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Determinants of corruption: can we put all countries in the same basket?

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Abstract

This paper aims to study the determinants of corruption by examining specificities relating to the region and the level of economic development. Starting from a cross-sectional study on 130 countries, we rely on the Bayesian Model Averaging (BMA) approach to address the issue of model uncertainty and identify the key determinants of corruption according to the level of development and the region. Our results highlight the need for specific remedies in the fight against corruption given the regional, sociocultural, economic and institutional specificities. Indeed, the key determinants of corruption in sub-Saharan Africa are not the most relevant in the East Asia and Pacific region. Similarly, the most important determinants in developed countries are not the most worrying in developing countries.

JEL classification: D73, P16, P35, C11, C31

Keywords: Corruption, Political economy, Public economics, Bayesian model averaging, Cross-sectional models

1. Introduction

The literature abounds with arguments and empirical evidence on the negative effects of corruption.[1] Corruption is considered among others as a factor inhibiting domestic and foreign investment (Wei, 2000; Habib and Zurawicki, 2002; Méon and Sekkat, 2005; Beekman et al., 2014, Gillanders, 2014), restricting economic growth (Mauro, 1995; Tanzi and Davoodi, 1998; Mo, 2001; Gyimah-Brempong, 2002; Aidt et al., 2008; Lisciandra and Millemaci, 2017; Cieślik and Goczek, 2018) and worsening fiscal deficits, inequality and poverty (Gyimah-Brempong, 2002; Jong-Sung and Khagram, 2005; Alesina and Angeletos, 2005; Glaeser and Saks, 2006; Apergis et al., 2010; Oto-Peralías et al., 2013). All governments, whether of developed or developing countries, hold up the fight against corruption as a priority objective of their economic policy. For developing countries, this commitment is sometimes a condition for receiving financial support from development partners. Despite these pledges, the level of corruption remains high and heterogeneous between countries.

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[1] We adopt the definition by Transparency International whereby corruption reflects the perception of the extent to which public power is used for personal gain.

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As treatment and healing are dependent on the diagnosis, several studies have striven to study the determinants of corruption by focusing on the historical, socio-cultural, institutional and economic factors that could explain it (see among others Treisman, 2000; Van Rijckeghem and Weder, 2001; Persson et al., 2003; Acemoglu and Verdier, 2000; Fisman and Gatti, 2002; Adsera et al. 2003; Serra, 2006; Pellegrini and Gerlagh, 2008; Fan et al. 2009; Henderson and Kuncoro, 2011; Ryvkin et al., 2017). [2] These studies often focus on certain determinants of corruption – e.g. historical determinants – and disregard other factors – e.g. economic determinants – and vice versa. In so doing, they do not address the issue as a whole and some key determinants are ignored. Some authors such as Treisman (2000) and Serra (2006) have understood this and propose a broader set of determinants of corruption with the intention of subsequently identifying the most significant determinants. The problem with these studies is that the determinants are treated indiscriminately. They do not distinguish between developed and developing countries and capture the specificities of countries simply through regional dummy variables. However, there is no reason to believe that the determinants of corruption in Africa are the same as those in Europe.[3] It is therefore important to investigate this possible heterogeneity in the determinants of corruption. To our knowledge, such an analysis has not been conducted on the determinants of corruption.

This paper thus fills this gap with the particularity of making a specific diagnosis on the determinants of corruption according to the level of development and the region.[4] Several theoretical and empirical reasons underlie this investigation. First, regional specificities in terms of natural resource endowments and socio-cultural and historical conditions add special features to the determinants of corruption. Moreover, regional proximities can create the "phenomena of contagion"; which could explain why countries have similar characteristics. The disagreements among authors support this point of view on regional heterogeneities. For example, while some studies show that a

[2] The factors discussed in the literature are developed in more detail in Section 2.

[3] Masanjala and Papageorgiou (2008) also highlight this problem regarding the determinants of economic growth and show that Africa, for example, has growth factors that are different from those of the rest of the world.

[4] The idea here is to distinguish between countries according to their income level following the World Bank classification.

socialist legal origin is associated with greater corruption and that an Anglo-Saxon legal origin would favor lower corruption (La Porta et al., 1999; Glaeser and Shleifer, 2002; Gerring and Thacker, 2005; Serra, 2006), other economists have their reservations or disagree with the results (Adsera et al., 2000; Brunetti and Weder, 2003; Pellegrini and Gerlagh, 2008). Second, all cross-country analyses on the determinants of corruption show that corruption decreases with the level of economic development. This result, which is the only point of consensus among the authors (see Serra, 2006), may mean that studies on the determinants of corruption should take into account the level of economic development that is not homogeneous across countries. For example, the administrative barriers or lack of computerization of administrations that can be important sources of corruption in developing countries may not be very relevant in developed countries to explain corruption. In these circumstances, can we really consider the same causes of corruption across all countries as is generally presented in cross-country empirical works? If not, what are the particularities or the most relevant determinants depending on economic development and region? The answers to these questions have important implications for targeted anti-corruption policy.

This paper provides answers to these questions starting out from the broad literature on the potential determinants of corruption. To this end, it relies on variable selection techniques to address the issue of uncertainty regarding the model specification. These techniques are much better known in economics for addressing the issue of uncertainty in cross-country determinants of economic growth (Levine and Renelt, 1992; Sala-I-Martin, 1997; Fernandez et al., 2001; Masanjala and Papageorgiou, 2008). Specifically, we use the Bayesian Model Averaging approach (BMA), which, based on the observed data, identifies the most relevant determinants of corruption, without *a priori* concerning the corruption model specification.

Our paper contributes to the literature in several ways. Firstly, as data have become more available and accurate, particularly for developing countries, studies on the determinants of corruption are more likely to be more accurate and informative. However, as it is impossible to take into account all the potential determinants of corruption through a single theoretical model, an empirical approach starting with the set of determinants and then identifying the most relevant of them seems to be the most optimal solution. Next, going further than previous papers on the determinants of

corruption, we identify the determinants of corruption specific to the level of economic development and to the region. Finally, by providing a specific analysis framework to better understand the determinants of corruption according to economic development level and geographical location, this article allows governments as well as international organizations to better target the root causes of corruption in order to fight effectively against this scourge.

Based on a set of 130 developed and developing countries, our results show that while some determinants of corruption are common to all countries, others are specific to the level of economic development and to the region. Indeed, for developed countries, corruption is mainly determined by the "willingness to delegate authority", while for developing countries in general, factors such as the quality of education and GDP per capita determine corruption.[5] Focusing on the specificity of sub-Saharan Africa, our results show that freedom of the press, the burden of regulation, linguistic fragmentation, political system, religion and political stability are the determinants of corruption peculiar to this region. In the region of East Asia and the Pacific, corruption is mainly explained by legal origin, religion, political stability and education. In Europe and Central Asia, we find as determinants of corruption freedom of information, the burden of government regulations, legal origin, religion, political stability and education. Regarding Latin America and the Caribbean, freedom of information and education were identified as determinants of corruption. Finally, in the Middle East and North Africa region, determinants of corruption are the political regime, political stability and education.

The rest of the article is organized as follows: Section 2 discusses the potential determinants of corruption. Section 3 presents the empirical approach. Section 4 is devoted to the presentation of results and comments. Section 5 provides a robustness analysis of the results. Finally, Section 6 concludes the paper.

[5] This term refers to the extent to which senior managers (public and private) delegate decision-making to their subordinates. It could thus be approximated by decentralization of decision-making.

2. Potential determinants of corruption

The determinants of corruption have been extensively addressed in the literature since the early 1990s. These determinants can be broadly grouped into three main blocks: historical and cultural factors, economic factors and institutional factors. [6]

2.1. Historical and sociocultural factors

In this block of factors, we can group the legal system and the colonial origin, religious culture, ethno-linguistic fragmentation and education.

The legal system. This is generally regarded as one of the leading determinants of corruption. Indeed, the cost of corruption in terms of probability of arrest, exposure and punishment depends on the efficiency of the legal system. Several authors highlight the fact that the common law system that characterizes Britain and its former colonies is more dissuasive than the civil law system which is present in continental Europe and its former colonies (La Porta et al. 1999; Treisman, 2000; Glaeser and Shleifer, 2002; Serra, 2006). For the proponents of this theory based on the historical roots of corruption, the former British colonies have a better code of public service because of the influence of the British bureaucracy. In this system, the functioning of the bureaucracy is focused on the procedural aspects of the law, which improves the ability of subordinates and judges to challenge the hierarchies in order to enforce the law, thereby reducing corruption (Treisman, 2000). However, the theory of the effectiveness of the British legal system is contested by several authors, such as Adsera et al. (2000), Brunetti and Weder (2003), Pellegrini and Gerlagh (2008). Moreover, like Treisman (2000), Serra (2006) shows that the colonial heritage of a country is an important determinant in explaining contemporary corruption. But colonial heritage is strongly linked with legal origin.

Religious culture. Since the work of Weber (1958) and Putnam (1993) on the importance of culture in the quality of institutions, studies have shown that religious culture may explain a significant share of corruption (Shleifer and Vishny, 1993; La Porta et al., 1999). The explanation is that religious traditions to some extent determine the relationships of individuals with social hierarchy, with the State and the family. For some authors, hierarchical religions such as Catholicism, Islam and Eastern Orthodoxy

[6] Refer also to Lambsdorff (2006) for more detailed explanations on the causes of corruption.

would be less stringent vis-à-vis the hierarchy. Similarly, the familialist traditions of some religions promote nepotism. From this point of view, Protestantism is perceived as more egalitarian and individualistic and less tolerant of abuses by public authorities. Thus, countries with a high proportion of Protestant worshipers would have a lower level of corruption (La Porta et al., 1999; Treisman, 2000; Serra, 2006; Pellegrini and Gerlagh, 2008). However, like Adsera et al., (2000), Melgar et al. (2010) find no influence of religious affiliation on corruption.

Ethnic and linguistic fragmentation. In a pioneering study, Mauro (1995) shows that countries with a strong ethno-linguistic fragmentation tend to be more corrupt. Similarly, some authors find the same effect with regard to ethnic fragmentation. In countries with high ethnic fragmentation, government officials are more likely to favor members of their ethnic group (Shleifer and Vishny, 1993; Pellegrini and Gerlagh, 2008). This effect is however not confirmed in Brunetti and Weder (2003).

Education. The shaping of the behavior of individuals, civic learning and the exemplary are favored by the school. Thus the quality and level of education are determining factors in the fight against corruption. Melgar et al. (2010) found that people who have completed at least secondary education are more likely to perceive the level of corruption than people with a primary education level. Similarly, Van Rijckeghem and Weder (2001) believe that good citizenship at school contributes to the reduction of corruption.

2.2. Economic factors

Among the economic factors whose influences on corruption are discussed in the literature, the level of development, government wage, natural resource rents and economic openness can all be put forward.

Economic development. This is the variable among the determinants of corruption on which there is a consensus in the literature. Corruption tends to be reduced with economic development (Paldam, 2002; Serra, 2006; Pellegrini and Gerlagh, 2008; Goel and Nelson 2010; Melgar et al., 2010). For example, Paldam (2002) shows that the level of corruption decreases when the country moves from being a poor country to a rich country. Similarly, according Melgar et al. (2010), the level of corruption tends to be reduced with the country's economic performance. For Treisman (2000) there is a causal

relationship between the improvement in income level and the decline in corruption, from the level of economic development to corruption. In this contribution on the causes of corruption, Trieisman raised the question of regional specificity, which he analyzes through dummy variables for each region. According to his results, Africa, Eastern Europe, Asia, Latin America and the Middle East are perceived as more corrupt than Western Europe and North America. He also shows that Latin America and Asia are perceived as significantly more corrupt than the average of all other continents. More interestingly, he found that even after controlling for economic development, Latin America and Eastern Europe are significantly more corrupt than Western Europe and North America. These interesting results raise the question of the determinants of corruption according to the level of economic development and the region.

Government wage. The influence of wage on corruption has been theorized by Becker (1968). Van Rijckeghem and Weder (2001) show that the low level of salaries of civil servants in developing countries would be a serious explanation for their very high level of corruption, insofar as in the public service, it attracts dishonest officials who seek to compensate for foregone wages by corruption. Higher wages involve higher costs when a position in the public service is lost due to corruption. A cost-benefit analysis suggests that higher wages provide an incentive to refrain from corruption (Becker, 1968). However, the wage effect can be ambiguous because politicians and the most corrupt parliamentarians can award themselves the largest remuneration (La Porta et al., 1999; Treisman, 2000).

Natural resource rents. According to the "rent seeking" theory, rent seeking explains a large part of corruption. When a State is highly centralized and public officials may have additional resources, the level of corruption is high (Rose-Ackerman, 1999). Similarly, when rents are high in a country because of its abundance of natural resources, the level of corruption is high (La Porta et al., 1999; Leite and Weidmann, 1999; Ades and Di Tella, 1999; Acemoglu and Verdier 2000).

Trade openness. Several studies empirically support the thesis that government corruption is lower in countries where the intensity of international trade is stronger (Ades and Di Tella, 1997, 1999, Leite and Weidmann, 1999; Graeff and Mehlkop, 2003, Charron, 2009). However, the literature is very ambiguous on this issue. Azfar and Knack (2003) show that the empirical link between corruption and trade intensity is the

result of selection bias. This relationship is weakened or disappears when the data used on corruption are more recent and cover a large sample of countries (Knack and Azfar, 2003; Graeff and Mehlkop, 2003). Treisman (2000) and Brunetti and Weder (2003) do not find any positive effect of trade intensity on corruption.

2.3. Institutional factors

In this group of determinants of corruption, we distinguish the factors related to political institutions, and those related to economic institutions.

Political institutions. In the literature, the most cited political variables are democracy, political stability, political regime, proportion of women in parliament and freedom of the press. For some authors, greater democracy promotes the reduction of corruption (Shleifer and Vishny, 1993 La Porta et al., 1999; Paldan 2000, Rock, 2009). For others, it is the duration of the democratic regime resulting in political stability that reduces corruption (Serra, 2006; Pellegrini and Gerlagh, 2008; Montinola and Jackman, 2002). So if democracy reduces corruption, political instability favors corruption (Melgar et al., 2010). Concerning the functioning of political systems, Rose-Ackerman and Kunicova (2001) indicate that a competitive electoral process helps reduce corruption. Persson et al. (2003) argue along similar lines and indicate that political competition within the government may lead to a decrease in corruption. According to Gerring and Thacker (2004), parliamentary political systems and unitary States (as opposed to the federal State) lead to a lower level of corruption. These results are also present in Treisman (2000), who shows that there is a negative correlation between corruption and federalism in a State. Concerning gender, some authors believe that a higher proportion of women in senior positions in the administration and parliament would help reduce corruption (Swamy et al., 2001; Dollar et al., 2001). As regards the influence of information on corruption, Adsera et al. (2000) see in newspaper circulation a major determinant of the fight against corruption. Indeed, when citizens are sufficiently informed and the media are free from all political powers, freedom of information contributes to the fight against corruption (Brunetti and Weder, 2003; Charron, 2009; Vadlamannati and Cooray, 2016).

Economic institutions. In this category we include the decentralization of decision-making and the influence of the State, generally captured through government

regulation. The structure of government in terms of degree of decentralization plays an important role in reducing corruption (Brunetti and Weder, 2003; Graeff and Mehlkop, 2003; Rose-Ackerman, 1999). When public officials have more, and more highly concentrated power, the level of corruption tends to increase (Leite and Weidmann, 1999). Like Shleifer and Vishny (1993), Fishman and Gatti (2002) show that corruption decreases as the level of decentralization increases. Arikan (2004) addresses this issue from a tax perspective and shows that fiscal decentralization leads to a lower level of corruption. Regarding government regulation, several authors point to the fact that an increase in the burden of government regulation causes more temptation for bribes, exacerbating corruption. Indeed, in order to limit costs associated with the proliferation of administrative procedures (e.g. custom procedures, number of procedures to start a business), the agents involved (companies in general) tend to bribe the officials in charge of the proper execution these procedures.

3. Empirical strategy

While the previous section outlines the potential determinants of corruption, this section is first and foremost intended to address the issue of uncertainty in the most relevant determinants. Second, it presents the data considered in this study.

3.1. Bayesian model averaging (BMA) methodology

No theoretical model is capable of taking into account all the determinants of corruption highlighted in the previous section. The empirical approaches are often criticized for their *a priori* choice of some determinants at the risk of missing the most relevant determinants. To shed light on the key determinants of corruption while considering the uncertainty associated with model specification given the relatively large number of potential determinants, we rely on the BMA method.[7] The interesting aspect of this approach is that it addresses two major issues that typically arise in empirical studies with a relatively large number of explanatory variables and limited data and for which classical regression models do not provide an effective response, namely: (i) which variables should be included in the model and (ii) their respective importance.

[7] This technique is briefly presented in this paper. For more technical details, we refer the reader to some key references, such as Hoeting et al. (1997, 1999), Fernandez et al. (2001) and Gnimassoun (2015).

The intuition behind the BMA method is simple. In the absence of a theoretical model of reference, this empirical approach considers that each potential determinant of corruption has a certain importance in setting up a model of corruption. But since the determinants of corruption that emerge from theoretical and empirical studies are numerous, it is not relevant to construct an empirical model that includes all of them. Otherwise, the risk of misleading econometric conclusions is significant because of the limited number of degrees of freedom involved in a large number of explanatory variables. With the BMA approach, the logic is to gather the broadest set of potential determinants of corruption and to perform all possible linear regressions from their combinations. At the end of these estimates (which may be millions), each potential determinant obtains an a posteriori probability that summarizes its importance to explain corruption in all the regressions in which it is involved. For example, if an explanatory variable appears in 200 regressions in which its coefficient has always been significantly different from zero, it will have a posteriori probability of 100%. When the posterior probability of a potential determinant is 50%, this means that its coefficient was significantly different from zero in 50% of regressions involving it. Similarly, if the PIP of an explanatory variable is 0, this means that it was not significant in any of the regressions in which it was considered. We apply this technique to several subsamples of countries given their level of economic development and their region in order to identify the key determinants that are specific to them.

More formally, consider the following cross-country empirical corruption model:

$$\mathbf{y} = \boldsymbol{\alpha_\gamma} + \boldsymbol{X_\gamma \beta_\gamma} + \boldsymbol{\epsilon}\ , \boldsymbol{\epsilon} \sim \boldsymbol{N(0, \sigma^2 I)} \quad (1)$$

where y is the level of corruption, X is the matrix of potential explanatory variables, α_γ is the constant, β_γ denotes the coefficients, ϵ is the error term and γ is an index for a specific model.

BMA addresses the problem of uncertainty in relation to model specification by estimating models for all possible combinations of $\{X\}$ and constructing a weighted average. Assuming that X contains K potential explanatory variables, this means estimating 2^K variable combinations and thus 2^K models, each with a certain probability of being the "true" model. Technically, this can be cumbersome to estimate when K is

large but BMA allows this through Monte Carlo Markov Chain (MCMC) simulations.[8] If θ is the quantity of interest, such as coefficients β, the associated posterior distribution given data D is:

$$\boldsymbol{p(\theta|D) = \sum_{\gamma=1}^{2^K} p(\theta|M_\gamma, D) p(M_\gamma|D)} \quad (2)$$

Thus, the posterior distribution of θ is an average of the posterior distribution under each of the models considered, weighted by their posterior model probability. For a model M_γ, the latter are obtained using Bayes' theorem:

$$\boldsymbol{p(M_\gamma|D) = \frac{p(D|M_\gamma)p(M_\gamma)}{\sum_{l=1}^{2^K} p(D|M_l)p(M_l)}} \quad (3)$$

where $p(D|M_\gamma)$ is the integrated likelihood of model M_γ. Like Fernandez et al. (2001), we choose a uniform prior probability which means a common prior model probability, i.e. $p(M_\gamma) = 2^{-K}$. This is a popular choice to represent the lack of prior knowledge. This implies that the prior probability of including a regressor is $1/2$ independently of the other regressors included in the model. On this basis, we consider that a potential determinant of corruption can be seen as a relevant determinant if its posterior inclusion probability is greater than or equal to 50% (see Raftery et al., 2001; Dufrenot et al., 2010).

3.2. Data

The data used cover 130 developedand developing countries.[9] Regarding our dependent variable, we use the corruption index provided by the World Bank (Corrup_WGI) ranging between -2.5 (high corruption) to 2.5 (low corruption) and

[8] Markov chain Monte Carlo (MCMC) methods, as a computer-intensive statistical tool, are primarily used for calculating numerical approximations of multi-dimensional integrals. In Bayesian statistics, the recent development of MCMC methods has been a key step in making it possible to compute large hierarchical models that require integrations over hundreds or even thousands of unknown parameters.

[9] We follow the UNCTAD definition by considering that an industrialized or developed economy is an economy in which the adjusted manufacturing value added per capita is higher than 2 500 international dollars or GDP per capita is higher than 20 000 international dollars.

which is one of the most widely used indices in the literature (see e.g. Treisman, 2000; Knack and Azfar, 2003; Serra, 2006; Pellegrini and Gerlagh, 2008).[10] This variable captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the State by elites and private interests. To avoid effects from a particular year and to obtain a large sample of countries with more reliable data, we consider an average of the index over the recent period from 2006 to 2013 for all countries in the study. By averaging the index by country, we do not lose much information since this index varies little over time for the same country. The advantage is that we focus only on inter-country differences that are more relevant to analyze. These cross-sectional differences are significant enough for our econometric results to be robust.[11] We proceed in the same way for all variables except dummy variables.

Concerning the historical and sociocultural variables, we rely on data constructed by La Porta et al. (1999) on legal systems and religious culture. Legal systems are dummy variables that take the value 1 for a particular legal system and 0 otherwise. We consider the British system of common law (legor_uk), the French system of civil law (legor_fr), the system of socialist law (legor_so), the system of German law (legor_ge) and the legal system of Scandinavian law (legor_sc). Regarding religious culture, three religious denominations were considered, namely Catholic (catho80), Islam (muslim80) and Protestant (protmg80). The weight of each religious culture is measured by the proportion of the population adhering to this religion. In the same category of historical and sociocultural variables, we consider ethnic fractionalization (ethnic) and linguistic fragmentation (language) as constructed by Alesina et al. (2003). Finally, we add to this category quality of education (qual_educ) as built by the World Economic Forum (WEF).

The economic variables that we consider are trade openness (openness) measured by the sum of exports and imports as a ratio of GDP, mining rents (mineral_rent) and oil (oil_rents), obtained from the WDI database of the World Bank. These rents, which

[10] These numbers match percentile rank among all countries and range from 0 (lowest rank) to 100 (highest rank). For example, regarding the range from - 2.5 to 2.5, a value of 0 for a country means that 50% of other countries record a better score and 50% an inferior score. See Kaufmann et al. (2011) for more methodological and analytical details.

[11] The standard deviations range between 0.36 and 0.83 depending on the sub-sample considered, while the averages vary from -0.03 to 1.35 depending on the sub-sample.

capture the influence of natural resources, are the difference between the value of production resources (mining and oil) at world prices and total costs of production. GDP per capita in purchasing power parity, expressed in logarithm (lgdppc_ppp) is also obtained from the WDI database.

In the category of institutional variables, we rely on several variables in line with the literature. We take the Freedom House democracy index (polity_right). The political stability index (ps_wgi) is provided by the World Bank through the Worldwide Governance Indicators. The type of political system (parliamentary or presidential) is captured by a dummy variable that takes the value 1 for a given plan and 0 elsewhere. It is obtained from the updated database of Keefer et al. (2001) on political institutions (Database of Political Institutions 2013). The effect of gender in the political sphere is taken into account by the ratio of women parliamentarians to men (Rwpseats) obtained from the Human Development Report. Freedom of information (Free_info) indicating the degree of freedom of the press, radio and television is constructed by Freedom House. Willingness to delegate authority (Wildg_aut), which is a measure of decentralization of power, is provided by WEF. The presence of government in the economy (gov_reg) is understood as the burden of government regulation and is also obtained through the WEF. All the data used and their sources are summarized in Table A.1 in the Appendix.[12]

4. Empirical results

To begin with, we present the results from our regressions for the whole sample. Then the results are presented by country sub-groups to show the relevant determinants depending on the level of development and region.

4.1. Broader determinants of corruption

Table 1 shows the results of the BMA obtained from the whole sample consisting of 130 countries. These results are based on 22 potential determinants and thus the

[12] Note that to facilitate the interpretation of the results the Corrup_WGI, Free_info, polity_right and ps_wgi variables have been transformed so that low values correspond to poor performance and higher values are associated with higher performance. We simply considered the opposite of the original value of these variables.

results of several million regressions (exactly $2^{22} = 4{,}194{,}304$ regressions).[13] The dummy variable "Developing" we then added captures the specificity of developing countries compared to developed countries. It takes the value 1 for developing countries and 0 for developed countries. The relevance of each variable in explaining corruption in all regressions ($P(\beta_k \neq 0|D)$) is given by the "PIP" column, which represents the posteriori inclusion probability (PIP), that is, the sum of the posterior probabilities of the different regressions in which the variable is included. A variable is considered to be relevant in explaining corruption if its PIP is greater than or equal to 50%. In other words, this variable has at least a 50% chance of being included in the explanatory model of corruption. Columns "Post Mean" and "Post SD" represent the posterior mean and the posterior standard deviation of the parameter β for each variable.

Based on these elements, several lessons can be drawn from the results of Table 1. These findings identify eight key determinants of corruption for the whole sample, namely freedom of the press, level of economic development, regulatory burden, judicial system, political system, political stability and willingness to delegate authority.[14] The quality of education and the oil rent are also distinguished, but with lower probabilities. These results are fairly standard in the literature. Indeed, the negative sign associated with the freedom of the press shows that more press freedom allows for a lower level of corruption, as has been demonstrated by several authors (Brunetti and Weder 2003; Pellegrini and Gerlagh, 2008). The role of the level of economic development is a matter of consensus in the literature (see Sierra, 2006) and the negative sign associated with it shows that corruption decreases with improving economic development level. The burden of regulation is also identified as a main cause of corruption, particularly because of the bribery phenomena it generates (Shleifer and Vishny, 1993). Our results also show that the socialist legal system is more permeable to corruption, as shown by La Porta et al. (1999). However, an improvement in the quality of education would reduce corruption, which is consistent with the results of Melgar et al. (2010). Similarly, a

[13] We do not include all the determinants, especially dummy variables for perfect colinearity reasons. This is the case for example of the variables on the legal system in which the Scandinavian legal system (legor_sc) is not included in the regression.

[14] As Treisman (2000), we used alternatively to GDP per capita, the latitudinal distance from the equator to account for the endogeneity problem between corruption and economic development to some extent. We get similar results that are available upon request from the authors. See also Section 5 for more details on the issue of endogeneity.

parliamentary political system compared to a presidential system would be associated with lower corruption. Like Serra (2006), we find that political instability is a breeding ground for corruption. Finally, the favorable influence of decentralization captured by the willingness to delegate authority is consistent since we find that a greater proportion of power to delegate is associated with lower corruption.

While these results are interesting and consistent with previous studies, they are very general and in fact not very informative because they fail to grasp the specificities linked to economic development level or those related to the region that are essential for conducting specific diagnostics. For example, these results clearly show what is often referred to as the "tragedy of developing countries" because of their level of corruption that is higher than that of developed countries. However, without a specific study, no one is able to state that the determinants of corruption that are relevant to developed countries are also valid for developing countries. The following analyses are intended to address these limitations.

Table 1: Broader determinants of corruption (whole sample)

Determinants	PIP	Post Mean	PIP	Post Mean
Catho80	0.149	0.001	0.261	0.001
Developing	---	---	**0.998**	**1.087**
Ethnic	0.164	0.095	0.110	0.052
Free_info	**0.931**	**-0.023**	**0.708**	**-0.014**
GDP_pc	**0.999**	**-0.441**	**0.992**	**-0.381**
Gov_reg	**0.862**	**-0.418**	**0.911**	**-0.468**
Language	0.041	0.002	0.041	0.005
Legor_fr	0.049	0.006	0.040	0.004
Legor_ge	0.041	-0.008	0.033	-0.002
Legor_so	**0.966**	**0.869**	**0.997**	**1.008**
Legor_uk	0.037	0.000	0.035	0.000
Mineral_rents	0.038	0.000	0.035	0.000
Muslim80	0.041	0.000	0.037	0.000
Oil_rents	0.400	0.009	0.461	0.009
Openness	0.040	0.000	0.047	0.000
Parl_system	**0.724**	**-0.410**	0.222	-0.084
Polity_right	0.386	0.079	0.266	0.048
Pr_system	0.149	0.052	0.144	0.045
Protmg80	0.052	0.000	0.093	-0.001
PS_wgi	**1.000**	**0.641**	**1.000**	**0.604**
Qual_educ	0.453	-0.134	0.336	-0.088
Rwpseats	0.048	-0.017	0.038	-0.009
Wildlg_aut	**0.999**	**-0.701**	**0.989**	**-0.610**

Note: The results are based on 500,000 draws and 100,000 burn-ins. For each simulation, we use a uniform model prior and the birth–death MCMC sampler. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The estimates cover the 130 countries in the sample.

4.2. Determinants of corruption by level of economic development

The results presented in Table 2 distinguish the determinants of corruption that are specific to developed countries from those specific to developing countries. Some determinants are common to both types of countries such the legal system and political stability. However, other determinants such as religion, oil rents and quality of education are more relevant to developing countries. Indeed, the results show that an increase in oil rent is conducive to corruption. Moreover, corruption appears higher in countries with a higher proportion of Catholics faithful and a socialist legal system. The reason for these results is that developing countries are generally the most endowed with natural resources and there are often interest groups involved in the exploitation of these natural resources. To the extent that transparency is not made in the management of natural resources, corruption develops more easily. Similarly, as regards religion, as we have pointed out above, hierarchical religions such as Catholicism, Islam and Eastern Orthodoxy would be less stringent vis-à-vis the hierarchy. This tolerance or lack of accountability is more widely observed in developing countries, thus encouraging corrupt behaviour of elites and hierarchical superiors. The low level of education of the population is also a lagging factor in the fight against corruption insofar as the accountability of public authorities is weaker. For developed countries, the special feature is willingness to delegate authority, that is, decentralization. In other words, the developed countries with a greater level of decentralization appeared less corrupt than the others. Moreover, the level of economic development does not explain the differences in the perception of corruption in developed countries; this shows some homogeneity in their structural characteristics.

Table 2: Determinants of corruption according to level of development

Determinants	Developing countries		Developed countries	
	PIP	Post Mean	PIP	Post Mean
Catho80	**0.638**	**0.002**	0.195	-0.001
Ethnic	0.055	0.007	0.049	0.003
Free_info	0.186	-0.001	0.056	0.000
GDP_pc	**1.000**	**-0.262**	0.057	-0.011
Gov_reg	0.242	-0.038	**0.637**	**-0.166**
Language	0.047	0.002	0.061	-0.012
Legor_ge	---	---	0.048	0.004
Legor_sc	---	---	0.049	0.004
Legor_so	**0.999**	**0.657**	**0.945**	**0.573**
Legor_uk	0.067	-0.006	0.095	-0.015
Mineral_rents	0.050	0.000	0.118	-0.008
Muslim80	0.070	0.000	0.082	-0.001
Oil_rents	**0.980**	**0.016**	0.044	0.000
Openness	0.045	0.000	0.107	0.000
Parl_system	0.199	-0.038	---	---
Polity_right	0.075	-0.002	0.059	0.001
Pr_system	0.105	0.014	0.072	0.012
Protmg80	0.049	0.000	0.051	0.000
PS_wgi	**1.000**	**0.409**	**0.852**	**0.309**
Qual_educ	**0.491**	**-0.071**	0.045	0.002
Rwpseats	0.081	0.025	0.049	-0.010
Wildlg_aut	0.051	-0.002	**1.000**	**-0.543**

Note: The results are based on 500,000 draws and 100,000 burn-ins. For each simulation, we use a uniform model prior and the birth–death MCMC sampler. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. We have 34 developed countries and 96 developing countries.

4.3. Determinants of corruption by geographic location

To further the analysis on the determinants of corruption, we follow the classification of the World Bank and we distinguish several regions. Given the relatively high number of potential determinants, we cannot perform regressions for the regions for which the number of countries, in our sample, is less than the number of explanatory variables. We therefore limit the number of explanatory variables to avoid being faced with a problem of insolvency of the model.

On the basis of results achieved so far, several variables appeared to be more fundamental in explaining the differences in perception of corruption. Irrespective of the specificities, the key determinants highlighted are the level of economic development, education, the burden of regulation, the political system, freedom of the press, decentralization, legal origin, oil rents and, to a certain extent, religion.

Considering only these variables, we study regional characteristics in order to measure the weight of each of these variables by region. The division performed by the World Bank groups all the countries into seven (07) geographical regions, namely East Asia and Pacific (EAP), Europe and Central Asia (ECA), Latin America and Caribbean (LAC), Middle East and North Africa (MENA), North America (NA), South Asia (SA) and Sub-Saharan Africa (SSA). Given the small number of countries in North America (two countries) and South Asia (five countries), these regions are not considered. However, the perception of corruption in all regions compared to Europe and Central Asia (ECA) is presented in Table 3. In this table, the "tragedy" of certain areas where the perception of corruption is greater clearly appears. Specifically, compared to the ECA region, corruption is higher in SSA, in LAC, in MENA and in SA. However, corruption is not significantly more pronounced in EAP and NA where it actually seems relatively lower.

Tables 3: Perception of corruption by region

	PIP	**Post Mean**
SSA	**1.000**	**1.329**
LAC	**0.994**	**1.023**
MENA	**0.911**	**0.787**
SA	**0.836**	**1.036**
EAP	0.260	0.127
NA.	0.210	-0.200
ECA	…	…

Note: The results are based on 500,000 draws and 100,000 burn-ins. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%.
ECA is considered as a reference since we cannot introduce all regions due to perfect collinearity.

Returning now to the regional characteristics presented in Table 4, we can draw several conclusions. Concerning EAP, the main determinants of corruption are economic development, religion, and political stability. Specifically, corruption is lower in countries with a high proportion of Protestant faithful, greater political stability and a higher level of economic development. The results for the ECA region show that corruption is mainly determined by freedom of the press, burden of regulation, legal system and willingness to delegate authority. Indeed, a transparent information system with depersonalization of procedures and decision-making processes are catalysts in the fight against corruption. Regarding LAC, corruption is mainly explained by freedom of the press, economic development and quality of education. In this region, corruption is

lower in countries where there is more freedom of the press and where the quality of education is higher. According to UNESCO, in Latin America and the Caribbean, it is difficult to enforce freedom of information laws, including the establishment of appropriate mechanisms to ensure timely access to information, promote a cultural change towards greater transparency among public servants and encourage requests for information from the public. For the MENA region, the differences in the perception of corruption are explained by linguistic fragmentation, political system, political stability, quality of education and willingness to delegate authority. Specifically, corruption appears to be lower in countries with a parliamentary political system, greater political stability, higher quality of education and greater decentralization of authority. These zones present more autocratic and monarchical political regimes. The high concentration of power and educational systems often in favor of the political regime expose countries to more corruption. However, contrary to expectations, linguistic fragmentation seems to reduce corruption in the region. This could possibly be explained by the fact that linguistic fragmentation in this region does not necessarily create the dominant groups and that the groups in power are controlled by others. Finally, the results for Sub-Saharan Africa (SSA), the differences in the perception of corruption in this region are explained by freedom of the press, burden of regulation, linguistic fragmentation, political system, religion and political stability. The least corrupt countries in this region are those in which the freedom of the press is higher, the quality of regulation is higher, linguistic fragmentation is lower, the proportion of Protestants is higher and political instability is lower. In contrast, countries with a presidential political system are those with the highest level of corruption.

Table 4: The main determinants of corruption by region

Determinants	EAP		ECA		LAC		MENA		SSA	
	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean
Catho80	0.299	-0.002	0.375	-0.001	0.214	0.004	0.195	-0.001	0.125	0.000
Free_info	0.194	-0.001	0.864	-0.016	0.746	-0.023	0.409	-0.006	0.964	-0.011
GDP_pc	0.950	-0.812	0.210	-0.068	0.509	-0.266	0.402	-0.191	0.318	-0.037
Gov_reg	0.093	0.005	0.613	-0.152	0.440	-0.199	0.337	0.017	0.868	-0.241
Language	0.164	0.086	0.088	0.010	0.076	-0.006	0.723	-0.699	0.935	0.556
Legor_so	0.208	0.105	0.950	0.514	0.145	0.006	---	---	---	----
Muslim80	0.358	0.004	0.079	0.000	---	---	0.363	-0.003	0.091	0.000
Oil_rents	0.126	0.003	0.197	0.004	0.088	0.001	0.336	0.004	0.339	0.003
Parl_system	0.106	-0.014	0.084	0.006	0.214	-0.288	0.626	-0.694	0.246	-0.092
Pr_system	0.139	-0.032	---	---	0.253	-0.293	0.398	-0.344	0.822	0.413
Protmg80	0.831	-0.021	0.271	-0.001	0.296	0.012	0.362	-0.005	0.694	-0.005
PS_wgi	0.857	0.380	0.246	0.075	0.323	0.193	0.588	0.133	0.973	0.213
Qual_educ	0.144	-0.029	0.091	0.007	0.665	-0.386	0.918	-0.319	0.292	-0.026
Wildlg_aut	0.192	0.065	0.996	-0.454	0.187	-0.102	0.690	-0.325	0.146	-0.015

Note: The results are based on 500,000 draws and 100,000 burn-ins. For each simulation, we use a uniform model prior and the birth–death MCMC sampler. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The number of countries is 42 for SSA, 21 for LAC, 15 for MENA, 13 for EAP, and 32 for ECA.

In summary, our results clearly show that there are regional particularities as well as specificities related to levels of economic development that should be considered when conducting an analysis on the determinants of corruption. Attempts in some studies to consider them through dummy variables only serve to capture the perception of corruption by region, but are not sufficient to identify the particularities that may be decisive in specific diagnoses.

5. Robustness analysis

To test the robustness of our results, several robustness analyses were performed. First, this Section looks at the question of endogeneity between corruption and level of development that is often noted but very little explored in previous studies. It also addresses the problem of the inverse causality between corruption and government regulation. Second, we change the indicator of the perception of corruption by considering not the Kaufmann indicator, but the perception of corruption indicator of Transparency International (TI).[15] Third, we consider an alternative method for dealing with model uncertainty and identifying the most relevant determinants of corruption.

[15] It should be noted that other measures of corruption exist such as the ICRG (International Country Risk Guide) measurement. But because of their low coverage in terms of number of countries, we prefer, for the robustness analysis, the Transparency International indicator for which we have complete coverage of our sample of countries.

Finally, due to the unavailability of data for all the countries in our sample, we study the influence of wages on corruption in the case of 89 countries, in line with the previous literature. While the latter analysis is not really a proof of robustness, given the purpose of our paper, it has the advantage of testing the sensitivity of the overall results (without specificity of income level and of region) with respect to the introduction of the variable representing the remuneration of officials (government wage).

5.1. Issue of potential reverse causality

Like all cross-national studies on the determinants of corruption, the BMA method is based on the OLS principle. It therefore does not directly consider the problem of endogeneity. But although it is often not considered in previous studies, the risk of endogeneity is present, especially as regards the relationship between the level of economic development and the level of corruption, because of the potential simultaneity bias between these two variables (Treisman, 2000). Specifically, if an improvement in the level of economic development can reduce corruption as shown by all the studies on the determinants of corruption, several studies also show that an increase in corruption hinders economic development (inter alia Mauro, 1995; Gray and Kaufmann, 1998; Wei, 1999). Because of this potential reverse causality, the OLS procedure provided biased and inconsistent results, because the explanatory variable (the level of economic development in our case) is correlated with the error term. To avoid reproducing this bias in our estimates, we use the method of instrumental variables. Indeed, instead of using the level of economic development as an explanatory variable in the equation of corruption, we rather use its estimated value from the exogenous variables that can simultaneously affect the level of economic development and the level of corruption but are not affected by the level of corruption.

The literature tells us that the level of development and the level of corruption can be influenced by common exogenous factors including geography and natural resource endowment. On geographical factors, it is now well known that tropical countries tend to have poor harvests, more disease and a suboptimal use of production technologies developed in more temperate zones; this negatively affects their level of economic development. Furthermore, because of its geographical position, a landlocked country is de facto limited in its economic development because it has limited access to

large economic markets (Sachs and Warner, 1997). Regarding natural resource endowment, this is considered by Sachs and Warner (1997) as a factor that can influence the level of development of countries. Ultimately, tropical location, landlocked location and dependence on natural resource are considered factors that adversely affect the level of development (Sachs and Warner, 1997, Bloom and Sachs, 1998). Geographical factors are also considered by institutionalists as factors that explain the level of corruption through the establishment of sustainable institutions. For example, Hall and Jones (1999) and Easterly and Levine (2001), among others, argue that when the geographical position of countries allows them to have good crop yields, it helps establish sustainable and effective institutions to protect landowners. These institutions are also effective in the fight against corruption.

Based on these arguments, we estimate the level of economic development from geographical factors. We do not consider natural resource endowment in the estimation of economic development because the variables related to it, namely oil and mining rents, are directly included in the regression of corruption. The relationship between the level of economic development and geographical factors is presented in Table A.2 in Appendix of the document. The value estimated on this basis is then used in the regression of corruption and to address the problem of endogeneity. The results, which are presented in Tables B.1 to B.3 in Appendix B, are very similar to those obtained previously in each sub-sample.

As with the level of development, there may be a reciprocal causal relationship between government regulation and corruption (see Macrae 1982, Bliss and Di Tella 1997). On the one hand, overregulation may be a deliberate strategy that is pursued to increase rent extraction, on the other hand, some governments attempt to overcome corrupt behavior by imposing detailed prescriptions. Therefore, this can be a very important source of endogeneity. We also deal with this problem by following Djankov et al. (2006) who instrumented regulation with several variables including legal origins, initial GDP per capita and linguistic fragmentation. The results of the regressions between government regulations and these variables are presented in Table A.3 in the Appendix. Then, to overcome the problem of endogeneity, we use in the equation of corruption, the estimated values of government regulation instead of observed values. The new results, reported in Table B.4 in the appendix, show that government

regulation is no longer a significant determinant for developed countries. However, the other results are not altered by instrumentation strategy. For developed countries, the main determinants of corruption remain the same (socialist legal origin, political stability and willingness to delegate authority). Similarly, for developing countries, the results remain broadly the same. Corruption depends significantly on the level of development, legal origin, political stability and the quality of education.

5.2. Alternative measure of corruption perception

To examine whether the choice of the measure of corruption influences our results, we consider the Transparency International Index (Corrup_CPI) for the year 2013 as an alternative measure of corruption perception. This indicator whose value varies between 0 (highly corrupt) to 100 (low corruption) is a composite index based on surveys indicating the extent to which public power is used for personal gain.[16] The results obtained from this new measure are very similar to previous results obtained with the Kaufmann indicator (see Table B.5 in Appendix B). This similarity between results is not surprising since both indicators of corruption are highly correlated (with a correlation coefficient of about 0.99). The differences lie in the posterior means. This difference comes from the coding differences between the two institutions. It should be noted that only the PIP really matters because it is what determines the importance of each potential determinant in explaining corruption. Regarding the determinants of corruption according to the level of development, the results also support the results in Table 1. The same determinants of corruption perception among the countries are identified, underlining the strength of our results.

5.3. Alternative to BMA: General-to-Specific (GETS) approach[17]

As a robustness analysis, we use the automated General-to-Specific (GETS) approach as an alternative to BMA to deal with model uncertainty. GETS, just like BMA, is one of the most influential econometric and statistical approaches for handling

[16] We have transformed this index (by taking 100-index) so that low values mean low corruption and high values correspond to high corruption.

[17] This approach is briefly discussed here. For details, see among others Krolzig and Hendry (2004), Hoover and Perez (2004), and, for a practical implementation, see Owen (2003) for OxMetrics and Clarke (2014) for Stata.

uncertainty modelling (see Ding and Knight, 2011). Roughly speaking, while BMA addresses model uncertainty by estimating models for all possible combinations of explanatory variables leading to thousands (or millions) of regressions, GETS addresses the same problem only relying on a single model, namely the general unrestricted model (GUM). The latter, which contains all the potential explanatory variables, is subjected to a series of step-wise statistical tests (see Hendry and Krolzig, 2004), leading to the removal of empirically unimportant variables to arrive at the proposed specific or final model. The validity of a selected model is mainly subject to the suitability of GUM to the data generation process (DGP). Thus it is important to rely on economic theory and previous empirical findings to determine the "prior general model" as we did in Section 2.

Implementing this approach leads to the specific (or final) models presented in Tables B.6 and B.7 in Appendix B. These results are similar to previous results (Tables 1 and 2). Indeed, the determinants retained in the final models of the GETS approach are exactly those whose PIP are greater than or equal to 50% in the BMA approach both for the whole sample and for subsamples of developed and developing countries. All this confirms previous findings and shows that our results are robust to the variable selection method.

5.4. Influence of government wage

Although its influence is controversial, government wage is often cited among the main determinants of corruption. Our previous analyses have not included this variable because it is not available for many of the countries in our sample (41 out of 130 countries). However, to study the influence of this variable, we apply the BMA to the 89 countries for which this variable is available.[18] The results of this procedure clearly show that the government wage has no influence on the level of corruption across countries. These results are not very surprising because although it is generally believed that low wages relative to living standards can increase corruption temptations, it is also true that the most corrupt politicians are also generally those who share the highest salaries, as stressed by Triesman (2000). Thus an increase in wages does not necessarily lead

[18] We follow Triesman (2000) using wage data from Schiavo-Campo et al. (2006). See Table A.1 in Appendix for more details on this variable.

towards a reduction in corruption. Furthermore, determinants whose PIP is more than 50% in this reduced sample are the same as those of the total sample, confirming once again the strength of our results (see Appendix B.8).

6. Conclusion and Discussion

If corruption is a scourge that plagues all societies, its root causes have been the subject of quantitative studies over recent years as data have become available, particularly on institutional variables, including corruption itself. Indeed, several authors have focused on identifying the causes of corruption through cross-country empirical studies. These studies have enriched the literature by proposing discussions on economic, institutional, socio-cultural and historical determinants of corruption. However, the question of specific groups or regions is generally ignored, suggesting that one could "put all countries in the same basket". This paper proposes to enrich the literature on the determinants of corruption by addressing the issue of specificities relating to the level of economic development and the region. More concretely, we start from the premise that the causes of corruption can evolve with the level of development or may vary from region to region. Is it likely for example that the determinants of corruption in Sub-Saharan Africa are the same as the determinants of corruption in Europe?

To investigate this issue and consider the potential differences that there might be in the explanation of corruption, we study the determinants of corruption according to level of development and region. To this end, we rely on the existing literature to obtain a relatively large number of potential determinants without discriminating between these variables. On this basis, and considering the problem of model uncertainty, we use a BMA approach to identify the most relevant determinants according to economic development level and region. The results clearly show that differences exist according to the level of economic development and the region and that we cannot apply the same treatment to all countries. Corruption in SSA is not explained by the same factors as in Europe. Our paper contributes to the literature on the determinants of corruption not only by analyzing these specificities, but also by addressing the issue of model uncertainty due to the relatively large number of potential determinants. It is thus helpful to have a model according to development level and region. By identifying these

peculiarities, our study also provides the possibility of a specific treatment of this common scourge. Our results are also robust to several tests, including tests on the dependent variable and the method for the treatment of model uncertainty.

Appendices

Appendix A: Data

Table A.1: Data description and sources

Variables	Definition	N	mean	S.D.
	Corruption indicators			
Corrup_wgi	Corruption indicator of Kaufmann et al. (2004) (World Governance Indicators). The indicator ranges from -2.5 (most corrupt) to 2.5 (least corrupt) over the period 2006-2013.	130	0.00195	1.063
Corrup_cpi	Indicator of corruption of Transparency International, ranging from 1 (most corrupt) to 100 (least corrupt) for 2013.	130	4.281	2.168
	Historical and sociocultural variables			
Catho80	The percentage of the population belonging to the Roman Catholic religion in 1980. The values are in percent (scale from 0 to 100). Source: La Porta et al. (1999))	130	33.13	36.34
Muslim80	The percentage of the population belonging to the Muslim religion in 1980. The values are in percent (scale from 0 to 100). Source: La Porta et al. (1999))	130	21.59	33.79
Legor_uk	The dummy variable for the origin of the legal system Common Law (La Porta et al., 1999)	130	0.300	0.460
Legor_fr	The dummy variable for the origin of the legal system French Civil Law (La Porta et al., 1999)	130	0.508	0.502
Legor_so	The dummy variable for the origin of the legal system Socialist Law (La Porta et al., 1999)	130	0.123	0.330
Legor_ge	The dummy variable for the origin of the legal system German Civil Law (La Porta et al., 1999)	130	0.0308	0.173
Legor_sc	The dummy variable for the origin of the legal system Scandinavian Law (La Porta et al., 1999)	130	0.0385	0.193
Protmg80	The percentage of the population of each Country belonging to the Protestant religion in 1980. The values are in percent (scale from 0 to 100). Source: La Porta et al. (1999).	130	12.26	20.79
Ethnic	The index of ethnic fractionalization that captures the probability that two randomly selected persons from a given country will not belong to the same ethnic group (Alesina et al. 2003)	130	0.452	0.268
Language	The index of linguistic fractionalization that captures the probability that two randomly selected persons from a given country will not speak the same language (Alesina et al. 2003)	126	0.400	0.300

Variables	Definition	N	mean	S.D.
Qual_educ	Quality of education, World Economic Forum (WEF)	122	4.434	0.802
	Economic variables			
Gov_reg	Burden of government regulation, 1-7 (best), World Economic Forum (WEF)	122	3.331	0.635
Openness	The proxy for the degree of country openness to international competition. It is the sum of merchandise exports and imports measured in current U.S. dollars divided by the value of GDP converted to international dollars using purchasing power parity (PPP) rates. Source: World Development Indicator	130	94.09	58.00
Mineral_rents	Mineral rents are the difference between the value of production for a stock of minerals at world prices and their total costs of production, 2006-2013. Source: World Development Indicators (CD-ROM 2015)	130	1.919	4.963
Oil_rents	Oil rents are the difference between the value of crude oil production at world prices and total costs of production 2006-2013. Source: World Development Indicators (CD-ROM 2015)	130	5.535	12.79
GDP_pc	The logarithm of real GDP per capita in constant dollars 2006-2013. Source: The World Bank's World Development Indicators (CD-ROM 2015)	130	9.111	1.286
Wage_pcgdp	Government wages relative to per capita income.	89	2.956	2.437
	Institutional variables			
Polity_right	Index of political rights. Higher ratings indicate countries that come closer to the ideals suggested by the checklist questions of: (1) free and fair elections; (2) those elected rule; (3) there are competitive parties or other competitive political groupings; (4) the opposition has an important role and power; and (5) the entities have self-determination or an extremely high degree of autonomy. Source: Freedom House.	128	3.400	2.055
PS_wgi	The proxy for the possibility to have wrenching changes in Government. It ranges from around −2.5 to around 2.5 (higher values correspond to less political instability). Source: Kaufmann et al. (1999)	130	-0.123	0.918

Variables	Definition	N	mean	S.D.
Wildlg_aut	Willingness to delegate authority, 1-7 (best). Source: World Economic Forum (WEF)	122	3.809	0.794
Pr_system	Dummy Presidential system of governance (Data Base of Political Institution, 2015)	130	0.577	0.496
Parl_system	Dummy Parliamentary system of governance (Data Base of Political Institution, 2015)	130	0.354	0.480
Rwpseats	Parliamentary seats, female to male ratio: Percentage of parliamentary seats held by women expressed as a ratio of those held by men. Source: Human Development Report, UNDP	129	0.255	0.176
Free_info	The index of freedom of information provided by Freedom House on the basis of the following criteria: (1) laws and regulations that influence media content (2) political influence over media content; (3) economic influence over media content (4) repressive actions which constitute violations of press freedom. Values range from 0 (total freedom) to 100 (total repression). Source: Freedom House (2015)	129	48.00	22.16
Latitude	Absolute value of the latitude of the country (i.e., a measure of distance from the equator), scaled to take values between 0 and 1, where 0 is the equator. Source: La Porta et al. (1999).	129	-1.604	0.989
Landlocked	Equal to 1 if the country is landlocked and 0 otherwise.	130	0.200	0.401

Table A.2: Economic development and geography

Variables	(1) $\ln(GDP\_PC)$		(2) $\ln(GDP\_PC)$	
landlocked	-0.826***	(0.191)	-0.846***	(0.235)
latitude	4.171***	(0.422)	0.578***	(0.125)
Constant	8.103***	(0.190)	10.23***	(0.179)
Observations	130		129	
R-squared	0.445		0.266	

In the results in (1), the latitudinal distance from the equator is not included as a logarithm. In (2), this variable is expressed as a logarithm. The estimates cover the 130 countries in the sample.
Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table A.3: Government regulations and its instruments

VARIABLES	Gov_reg	
GDP_pc70	0.0761	(0.0657)
Legor_uk	-0.287	(0.209)
Legor_fr	-0.663***	(0.202)
Legor_so	-0.556**	(0.270)
Language	0.401*	(0.214)
Constant	3.034***	(0.672)
Observations	108	
R-squared	0.186	

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Appendix B: Robustness checks

Table B.1: Broader determinants of corruption (whole sample)

Determinants	PIP	Post Mean	PIP	Post Mean
Catho80	0.046	0.000	0.048	0.000
Developing	---	---	**0.903**	**0.388**
Ethnic	0.105	0.023	0.113	0.029
Free_info	**0.681**	**-0.005**	**0.580**	**-0.004**
GDP_pc_bar	**0.995**	**-0.234**	**0.920**	**-0.181**
Gov_reg	**0.776**	**-0.164**	**0.882**	**-0.198**
Language	0.059	0.007	0.072	0.012
Legor_fr	0.051	0.003	0.042	0.002
Legor_ge	0.038	0.000	0.033	0.002
Legor_so	**1.000**	**0.708**	**1.000**	**0.695**
Legor_uk	0.055	-0.004	0.049	-0.003
Mineral_rents	0.083	-0.001	0.068	-0.001
Muslim80	0.073	0.000	0.061	0.000
Oil_rents	0.069	0.000	0.075	0.000
Openness	0.070	0.000	0.042	0.000
Parl_system	**0.800**	**-0.243**	0.452	-0.109
Polity_right	0.079	0.001	0.069	0.001
Pr_system	0.173	0.035	0.228	0.042
Protmg80	0.042	0.000	0.037	0.000
PS_wgi	**1.000**	**0.442**	**1.000**	**0.410**
Qual_educ	**0.975**	**-0.197**	**0.914**	**-0.166**
Rwpseats	0.044	0.005	0.040	0.005
Wildlg_aut	**0.986**	**-0.275**	**0.968**	**-0.253**

Note: The results are based on 500,000 draws and 100,000 burn-ins. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The estimates cover the 130 countries in the sample.

Table B.2: Determinants of corruption according to level of development

Determinants	Developing countries		Developed countries	
	PIP	Post Mean	PIP	Post Mean
Catho80	0.057	0.000	0.192	-0.001
Ethnic	0.087	0.019	0.049	0.002
Free_info	0.247	-0.001	0.056	0.000
GDP_pc_bar	**0.990**	**-0.260**	0.067	0.006
Gov_reg	**0.571**	**-0.116**	**0.625**	**-0.163**
Language	0.079	0.012	0.061	-0.012
Legor_ge	---	---	0.049	0.004
Legor_sc	---	---	0.049	0.004
Legor_so	**1.000**	**0.828**	**0.959**	**0.583**
Legor_uk	0.081	-0.008	0.093	-0.015
Mineral_rents	0.075	-0.001	0.117	-0.008
Muslim80	0.104	0.000	0.082	-0.001
Oil_rents	0.098	0.000	0.044	0.000
Openness	0.044	0.000	0.106	0.000
Parl_system	0.408	-0.104	---	---
Polity_right	0.089	-0.003	0.058	0.001
Pr_system	0.353	0.081	0.071	0.012
Protmg80	0.045	0.000	0.052	0.000
PS_wgi	**1.000**	**0.486**	**0.865**	**0.315**
Qual_educ	**0.999**	**-0.252**	0.045	0.002
Rwpseats	0.097	0.034	0.050	-0.011
Wildlg_aut	0.094	-0.011	**1.000**	**-0.545**

Note: The results are based on 500,000 draws and 100,000 burn-ins. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. We have 34 developed countries and 96 developing countries.

Table B.3: The main determinants of corruption by region

Determinants	EAP		ECA		LAC		MENA		SSA	
	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean
Catho80	0.095	-0.000	0.406	-0.002	0.267	-0.006	0.192	-0.001	0.132	0.000
Free_info	0.405	-0.008	**0.973**	**-0.018**	**0.675**	**-0.022**	0.346	-0.005	**0.994**	**-0.012**
GDP_pc_bar	0.464	-0.281	0.108	-0.008	0.170	0.051	0.245	-0.132	0.090	-0.003
Gov_reg	0.132	0.013	**0.608**	**-0.149**	0.219	0.070	0.373	0.040	**0.943**	**-0.277**
Language	0.139	0.040	0.091	0.008	0.093	0.034	**0.875**	**-0.896**	**0.994**	**0.630**
Legor_so	**0.719**	**0.839**	**0.991**	**0.542**	---	---	---	---	---	---
Muslim80	**0.901**	**0.021**	0.084	0.000	0.099	-0.002	0.316	-0.003	0.095	0.000
Parl_system	0.143	-0.017	0.094	0.006	0.325	0.567	**0.638**	**-0.701**	0.155	-0.044
Pr_system	0.469	-0.402	---	---	0.267	0.392	0.324	-0.211	**0.919**	**0.477**
Protmg80	**0.823**	**-0.027**	0.284	-0.001	0.370	-0.020	0.327	-0.145	**0.743**	**-0.005**
PS_wgi	**0.871**	**0.577**	0.208	0.055	0.428	0.267	**0.757**	**0.180**	**0.987**	**0.217**
Qual_educ	**0.852**	**-0.802**	0.098	0.009	**0.644**	**0.399**	**0.964**	**-0.365**	0.388	-0.037
Wildlg_aut	0.104	0.003	**0.995**	**-0.456**	0.267	0.163	**0.867**	**-0.420**	0.176	-0.021

Note: The results are based on 500,000 draws and 100,000 burn-ins. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The number of countries is 42 for SSA, 21 for LAC, 15 for MENA, 13 for EAP, and 32 for ECA.

Table B.4: Broader determinants of corruption (control for reverse causality between corruption and government regulation)

Variables	Whole sample		Developed countries		Developing countries	
	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean
Catho80	0.059	0.000	0.046	0.000	0.117	0.000
Ethnic	0.053	0.016	0.042	0.000	0.077	0.036
Free_Info	0.106	-0.001	0.086	0.000	0.054	0.000
GDP_Pc_Bar	**0.961**	**-0.445**	0.191	0.084	**0.945**	**-0.525**
Gov_Reg_Bar	0.066	-0.025	0.044	-0.013	0.080	-0.035
Language	0.044	0.005	0.055	-0.024	0.080	0.034
Legor_Fr	0.055	0.009	0.074	0.019		
Legor_Ge	0.045	-0.010	0.040	-0.002		
Legor_So	**1.000**	**1.523**	**0.620**	**0.706**	**0.995**	**1.565**
Legor_Uk	0.047	-0.005	0.118	-0.063	0.116	-0.033
Mineral_Rents	0.095	-0.002	0.061	-0.007	0.059	-0.001
Muslim80	0.055	0.000	0.133	-0.007	0.061	0.000
Oil_Rents	0.039	0.000	0.057	0.003	0.043	0.000
Openness	0.097	0.000	0.154	-0.001	0.047	0.000
Parl_System	**0.563**	**-0.384**			0.170	-0.064
Polity_Right	0.053	0.003	0.151	0.065	0.047	-0.001
Pr_System	0.444	0.292	0.090	0.062	0.425	0.218
Protmg80	0.041	0.000	0.048	0.000	0.056	0.000
PS_Wgi	**1.000**	**0.997**	**0.644**	**0.491**	**1.000**	**1.013**
Qual_Educ	**0.821**	**-0.322**	0.044	-0.006	**0.978**	**-0.493**
Rwpseats	0.045	0.012	0.050	-0.033	0.216	0.226
Wildlg_.Aut	**1.000**	**-0.838**	**0.999**	**-1.540**	0.209	-0.073

Note: The results are based on 500,000 draws and 100,000 burn-ins. For each simulation, we use a uniform model prior and the birth–death MCMC sampler. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. We have 34 developed countries and 96 developing countries.

Table B.5: Determinants of corruption using CPI measure of corruption for 2013

Determinants	PIP	Post Mean	PIP	Post Mean
Catho80	0.160	0.009	0.17124	0.00937
Developing			0.58117	4.84393
Ethnic	0.254	2.066	0.20806	1.60603
Free_info	**0.975**	**-0.290**	**0.88852**	**-0.23374**
GDP_pc	**0.898**	**-3.254**	**0.76382**	**-2.58449**
Gov_reg	**0.865**	**-5.276**	**0.84593**	**-5.13875**
Language	0.054	-0.178	0.04179	-0.09030
Legor_fr	0.048	0.019	0.04231	-0.00538
Legor_ge	0.033	-0.045	0.02633	-0.01005
Legor_so	**0.486**	**3.578**	**0.60685**	**4.94580**
Legor_uk	0.044	-0.061	0.03551	-0.04884
Mineral_rents	0.045	0.006	0.03362	0.00343
Muslim80	0.041	0.000	0.03594	0.00048
Oil_rents	0.225	0.046	0.20933	0.04436
Openness	0.038	0.000	0.02944	-0.00009
Parl_system	0.172	-0.718	0.11006	-0.41524
Polity_right	0.120	0.194	0.09655	0.13826
Pr_system	0.062	0.117	0.04950	0.09960
Protmg80	0.044	-0.001	0.04797	-0.00249
PS_wgi	**0.926**	**4.847**	**0.93078**	**5.05380**
Qual_educ	0.093	-0.189	0.08473	-0.17442
Rwpseats	0.035	-0.054	0.02976	0.00439
Wildlg_aut	**0.989**	**-6.865**	**0.97553**	**-6.60716**

Note: The results are based on 500,000 draws and 100,000 burn-ins. For each simulation, we use a uniform model prior and the birth–death MCMC sampler. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The estimates cover the 130 countries in the sample.

Table B.6: Specific model of corruption (all sample, GETS approach)

Variables	GETS1		GETS2	
Ps_wgi	0.342***	(0.0567)	0.316***	(0.0547)
Legor_so	0.479***	(0.108)	0.500***	(0.104)
Free_info	-0.00834***	(0.00258)	-0.00713***	(0.00251)
Wildlg__aut	-0.283***	(0.0642)	-0.251***	(0.0626)
Parl_system	-0.246***	(0.0853)		
Oil_rents	0.0115***	(0.00369)	0.0109***	(0.00356)
Gov_reg	-0.252***	(0.0637)	-0.264***	(0.0614)
GDP_pc	-0.236***	(0.0429)	-0.201***	(0.0428)
Developing			0.476***	(0.113)
Constant	3.577***(0.395)		2.805***	(0.430)
Observations	121		121	
R-squared	0.899		0.906	

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*
The estimates cover the 130 countries in the sample.

Table B.7: Specific model of corruption by level of economic development (GETS approach)

Variables	(Developing countries) GETS1		(Developed countries) GETS2	
Ps_wgi	0.381***	(0.0551)	0.334***	(0.0921)
Legor_so	0.557***	(0.119)	0.621***	(0.136)
Oil_rents	0.0183***	(0.00335)		
Gov_reg	-0.214***	(0.0687)	-0.211***	(0.0684)
GDP_pc	-0.277***	(0.0408)		
Wildlg__aut			-0.504***	(0.0699)
Constant	3.207***	(0.444)	1.820***	(0.324)
Observations	88		34	
R-squared	0.716		0.928	

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*
We have 34 developed countries and 96 developing countries.

Table B.8: Determinants of corruption including wage

Determinants	PIP	Post Mean
Catho80	0.059	0.000
Developing	**0.572**	**0.235**
Ethnic	0.325	0.152
Free_info	**0.801**	**-0.009**
GDP_pc_bar	**0.638**	**-0.146**
Gov_reg_bar	**0.725**	**-0.208**
Language	0.132	0.036
Legor_fr	0.071	-0.002
Legor_ge	0.042	0.000
Legor_so	**0.916**	**0.557**
Legor_uk	0.060	-0.006
Mineral_rents	0.048	0.000
Muslim80	0.225	-0.001
Oil_rents	0.061	0.000
Openness	0.075	0.000
Parl_system	0.144	-0.033
Polity_right	0.092	0.001
Pr_system	0.102	0.016
Protmg80	0.060	0.000
PS_wgi	**1.000**	**0.477**
Qual_educ	**0.544**	**-0.113**
Rwpseats	0.133	0.058
Wage_pcgdp	0.041	0.000
Wildlg_aut	**0.835**	**-0.266**

Note: The results are based on 500,000 draws and 100,000 burn-ins. Statistics in bold are those for which the posterior inclusion probability is greater than or equal to 50%. The estimates cover 89 countries in the sample.

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