(21.80456)	(52.81805)
CPI x Low GEFF	42.22883*	-145.1455***	31.93429	-98.17641*
	(23.93689)	(43.51133)	(29.57922)	(56.37677)
GFC pc			0.091148***	-0.206552***
			(0.009361)	(0.009156)
L pc	391.4275***	82.71454**	301.8153***	136.1212***
	(24.14136)	(42.08495)	(22.10849)	(42.78571)
Prob J	0.068933	0.065447	0.200708	0.122236
Countries	48	48	48	48
Observations	288	240	284	236

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

We observe that the control and reduction of corruption increases per capita income (level and growth) in countries with a high GEFF score. On the other hand, countries with low

performance in public management do not achieve the same effect in terms of economic growth. These findings are in line with the hypothesis that consumers and firms base their decisions on the perception of government performance (Kraay et al., 2010), and accordingly agents that believe that the system is inefficient and corrupt can postpone or interrupt new investments, which consequently hinders economic growth.

In addition, as suggested by Afonso et al. (2020), we further investigated government spending efficiency with two other objective metrics: total Public Sector Performance (PSP) and Public Sector Performance Opportunity (PSP-OP).

First, we use the Public Sector Performance Opportunity (PSP-OP) indicator, which is derived from performance in areas such as education, administrative, health, and public infrastructure (PISA scores, life expectancy, and cardiovascular diseases are representative of the indicators used). Second, we evaluate the PSP indicator, which is computed as the average between PSP-OP and an indicator that evaluates three government functions (Musgravian), namely: allocation, distribution, and stabilisation (Afonso et al., 2005).

For this purpose, we created a cross-country panel dataset, covering a sample of 36 countries[6] for the period between 2012 and 2017. Tables A2 and A3 (in the Appendix) present the results for PSP and PSP-OP, respectively. The results suggest that higher public sector performance has a positive effect on GDP pc (level and growth) for both models.

Looking at country groups, those countries with high performance in public management (above the sample average) tend to perform better in terms of economic development (GDP pc) after they reduce corruption (see Tables A4 and A5 in the Appendix). By contrast, countries with low performance in the public sector have worse economic results, or do not benefit from the decrease in corruption.

4.3. Private Investment and Corruption: The Transmission Channel

We analysed the effects of corruption in the previous section, whilst controlling for different variables, without examining how the effect is transmitted to economic activity. One of the channels presented in the empirical studies is the negative impact on private investment.

Despite the relevance of the topic, the literature does not provide sufficient evidence regarding those channels or instruments that definitively reveal the relation between corruption

[6] Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

and investment. This negative association has been the subject of debates and studies over the years (Mauro, 1995), however, despite being an intuitive topic, the results to date are inconclusive, with some authors indicating that the effect of corruption on investment is not statistically significant (Shaw et al., 2011).

In order to contribute to the empirical literature, we investigated the relation between corruption and private investments, by comparing different types of econometric models, namely: static (OLS and Fixed Effects) and dynamic (OLS, Fixed Effects and GMM) models. As we highlighted in the previous sections, the main focus in the literature is on the GMM model, however the other models confirm and provide new information for our analysis.

As in the previous models, we analysed 48 countries and used the CPI as a proxy for corruption. However, due to the unavailability of more recent data for private investment, our sample only covers the period from 2012 to 2015.

Table 11 highlights the results of the static models (OLS and fixed effects) and indicates problems of serial correlation and the insignificant effect of corruption on private investment (OLS). On the other hand, the Fixed Effects model is more promising, in that it suggests an adverse influence of corruption on investment[7].

Table 11: OLS, Fixed Effects, and GMM. Corruption and Private Investment.

Dependent Variable	OLS Static	OLS Dynamic	FE Static	FE Dynamic	GMM
	Private Investment				
Priv. Invest (-1)		0.980407***		0.216346**	0.108511
		(0.022838)		(0.095613)	(0.305952)
CPI	0.308559	0.105062	1.081378*	1.313212**	1.658952
	(0.227821)	(0.068092)	(0.572763)	(0.622329)	(1.023468)
GDP	0.163767***	0.010032***	0.219284***	0.178306***	0.175076***
	(0.001569)	(0.003649)	(0.009618)	(0.023122)	(0.048505)
c	-10.13295	-10.43711**	-131.7519***	-140.6551***	
	(15.18233)	(4.528347)	(36.77559)	(40.32669)	
Adj R sq	0.982788	0.998912	0.999042	0.999463	
DW	0.063917	1.67741	1.377608	2.446389	
Prob F	0	0	0	0	
Prob J					0.355346
Countries	48	48	48	48	48
Observations	192	144	192	144	96

*** - significant at 1%; ** - significant at 5%: * - significant at 10%.
Standard deviations in brackets.

[7] After the comparative test, the Fixed Effects model proved to be more appropriate than the OLS model.

Despite providing information and confirming some patterns of behaviour, the OLS and Fixed Effects (static) models suffers from some issues regarding the quality of the estimators. On the other hand, the Fixed Effect and GMM[8] models present interesting results, which indicates the existence of a potential transmission channel.

5. Concluding Remarks

The phenomenon of corruption is long-lived and is present in different areas of scientific knowledge, being linked to the philosophical perspective and moral and political degeneration, as well as the effects on the economy and welfare. This study contributes to this debate by investigating the effects of corruption on the economy, as well its role as a potential transmission channel.

The findings of our study indicate that corruption has a negative effect on the economy – specifically on the level and growth of GDP pc. Our results regarding the impacts of corruption are broadly consistent with the "sanding the wheels" hypothesis.

We also find that the size of the government matters. Large governments register less benefit from reducing corruption than small governments. This isolated finding would support the hypothesis that large governments are bureaucratic and inefficient, and that therefore corruption is an option to circumvent such obstacles.

However, this result can obscure the real reason for the effects of corruption and further research indicates that the level of economic development associated with the size of the government can provide another conclusion.

The findings of our research highlight that small governments in developed economies benefit relatively more from reducing corruption than in the case of developing economies. Maybe this result stems from the degree of maturity of institutions in developed countries and/or the fact that they generally have in place more resources to inhibit and control corruption. In addition, large governments can have positive effects after reducing corruption. These results are in agreement with some studies, such as that of Kotera et al. (2012).

Accordingly, the large governments => high bureaucracy => high inefficiency chain of events and the consequent breeding ground for corruption is not confirmed. The models indicate that countries with low quality of public services have low responses to growth of GDP, after reducing corruption and that low efficiency in public management can be the main factor which

[8] The CPI coefficient has a p-value equal to 0.108.

is responsible for generating conditions for corruption in order to circumvent barriers and that this corruption consequently stimulates economic activity.

Finally, we find that private investment is negatively affected by an increase in corruption. This is an important finding, which confirms the understanding that corruption slows down innovations and distorts the economic system, and consequently that it is detrimental to economic performance. This result points to a potential transmission channel which negatively affects growth of GDP.

Our study contributes to the growing corpus of research which shows that corruption has a complex character and that it needs to be analysed in the light of not only the size of government, but also of the level of economic development and the effectiveness of public policies. In addition, based on dynamic models (GMM - panel data), our study fills a gap in the literature by examining the effects of the CPI on the level and growth of GDP per capita, using different control variables.

Despite its varied contributions, our study has some limitations. An important finding suggests that developing economies benefit from or are not affected by increased corruption. Regardless of the debate on the moral issue, this result needs to be treated with extreme caution, bearing in mind that this paper and many others only partially examine the problem when it comes to only investigating economic growth and that other important factors were not analysed, such as human development, income inequality, and poverty. In this sense, whilst accepting that nowadays a certain level of corruption can lead to a perpetual vicious cycle of inefficiencies and corruption (Alesina and Angeletos, 2005) which could even have a positive effect on economic growth, it must be stressed that corruption can bring a high cost to society in the future.

In this sense, future research should consider alternative methods to measure economic performance, in addition to investigating other indexes which are capable of classifying government size, such as, for instance, the number of public servants per capita. With regards the transmission channel of corruption, it would be interesting to use a larger sample and to disaggregate private investment in different sectors. Finally, another suggestion is to analyse the effects of corruption based on the PVAR approach (Bação et al., 2019), which could contribute substantially to understanding the implications of corruption on economic variables.

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Appendix

Table A1: Data Sources

Data Source	Code	Original Series
International Monetary Fund	GDP_rppp	Gross domestic product, in billions of constant 2011 international dollars.
International Monetary Fund	ipriv_rppp	Private investment (gross fixed capital formation), in billions of constant 2011 international dollars
Transparency International		Corruption Perception Index (estimate)
World Bank	NY.GDP.PCAP.PP.KD	GDP per capita, PPP (constant 2017 international $)
World Bank	NE.CON.GOVT.ZS	General government final consumption expenditure (% of GDP)
World Bank	GE.EST	Government Effectiveness (estimate)
World Bank	NE.GDI.TOTL.KD	Gross capital formation (constant 2010 US$)
World Bank	SL.TLF.ACTI.ZS	Labour force participation rate, total (% of total population ages 15-64) (modelled ILO estimate)
World Bank		Government Effectiveness (estimate)
World Bank	SP.POP.TOTL	Population, total
Afonso, A., Jalles, J., and Venâncio, A. (2020)	PSP; PSO-OP	Public Sector Efficiency composite indicators

Table A2: GMM - Government Effectiveness (PSP)

Dependent Variable	Model 1		Model 2	
	(1)	(2)	(3)	(4)
	GDP pc	D(GDP pc)	GDP pc	D(GDP pc)
GDP pc (-1)	0.609698***		0.563731***	
	(0.020543)		(0.017438)	
D(GDP pc (-1))		-0.233262*		-0.056687
		(0.121411)		(0.070489)
CPI	73.76631**	99.53692	93.17288***	97.07783
	(34.74565)	(108.9810)	(25.07952)	(122.4467)
PSP	1352.019**	17006.00***	1349.588*	18470.64***
	(594.7259)	(5734.751)	(824.7539)	(5489.416)
GFC pc			0.492197***	-0.204874***
			(0.024007)	(0.044200)
L pc	712.3517***	-135.5011	496.4722***	-164.8489
	(86.80968)	(264.1804)	(49.85817)	(249.2911)
Prob J	0.118530	0.339620	0.175395	0.312623
Countries	36	36	36	36
Observations	144	108	144	108

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

Table A3: GMM - Government Effectiveness (PSP-OP)

Dependent Variable	Model 1		Model 2	
	(1)	(2)	(3)	(4)
	GDP pc	D(GDP pc)	GDP pc	D(GDP pc)
GDP pc (-1)	0.618567***		0.564198***	
	(0.025261)		(0.037929)	
D(GDP pc (-1))		-0.384437***		-0.160097***
		(0.020542)		(0.029869)
CPI	97.04332***	107.2535***	95.93748***	51.44965
	(33.25991)	(34.04866)	(22.58003)	(42.13562)
PSP OP	16747.07**	-1582.487	13636.68**	629.7857
	(6732.666)	(9185.841)	(6589.890)	(9301.633)
GFC pc			0.484079***	-0.207249***
			(0.064310)	(0.059221)
L pc	665.5255***	259.0339***	497.2616***	315.5274***
	(58.57603)	(68.08836)	(37.14735)	(76.09392)
Prob J	0.175864	0.307278	0.325130	0.365831
Countries	36	36	36	36
Observations	144	108	144	108

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

Table A4: Government Effectiveness: Low and High PSP

Dependent Variable	Model 1		Model 2	
	(1)	(2)	(3)	(4)
	GDP pc	D(GDP pc)	GDP pc	D(GDP pc)
GDP pc (-1)	0.549151***		0.507074***	
	(0.037610)		(0.020289)	
D(GDP pc (-1))		-0.395747***		-0.175278***
		(0.013671)		(0.014651)
CPI	149.0849**	274.6944**	180.7499***	204.7839
	(71.61359)	(122.4291)	(53.24741)	(138.0839)
CPI x Low PSP	-276.3176*	-209.8556	-213.3145**	-136.1927
	(143.6424)	(146.7715)	(96.38146)	(144.0551)
GFC pc			0.538335***	-0.199213*
			(0.043309)	(0.102709)
L pc	935.4435***	409.2960***	658.4549***	384.2116***
	(169.6991)	(111.8371)	(119.5852)	(103.9162)
Prob J	0.494430	0.357532	0.479404	0.414803
Countries	36	36	36	36
Observations	144	108	144	108

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

Table A5: Government Effectiveness: Low and High PSP-OP

Dependent Variable	Model 1		Model 2	
	(1) GDP pc	(2) D(GDP pc)	(3) GDP pc	(4) D(GDP pc)
GDP pc (-1)	0.599243***		0.510982***	
	(0.025469)		(0.023789)	
D(GDP pc (-1))		-0.399012***		-0.177368***
		(0.018282)		(0.033183)
CPI	134.7779	37.28887	175.2229***	-6.980561
	(90.26518)	(290.1430)	(54.09895)	(273.3168)
CPI x Low PSP OP	-104.9891	77.15909	-119.6019*	100.9540
	(102.3430)	(291.2697)	(61.89311)	(268.0504)
GFC pc			0.570804***	-0.199596**
			(0.033958)	(0.081597)
L pc	721.8096***	302.1416***	531.1894***	309.5089***
	(82.98733)	(86.85223)	(57.92936)	(91.99260)
Prob J	0.320220	0.560995	0.299179	0.545469
Countries	36	36	36	36
Observations	144	108	144	108

*** - significant at 1%; ** - significant at 5%; * - significant at 10%.
Standard deviations in brackets.

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EconPol Europe - The European Network for Economic and Fiscal Policy Research is a unique collaboration of policy-oriented university and non-university research institutes that will contribute their scientific expertise to the discussion of the future design of the European Union. In spring 2017, the network was founded by the ifo Institute together with eight other renowned European research institutes as a new voice for research in Europe. A further five associate partners were added to the network in January 2019.

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1) sustainable growth and ‘best practice’,

2) reform of EU policies and the EU budget,

3) capital markets and the regulation of the financial sector and

4) governance and macroeconomic policy in the European Monetary Union.

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