Tampere University

KOURAMOUDOU KÉÏTA

Essay on the Economics of Corruption

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ACADEMIC DISSERTATION
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Au nom d'Allah, le Tout Miséricordieux, le Très Miséricordieux.
Toutes louanges et tous remerciements sont dus à Allah, Seigneur de Âlamîn (hommes, djinns et tout ce qui existe autre qu'Allah)
Le Tout Miséricordieux, le Très Miséricordieux.
L'Unique Maître du jour de la rétribution.
C'est Toi que nous adorons, et c'est de Toi que nous cherchons aide.
Guide-nous dans la voie droite,
La voie de ceux que Tu as comblés de Tes grâces, non pas la voie de ceux qui ont encouru Ta colère, ni des égarés.

Amen !

(Sourate 1. Al-Fâtihah, Qour'ân)

To my parents, to my children Eden and Fati, more than ever!

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Kouramoudou Kéïta

ABSTRACT

Corruption is a serious impediment to the prosperity and development of societies. It is typically a significant social and economic problem in less-developed countries, but its various aspects and consequences have long been recognised in more developed countries, too. Corruption significantly fosters inequalities and poverty by undermining institutions, leading to the misallocation of resources, the blurring of public policy and the hindering of private sector development. Strictly from the perspective of the *Public Choice* current, corruption must be monitored at all costs because the role of the public sector is gradually being privatised. Furthermore, corruption considerably affects any representative debate on public decisions. The first empirical studies on the economic consequences of corruption began in the 1990s, and these studies found that corruption damages the economic performance of countries. However, the negative effect of corruption has not proven systematic. Indeed, corruption may have virtues in the contexts of inefficient government policies and institutions. The underpinning of this dissertation lies in the problematic of the effect of corruption on economic performance.

Using data from a total of 99 countries worldwide over 2006–2014, this dissertation concludes that the influence of corruption on the economy is mixed. In particular, corruption reduces per capita GDP growth in the presence of high political instability, violence and terrorism. Furthermore, corruption seems to exacerbate the negative consequences of such governance failures on growth. While underlining its detrimental aspects, the study at the same time argues that corruption may nevertheless have virtue. This therefore gives credit to the 'efficient' corruption hypothesis, albeit contradictory with collective morals. Indeed, corruption becomes beneficial to per capita GDP growth in the presence of (i.) poor public administration displaying strong political pressure and inefficient public policies; (ii.) a deficient regulatory framework to promote private sector development; and (iii.) weak rule of law, likely to question contracts and threaten private properties. In such cases, corruption rather seems to mitigate the costs of governance failures on economic growth.

Furthermore, the dissertation tackles the recurring causality issue between bad governance and corruption. Although the mainstream line of economic research suggests that distorted bureaucracy provokes corruption, it is also well known that bureaucrats deliberately encourage distortive tediousness within the administration in order to raise motives for bribery. At this level, the dissertation examines a series data for 117 countries worldwide with a time span of 1996–2013. The empirical analysis yielded substantial evidence of causal effects *à la* Granger between poor governance and corruption. In particular, a unidirectional causal link was found between the absence of Voice and accountability to corruption. Meanwhile, the data indicate a bidirectional causal nexus between corruption and other aspects of institutional shortcomings, including (i.) political instability, violence and terrorism; (ii.) poor public administration with strong political pressure and inefficient public policy; (iii.) a deficient regulatory framework to promote private sector development; and (iv.) weak rule of law, likely to question contracts and threaten private properties.

Moreover, another interesting topic debated in the dissertation relates to the cyclical behaviours of corruption. Although volumes of research have analysed the relationship between corruption and economic growth, few studies observed corruption from the angle of economic cycles. For instance, according to Galbraith (1997), embezzlement flourishes in business booms and withers in recessions. In this context, the dissertation tests the empirical validity of this hypothesis using data from 110 countries worldwide over the 1984–2011 period. The findings are rather contradictory regarding the benchmark hypothesis. Our data suggest that corruption shrinks when transitory income increases, which means that economic booms encourage integrity, while recessions make corruption bloom.

In particular, our findings show that economic booms significantly help in reducing corruption habits in high-income countries, or in those with a good quality of rule of law. At the same time, economic depression constitutes a considerable risk for more corruption. On the other hand, our results indicate that integrity gains resulting from the growth in economic activities overall remain low in low-income countries, or in those with a poor rule of law. For these countries, expansion cycles do not necessarily mean a decline in corruption practices, nor do recessions mean further corruption. Note also that such a result does not mean that corruption is low in these countries – indeed it is quite the opposite.

In the end, the dissertation examines total factor productivity (TFP) (also referred to as Solow residual in the economic literature) as a channel through which

corruption might undermine the economic prosperity of countries. The rationale for such a study is that extensive research has shown that TFP also contributes significantly to the growth of output of countries, as does human or physical capital. In addition, economic growth is becoming increasingly sensitive to variance in TFP growth rather than to variance in twin growth factors. The study therefore assumes that corruption could channel TFP to affect economic growth. Using statistics from 90 countries worldwide over a time span of 1996–2014, the empirical survey tests the effect of corruption on such productivity. Then, it attempts to measure the influence of tax burden on the hypothetical relationship. Our findings unambiguously conclude that corruption and tax burden lower productivity. In particular, a one-unit increase in the corruption standard deviation is associated with a decrease in productivity of about 0.041 %. Moreover, when the effect of tax burden is considered, the overall effect of corruption on TFP becomes positive, which means that tax rate increases can alleviate the cost of corruption in terms of productivity.

Keywords: corruption, bureaucracy, economic growth, investment, governance, business cycles, institutions, total factor productivity, tax burden

TIIVISTELMÄ

Korruptio on tyypillisesti merkittävä sosiaalinen ja taloudellinen ongelma vähemmän kehittyneissä maissa, mutta sen piirteet ja seuraukset ovat jo pitkään olleet tuttuja myös kehittyneissä maissa. Korruptio kasvattaa epätasa-arvoa ja köyhyyttä, heikentää instituutioita, johtaa resurssien väärinkäyttöön, vääristää politiikkaa ja vaarantaa yksityisen sektorin kehityksen. Lisäksi korruptio vaikuttaa julkiseen keskusteluun, mielipideilmastoon ja kansalaisten käyttäytymiseen. Korruptiota on siis suitsittava kaikin keinoin.

Korruption taloudellisten vaikutusten empiirinen tutkimus käynnistyi 1990-luvulla. Tutkimusten mukaan korruptio on pääosin haitallista kansantaloudelle, mutta ei välttämättä kaikissa tapauksissa. Siitä voi olla jopa hyötyä, jos virallinen hallinto ja instituutiot ovat kelvottomia. Korruption vaikutus kansantalouden suorituskykyyn on hyvin monisyinen.

Väitöskirjassa tarkastellaan korruption vaikutusta talouskasvuun maailman 99 maassa vuosina 2006–2014. Yleinen havainto on, että korruptio heikentää talouskasvua, kun maassa on poliittista epävakautta, väkivaltaa ja terrorismia. Korruptio myös voimistaa virallisen hallinnon heikkouden kielteisiä kasvuvaikutuksia. Väitöskirjassa osoitetaan kuitenkin myös, että korruptio saattaa joskus toimia toiseenkin suuntaan. Korruptiolla voi olla positiivisia vaikutuksia, jos hallinto on poliittisesti jyrkkää ja tehotonta, sääntely estää yksityisen sektorin kehityksen ja oikeusvaltioperiaate ei toimi. Tällaisissa tapauksissa korruptio saattaa lieventää hallinnon virheiden negatiivisia kasvuvaikutuksia. Niin sanottu "tehokkaan korruption hypoteesi" saa siis osittaista tukea.

Väitöskirjassa paneudutaan huonon hallinnon ja korruption väliseen syy-seuraussuhteeseen. Huono hallinto mahdollistaa sinänsä korruption, mutta poliitikot ja byrokraatit saattavat myös tarkoituksellisesti vääristää hallintoaan synnyttääkseen itselleen hyödyllistä korruptiota. Asiaa tutkitaan 117 maan aineistolla ajanjaksolla 1996–2013. Syy-yhteys on yksisuuntainen, kun vastuu korruptioon puuttumisesta on heikosti määritelty. Kaksisuuntaista syy-yhteyttä esiintyy, kun maassa on poliittista epävakautta, väkivaltaa ja terrorismia, hallinto voimakaan poliittinen ja tehoton, sääntely estää yksityisen sektorin kehityksen ja oikeusvaltioperiaatteessa on vakavia puutteita.

Aikaisemmassa tutkimuksessa on laajalti paneuduttu korruption kasvuvaikutuksiin, mutta sen kytkentää taloussuhdanteisiin on tutkittu vähän. Väitöskirjassa asiaa tutkitaan 110 maan aineistolla vuosina 1984– 2011. Tulokset antavat osittaista tukea hypoteesille, että korruptio vähenee noususuhdanteessa, mutta lisääntyy talouden taantumassa. Suhdannevaikutus on erityisen selvä korkean tulotason maissa ja maissa, joissa oikeusvaltioperiaate on vahva. Matalan tulotason maissa ja niissä, joissa oikeusvaltioperiaate on heikko, nousukausi ei välttämättä vähennä (yleensä runsasta) korruptiota eikä laskukausi lisää sitä.

Väitöskirjassa tutkitaan myös korruption vaikutusta talouden kokonaistuottavuuteen. Ideana on, että korruptio voi vaikuttaa talouteen niin sanotun Solow-residuaalin kautta. Asiaa tarkastellaan 90 maan aineistolla vuosien 1996–2014 aikana. Havaintona on, että korruptio alentaa kokonaistuottavuutta, mutta kun verorasituksen vaikutus otetaan huomioon, korruption vaikutus kokonaistuottavuuden kääntyy positiiviseiksi. Toisin sanoen veronkorotukset voivat lieventää korruption tuottavuushaittoja.

Avainsanat: korruptio, byrokratia, talouskasvu, investoinnit, hallinto, suhdannesyklit, instituutiot, kokonaistuottavuus, verotus

CONTENTS

1 INTRODUCTION

1.1 General background

For four decades, the problematic of corruption has been one of the hot topics for researchers in economics. After the 2003 United Nations convention against corruption, which took place in Mérida (Mexico), a total of 140 countries signed cooperation agreements. However, despite being singled out, phenomena linked to corruption tended to increase. It has many aspects and concerns systematically all the countries. Although for some countries the magnitude of corruption appears to be relatively weak, for others it is severe, often leading in the long run to social unrest. Indeed, one of the main arguments highlighted by the well-known 'Arab Spring' was bribing, as well as embezzlement committed by those in power to the detriment of the public. A report from Transparency International (TI) declared that 'corruption is one of the greatest challenges of the contemporary world. It undermines good governance, systematically distorts public policy, leads to a misallocation of resources, deteriorating the private and public sector development and specially affects the poor'.

This doctoral dissertation constitutes an empirical contribution to investigations of the macroeconomic implications of corruption and governance. For many years, studies have agreed that the development of contemporary societies necessarily goes hand in hand with good governance, as well as with effective institutions (North and Thomas, 1973; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu, Johnson, and Robinson, 2001; Mo, 2001; Paul, 2010). In particular, the commonly shared viewpoint is that corruption is detrimental to economic growth and development, as it breaks the fair frame of competition, distorts the markets and hinders investments, among other impacts (Shleifer and Vishny, 1993; Mauro, 1995; Mo, 2001; Egger and Winner, 2005; Virta, 2010).

However, economists claim that government intervention through good regulations prevents market failures and encourages economic performance. Good regulations tend to foster economic development (Djankov, McLiesch, and Ramalho, 2006; Gillanders and Whelan, 2014), increase productivity and output

(Barseghyan, 2008; Aghion, Bundell, and Griffith, 2009), stabilise the macroeconomy (Loayza, Oviedo, and Serven, 2005), promote trade (Freund and Bolaky, 2008) and enhance entrepreneurism (Klapper, Laeven, and Rajan, 2006). Conversely, excessive regulation can stifle economic development, thus raising questions about the appropriate number of regulations that should be applied. For instance, Huntington (1968) cautions against the absence of flexibility often inherent to excessive regulation, then puts forward that '[…] in terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy'.

However, good practices in the conduct of development policies, which include the battle against corruption, stand high on the agenda of International Financial Institutions (IFIs) such as the World Bank or the International Monetary Fund (IMF). These institutions help secure transactions and guarantee high productivity of their loans for economic development.

Notions relative to the quality of governance and corruption are deeply intertwined (Kaufmann, 2005). Khan (1996) defines corruption as 'behavior that deviates from the formal rules of conduct governing the actions of someone in a position of public authority because of private-regarding motives such as wealth, power, or status'. Governance is perceived as institutions and practices by which authority is exercised in a country for the common interest (Kaufmann, 2005). In their theoretical analyses, Banerjee (1997) and Guriev (2004) argue that corruption and poor institutions are the key determinants of existing poor regulations and bad governance (see also Breen and Gillanders, 2012).

A substantial number of studies suggest that corruption is harmful to economic development, as it is commonly known to be negatively correlated with economic growth, investments or welfare (Mauro, 1995; Mo, 2001). Metaphorically, corruption is seen as sand in the wheels of the economy (*Sanding the wheels hypothesis*, SWH). In the same line, Shleifer and Vishny (1993) argue that corruption hampers economic development because of its distortive effects on investments, particularly foreign direct investments. This is also highlighted in the seminal work of Wei (2000). Bliss and Di Tella (1997) in turn argue that corruption encourages monopolies, whose profits are drained by bureaucrats.

As opposed to SWH, an alternative claim, i.e. *Greasing the wheels hypothesis* (GWH), maintains that corruption can have virtues, especially in the presence of more profound distortions in the economy. According to Bardhan (1997), in a second-best world with pre-existing distortions, additional distortions caused by corruption may indeed improve welfare despite absorbing some resources. Accordingly, one might argue that the extent to which corruption affects economic performance is conditional on the quality of institutions, or of governance. In the same line, relatively recent empirical work shows that corruption is even more detrimental to growth in countries with effective institutions; whereas, conversely, corruption shows beneficial effects *vis-à-vis* economic growth when governance is poor (Méndez and Sepúlveda, 2006; Aidt, Dutta, and Sena, 2008; Méon and Weill, 2008; Aidt, 2009).

In spite of arguments in favour of GWH, corruption remains a serious problem. For instance, Myrdal (1968) and Kurer (1993) emphasise bureaucrats' self-interests in the creation of economic distortions. This viewpoint is shared by Kaufmann and Wei (2000), who contend that corruption endogenously leads to poor governance and exacerbates economic distortions. To put it differently, corruption itself causes the second-best world (Djankov, La Porta, Lopez-De-Silanes and Shleifer 2002; Guriev, 2004; Breen and Gillanders, 2012).

The underpinning of this thesis rests on the deep analysis of the Sanding–Greasing the wheels hypotheses. The dissertation is organised as follows: The next sections respectively explore the definitions of key concepts related to corruption; they then analyse its main measurements. The introductory part of the dissertation concludes with summaries of four empirical studies (essays), all of which employed modern econometric methods. The remainder of the dissertation successively presents these studies in detail.

1.2 Definition of key concepts

1.2.1 Definition of corruption

Corruption has increasingly become a fundamental issue, since the importance of the state is increasingly being stressed, with a particular focus on institutions as indispensable actors in economic development. Thus, disciplines such as political science, economics or sociology are becoming increasingly interested in the issues of corruption (Fisman and Golden, 2017).

In the literature, there are several definitions of corruption. For instance, Nye (1967) defines it as 'behavior which deviates from the formal duties of a public role because of private-regarding (personal, close family, private clique) pecuniary or status gains; or violates rules against the exercise of certain types of private-regarding influence'. Khan (1996) moves in the same direction by defining corruption as 'behavior that deviates from the formal rules of conduct governing the actions of someone in a position of public authority because of private-regarding motives such as wealth, power, or status'. The World Bank also uses the same definition, in, however, much simpler terms: 'the abuse of public agent for private ends'. However, according to Rose-Ackerman (1999), it is 'an illegal payment in favour of a public agent to obtain an advantage that may or may not be deserved without reward'. The definition provided by Rose-Ackerman seems to slightly deviate from the perception of corruption as a contract conditioned by an exchange between those involved in corruption. In this case, the reward to be perceived by the corrupt is relative. In other words, one might argue that the present approach relies more on the fact that public service is privatised due to the opportunistic behaviour of the representative of the State. A similar viewpoint is highlighted in the work of Shleifer and Vishny (1993), who perceive corruption under the prism of a sale by a government agent of public authority for personal ends (Thompson, 1993).

Furthermore, Kurer (2005) suggests a more generalised definition, one more common to all societies, while taking into account the main features of the other definitions. To him, corruption is the violation by a public official of non-discriminatory standards for the purpose of obtaining private profit. In this definition, one can see that the focus is more on the infringement act of norms that are fundamentally non-discriminatory in nature. At the same time, this description considerably reduces the complexity and specificity usually associated with the phenomenon. Moreover, it also goes beyond the classical perception of the term, as it generalises the norms, hence including any action contrary to normative requirements regulating the administration. The impartiality principle therefore remains the underpinning of this definition, as it embodies the essence of public services. As a result, several illegal practices are included in the acceptance of corruption, such as bribery, embezzlement, breach of trust, conflict of interest or fraud.

Faced with these multiple forms, de Sardan (1996) uses the term 'complex of corruption'. He defines corruption as a range of illegal practices associated with governmental, parastatal or bureaucratic functions, in contradiction with the ethics of public goods/services, allowing illegal forms of enrichment or the abuse of those positions of power. Such an apprehension of corruption, founded on both the violation of rules governing the conduct of bureaucratic procedures and the non-exclusion principle, is universal and even covers other activities, such as money laundering or insider trading, for example. It applies to any bureaucracy independent of country, region or sector (private or public) – unlike in previous definitions, where one might imagine that corruption is exclusively limited to the clerks of the state. Yet, the private sector also experiences opportunistic behaviours, such as hiring relatives or acquaintances, or giving gifts for contracts (Rose-Ackerman, 1999).

1.3 Forms of corruption

Depending on how it is conducted, corruption may have many facets, as discussed in the previous sub-section. However, it can also be categorised with respect to actors involved in the process – or more specifically, according to the magnitude of power at their disposal due to their hierarchical positions within the administration. To Rose-Ackerman (2002), the consequences of corruption are more or less dramatic in line with the degree to which the actors involved hold more or less important responsibilities. With this classification, which is the most widespread in the literature (Rose-Ackerman, 2002; Amundsen, 1999), one can distinguish, respectively, 'political' corruption and 'bureaucratic' corruption.

Moreover, in addition to the political and bureaucratic categorisation of corruption, Amundsen (1999) theorises the power relationships between the state and society to derive another scheme of corruption. This time, depending on how the act of corruption is planned and especially on who the beneficiaries and victims are, one can also distinguish 'extractive' and 'redistributive' corruption. In a corrupt society, when the balance of power turns in favour of the state (the beneficiary) to the detriment of the society (the victim), extractive corruption occurs. On the other hand, in a corrupt society in which society holds the balance of power to the detriment of the state, redistributive corruption predominates. However, this dissertation only focusses on the former categorisation of corruption.

1.3.1 Political corruption

In the classical sense, political corruption (also called grand corruption) refers to opportunistic behaviours of elected politicians who are popular mandate holders, such as the heads of the state, deputies, senators or other, locally elected officials. In contrast, to Heidenheimer, Johnston and LeVine (1993), political corruption can be defined as a transaction between the non-state sphere and an actor of the public administration within which public authority is oriented toward private interest.

This approach, also in line with the classical definition of corruption, does not specify the appointed or elected status of the actor of the public administration. As a result, following Heidenheimer and Johnston (1993), political corruption would occur when a clerk of the state deviates from the formal rules governing his/her administration against a private agent. In a relatively recent work, one can, however, observe some significant differences in the definition of political corruption. For instance, Transparency International (TI) associates corruption among non-elected senior administrative officials (e.g. ministers, chiefs of staff) to political corruption; hence the Anglo-Saxon name *grand corruption* in reference to the importance of the responsibilities of the participants. According to Méry, cited in de Sardan (1990: 49), political corruption is a sort of social secret sharing by which those in power (political or administrative) receive personal benefits of various kinds due to their mandate or position. One may point out that the present definition slightly deviates from the previous ones, as it specifies the nature of the mandate: administrative or political.

Moreover, note that political corruption comes in many forms, such as bribery, extortion and patronage, all of which have as their objective either obtaining private revenues or controlling economic markets. Here, our discussions focus more on bribery, which seems to be the most common form. In addition to bribery, political extortion may also involve high-level decision-makers. McChesney (1997) provides an example of political extortion: 'politicians [that] may maximize returns by threatening expropriation of existing private rents and then forbear implementation of the threat in exchange for a payoff'. The 'private benefit' of political extortion, however, does not need to be pecuniary; it can be in the form of buying voting support or suppressing future opponents from running in elections. Patronage and nepotism appear to be other forms of political corruption. These forms are most often specific to countries with institutional shortcomings (Alence, 2004); thus, those in power can ensure loyalty around the executive power. However, they may seriously hinder the effectiveness of public policy.

As for the consequences, a consensus exists: they can be dramatic. By example, Rose-Ackerman (2002) concludes that corruption by state senior bureaucrats leads to economic ineffectiveness and significantly affects foreign investment decisions in the country, primarily due to the uncertainty that it encourages. The absence of a threat on investments is likely to encourage investment decisions. Tanzi and Davoodi (1997) also share this analysis. Their empirical investigations conclude that countries with a serious level of grand corruption are also those with low levels of foreign direct investments (FDIs) (see also Bayley, 1966; Myrdal, 1989; Wei, 2000; Egger and Winner, 2005; Aidt, 2009); however, such countries also have a large share of public investments in gross domestic product (GDP) as well as a low quality of infrastructures (Kenny, 2009). Further, Hussain and Faruqee (1994) argue that such an important proportion of public investments can be explained by the flowering of *white elephant* large projects, with very few incidences in terms of economic development. These public investments, arranged by decision-makers, constitute at the same time their own sources of personal enrichment; therefore, they can extract and maximise their rents (Rose-Ackerman, 2002; Nellis and Kikeri, 1989, 2001). In order to monitor such behaviours, Manzetti and Blake (1996) encourage privatisation, which is associated with a competitive system, is less opaque and is subject to market forces instead of discretionary regimes (Manzetti, 1999). However, procedures towards privatisation are also likely to foster attempts at corruption and lobbying (Nellis and Kikeri, 1989; Manzetti and Blake, 1996).

Beyond the economic aspect, and more importantly, political corruption represents a serious threat to the legitimacy of institutional structures, which it progressively destroys (Nye, 1967) – this is facilitated by corrupt officials who violate the law to serve the interests of certain groups rather than those of the entire population. The social injustice created by this situation, in turn, can lead to major social crises, revolts and even military coups (Nye, 1967). All this further contributes to the weakness of a democracy, with possibly detrimental implications for economic development.

1.3.2 Bureaucratic corruption

Originally, the first person to refer to *bureaucracy* was the French philosopher Jean Claude Marie Vincent de Gournay (1712–1759). Etymologically, bureaucracy is composed of two terms: *Bureau*, a French word meaning *desk*, and by extension *office*, including administrative departments in charge of a specific service; and *kratia*, which means power, force or rule. The bureaucracy concept appeared in France just prior to the well-known French Revolution of 1789, and then it spread to the rest of the world (Le Maux, 2006).

In sociology, or in political science, bureaucracy has two meanings. On the one hand, the first understanding, also called the Weberian approach, as influenced by the work of Weber (1922), argues that a bureaucrat is a highly skilled person whose talent is at the service of his/her hierarchy in order to satisfy the collective interest. On the other hand, the second understanding is related to managerial concerns. This understanding sees bureaucrats as private agents who are likely to make decisions according to their own preferences (Krueger, 1974; Brennan and Buchanan, 1980). The rationale for this alternative approach is that even though bureaucrats are mandated to make decisions with respect to collective interest, they likely deviate from this formal duty by prioritising choices that first maximise their own salaries, perquisites, power, honours and authority (Wyckoff, 1988a, 1990). This understanding is the most common in the economic sciences.

Moreover, the main actors of bureaucratic corruption are appointed administrators whose role is to implement government policies. In this case, the corrupt official has the resources of power and can opportunistically exploit them if there is no effective control from the hierarchy. Following Rose-Ackerman (1998), bureaucratic corruption can therefore be described as 'corrupt acts of appointed bureaucrats in their dealings with either their superiors (political elites) or with the public'.

Bureaucratic corruption, which mainly involves the use of bribery, is also referred to as petty corruption, due to the low-level officials involved in the activity (Rose-Ackerman, 1998; Leff, 1964). It is mainly explained by the lack of high wages in exchange for labour. Thus, with the need to compensate for low remuneration, the bureaucrat may resort to backhanded deals (Mauro, 1998). Ehrlich and Lui (1999), in addition, argue that when bribery levels are high or the probability of detection and fines is low, the salaries necessary to eliminate corruption are high. This may explain why, in poorer countries, corruption is generalised and difficult to eliminate.

The literature identifies three main ways through which the bureaucrat can become corrupt. The corrupt official can act on economic markets by using bribes to make supply and demand equal (Ackerman, 1998). Put differently, in the public procurement framework, the criterion for winning a permit or contract is neither talent nor efficiency, but rather the highest bidder in terms of the bribe (Cadot, 1987; Mishra, 2006; Jain, 2001). Such a method seriously hampers competition and its legitimacy. Another means of corruption relates to receiving payments as a pledge to expedite the administrative process. Moreover, for corrupt bureaucrats, it is not uncommon to bribe in order to reduce or set aside a criminal sentence, or even to lower costs (Ackerman, 1998).

Even though this type of corruption primarily involves low-level officials, its aggregate effects in a country negatively influence overall socioeconomic development, diminish public sector effectiveness and hinder private sector development (Thompson, 1995; Knack and Keefer, 1995; Khan, 2002). In particular, Mauro (1995) shows that corruption is negatively associated with investment ratio and economic growth (Swaleheen, 2011; Mallik and Saha, 2016; Kim, Ha, and Kim, 2017).

However, although the harmful effects of corruption are not in dispute, it has also been demonstrated that bureaucratic corruption can boost the productivity of the economy by reducing *red tape*. For investors, less time spent in the queue dealing with bureaucratic procedures also means fewer barriers to investments, and thus more incentive to invest, all things being equal. Aside from acting as an incentive for bureaucrats to speed up administrative process, bureaucratic corruption has also been shown to increase the productivity of capital. For instance, Leff (1964) argues that the readiness to bid a bribe is associated with individual skills and talent, with the implication that licenses tend to be allocated to the most efficient firms (Méon and Sekkat, 2005). Beck and Maher (1986) show that, in a bribery game in which licenses are illicitly issued to the firm bidding the highest bribe, the lowest-cost firm always wins the game. That is, corruption enables the imperfectly informed bureaucrat to choose the best potential investment, with due effects on the proper allocation of capital. This is in line with an original idea by Leff (1964): ‘if the government erred in its decision, the course made possible by corruption may well be the better one’.

1.4 Measurements of corruption

Two main indices of corruption appear to be the most frequently used in the empirical work: the Corruption Perception Index (CPI), published by Transparency International (TI), and *Control of Corruption* (CC), computed by a team of researchers led by Daniel Kaufmann at the World Bank (WB) through the Worldwide Governance Indicators (WGI).

Both indices are constructed on the basis of methodologies that assess subjective opinions about how corruption is perceived in various countries. In order to reduce measurement error, both indices attempt to average different sources, and they both use similar and intertwined sets of inputs (Treisman, 2007). The sources include surveys of international or domestic businesspeople, public sector organisations, non-government organisations, country risk ratings provided by business consultancies, and polls.

Statistics from the CPI have been published annually since 1995, in 54 countries. They have, over time, covered an increasing number of countries and territories around the world, with 176 in 2016. Since 2012, the CPI has applied a two-step method summarised through the following formula: $((\frac{x_i - mean(x)}{std(x)}) \times sign \times 20 + 45$. All the sources are standardised by subtracting the mean of the data and dividing by the standard deviation (*std*). They are then readjusted such that the mean and the standard deviation respectively equal 45 and 20 (TI, 2012a). The final index varies between 0 to 100, with 0 standing for the utmost perceived corruption, and 100 indicating full integrity.

Since its first publication in 1996, CC has covered a much broader number of countries and territories: from 204 countries and territories in 1996 to 214 in 2016. The data were bi-annually published between 1996 and 2002, and then made available for subsequent years. The WB applies an Unobserved Component Model (UCM) (Kaufmann, Kraay and Mastruzzi, 2006) in which corruption is approximated as a linear function of unobserved corruption g, in a country j, and a disturbance u. The formula then reads: $y_{ik} = a_k + b_k(g_i + u_{jk)}$; thus, the observed score y of corruption in a country j depends on the value of the unobserved corruption g (or any other governance variable available in WGI) in country j and an error term u. The parameters a and b are used to rescale the data from each source into common units. The standardised indices lie between -2.5 and 2.5, with the lower bound meaning utmost corruption and the upper bound standing for full integrity.

Both indices have strengths and weaknesses. Regarding the construction of their indices, TI takes into account countries and territories for which there are at least three component ratings. While this may be restrictive in terms of countries covered (especially in the first years of publication), it provides more precision and seems relatively robust. TI essentially uses the averages of standardised values and adjusts them to reduce sensitivity to changes in the surveys and countries (Treisman, 2007). As opposed to the CPI, in the case of CC, each country with at least one component rating can be included; however, this entails the possible consequence of a lack of precision.

Moreover, the CPI and CC indices display a comparative deficit problem. The standardisation, which places different indicators on a common scale, does not promote the detection of changes over time. Comparing scores or rankings across years would not make sense, as their variations are also explained by adding a new source or dropping an outdated one in the calculation of the index (Andvig, Amundsen and Søreide, 2000).

Accordingly, from 2012, TI (2012b) significantly amended its methodology by aggregating data from each of the data sources, including just one year's data from each data source. As a result, 'any change from year to year in the raw scores will therefore be translated into a change in the rescaled score from that data source' (TI, 2012b). More generally, Arndt and Oman (2006) point out the likelihood of the correlation of errors among sources of WGI (see also Kurtz and Shrank, 2008). Although the WB clearly rejects these criticisms, labelling them as either 'conceptually incorrect or empirically unsubstantiated' (Kaufmann, Kraay, and Mastruzzi, 2007), it does, however, recognise, alongside TI, the need to further examine both conceptual and methodological constraints.

Furthermore, both corruption measurements attempt to estimate the degree of precision of each country's rating. For the CPI, using a bootstrap methodology, the standard errors associated with countries are very different, suggesting a lack of consensus about the level of corruption. Likewise, for the CC, the standard errors resulting from the estimation of the UCM tend to decrease with the number of sources available (Treisman, 2007). Regarding the CC, Lambsdorff (2006) argues that using sources such as Global Insight (Standard and Poors/DRI), International Country Risk Guide (ICRG) or Business Environment Risk Intelligence (BERI) can be problematic. In particular, the first two sources assess the potential political risk of corruption in a country, while the third source adopts a definition of corruption considered 'inappropriate' because it uses 'mentality' as one of the criteria for measuring the level of corruption in the country.

However, although the CPI and CC differ with respect to methodologies employed and sometimes sources, they nevertheless remain highly correlated (e.g. r = 0.96 in 2002, r = 0.98 in 2004, 2013). Alongside TI and WB, Political Risk Services (PRS) also produces cross-national corruption ratings (ICRG). Its statistics have the advantage of being systematically available since the early 1980s. Being itself a source for the CC, ICRG unsurprisingly displays a strong correlation with the CC (r = 0.84 in 1996), as with the CPI (r = 0.88 in the same year).

Although widely used in research, subjective-based indices generally face many criticisms. Undoubtedly the most obvious of these is that perceptions of corruption do not measure corruption itself but only opinions about how people perceive corruption in the country (Treisman, 2007). Since these opinions are not built on facts, they could simply be wrong. Some studies argue that many cognitive biases can affect the perception of corruption. First, interviewees' responses about their perceptions of corruption may be affected by the 'bandwagon effect'. This means that their perceptions may tend to agree with common – i.e. majority – perceptions about corruption in a given country (Sequeira, 2012). Media, government anti-corruption campaigns, politically motivated denunciations by political opponents, and pressure groups significantly help in the construction of such opinions.

The second cognitive bias is the 'halo effect', which refers to the tendency to associate corruption with a lower standard of development (Sequeira, 2012). In line with this idea, Treisman (2007) argues that ratings by commercial risk-rating agencies and experts might disproportionately evaluate corruption in a non-realistic way, on the basis of their greater familiarity with certain cultures or their preconceptions that corruption is higher in underdeveloped countries, and lower in developed countries (Glaser, La Porta, Lopez-de-Silanes and Shleifer, 2004).

As Treisman (2007) points out, another source of bias in perceived corruption is related to the fact that cross-national differences in data can also reflect differences in the extent to which people identify with their government, in the extent of social and economic injustice, and in the degree of cynicism and opportunism among politicians in the society. This can be confusing, even puzzling, as at the same time, studies have used these statistics to examine the links between social trust, inequality and democracy on the one hand, and corruption on the other.

Another factor that calls into question the validity of subjective-based indices relates to their sources, which sometimes measure quite different things, thus making their aggregation inconsistent. This is evidenced through the sheer variety of both questionnaires and their respondents. Some surveys, for instance, focus on the size of bribes, while some ask about their frequency; others examine the relative seriousness of the problem, still others the burden that it imposes on the economy. In terms of scope, some capture low-level administrative corruption, whereas others have a narrow, regional or even worldwide focus. Furthermore, other assessments include 'dirty' political behaviours.

At the same time, respondents include country inhabitants, western experts or pools of international business agencies. Given this 'confusion', it becomes difficult to say exactly what the resulting indices actually measure. Besides, it appears that 'most factors that predict perceived corruption do not correlate with recently available measures of actual corruption experiences' (Treisman, 2007).

1.5 Summary of the essays

This doctoral dissertation represents an empirical contribution to investigations of the economic implications of corruption at the macroeconomic level. The literature review clearly shows two main views on the impact of corruption on economic performance. In fact, conventional wisdom indicates that corruption is detrimental to growth and economic development, as it does not foster a fair frame of competition, which in turn distorts markets (Shleifer and Vishny, 1993; Mauro, 1995; Knack and Keefer, 1995). For advocates of such a claim, corruption is metaphorically like sand in the *wheels* of the economy. And yet, marginal but appealing counter-arguments hypothesise that corruption may have virtues, since it may help to remove some pre-existing distortions (Leff, 1964; Huntington, 1968; Bardhan, 1997; Méon and Sekkat, 2005). Corruption is, in this view, considered an efficiency-enhancing factor, one which metaphorically lubricates the *wheels* of the economy.

Basically, much of this dissertation is devoted to this debate. Another part of the work assesses the cyclical behaviours of corruption, after which it measures how corruption could impact productivity. To examine these issues, four essays were developed with the aim of empirically checking specific hypotheses. Beforehand, the dissertation, in its introductory section, shed some light on the concept of corruption by reviewing its general background, definitions of key concepts and measurements of corruption. The setting will be finally completed with the summaries of the essays. The second part is devoted to the four essays.

1.5.1 Essay I. Corruption and governance – Sand or grease in the wheels?

In the analysis of the impact of corruption on economic performance, most studies determine corruption to be detrimental to economic activities and economic development (Shleifer and Vishny, 1993). Mauro (1995) and Knack and Keefer (1995) are known as pioneering studies that provided empirical justifications for this hypothesis. Subsequent contributions, such as Brunetti and Weder (1998) or Mo (2001), also go in the same direction, concluding that corruption hinders economic growth (Mallik and Saha, 2016). Regarding the correlation with investment, studies show that corruption also tends to reduce capital stock (Hines, 1995; Wei, 2000; Paul, 2010). These sceptical views suggest that corruption is like sand in the *wheels* of economies, hindering their good performance and *in fine* their development (i.e. *Sanding the wheels hypothesis* (SWH)).

Alternative studies, however, suggest that corruption nevertheless has virtues in some circumstances. The premises of the 'efficient corruption' theory are put forward in Leff (1964), Leys (1965) and Huntington (1968). They claim that corruption might be beneficial in the presence of distortions caused by poor governance, or by ineffective institutions. The major underpinning of this hypothesis is that inefficient bureaucracy constitutes a serious obstacle to investment (Beck and Maher, 1986; Méon and Sekkat, 2005; Méndez and Sepúlveda, 2006). Inefficient bureaucracy, for instance, includes rigidity, tediousness, sluggishness or *red tape* within the administration. In those circumstances, bribes may act as lubricants to ease, or eventually boost, the functioning of a bureaucracy in the grips of inefficiency (hence, *Greasing the wheels hypothesis* (GWH)). According to this view, Bardhan (1997) therefore concludes that in a second-best world with pre-existing distortions, additional distortions caused by corruption may indeed improve welfare despite absorbing some resources.

The first article examines the validity of GWH. Following the empirical investigations conducted by Méon and Sekkat (2005), this study tests the effect of corruption on changes in the real GDP per capita growth of 99 countries worldwide, over a time span of 2006–2014. In addition, four dimensions of governance are adopted in order to capture the quality of institutions: *Political instability and violence/terrorism*, *Government inefficiency*, *Regulatory burden* and the absence of *Rule of law*.

In order to capture the extent of corruption, the empirical investigations focus on data from the factors *Bribe incidence* and *Bribe depth*. Notably,unlike perception-based indices, these factors are based on facts. More specifically, *Bribe incidence* measures the proportion of firms experiencing at least one bribe payment request out of six transactions dealing with utilities access, permits, licenses and taxes. *Bribe depth*, on the other hand, captures the percentage of transactions whereby a gift of informal payment was requested, again out of six transactions dealing with utilities access, permits, licenses and taxes. Their respective statistics were generated from surveys of more than 131,000 firms from 139 countries worldwide. These statistics have been available since 2006 through the Work Bank Enterprise Survey of Business Managers (World Bank Group).

Regarding the effects of bad governance on economic growth, our findings show that a politically unstable environment with omnipresent violence and terrorism reduces economic growth. Likewise, a public administration of poor quality with a strong influence of the political system, or inefficient public policies with a weak government, also tend to affect the growth of the economy. The study also provides substantial evidence that the economy is impacted when governments fail to formulate effective policies, including implementing regulatory mechanisms to promote the development of the private sector. Finally, our data suggest that flaws in terms of rule of law that question the security of the economic environment also negatively affect economic growth.

As for testing the validity of GWH, we found that corruption clearly reduces per capita GDP growth in the presence of political instability and/or violence/terrorism. In such a context, corruption becomes increasingly costly to the economy, as it amplifies the negative effect of the instability on the GDP. This is consistent with the alleged *sand* effect of corruption (SWH). However, our investigations show that corruption becomes more virtuous in the presence of inefficient public policies and the absence of sound policies or a regulatory framework to support private sector growth. Likewise, the data again point to the beneficial effects of corruption on growth when the quality of rule of law is poor. In both cases, in addition to its positive effect on economic growth, corruption clearly alleviates the cost of institutional distortions on growth – which is the strict definition of the *grease* effect (GWH).

1.5.2 Essay II. Testing for Granger causality between corruption and governance

Promoting good practices in the conduct of development policies, i.e. the battle against corruption, stands high on the agenda of international financial institutions such as the World Bank (WB) or the International Monetary Fund (IMF). Government intervention to guarantee the good quality of regulation may significantly help in preventing market failures while also encouraging economic performance (North and Thomas, 1973; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu, Johnson, and Robinson, 2001). While suitable regulations seem to have positive economic implications (Gillanders and Whelan, 2014) on the one hand, excessive regulations on the other are likely to stifle economic development, as they could be the source of *red tape* and disproportionate bureaucratic delays, which could in turn pave the way for further corruption.

We hypothesise that an endogeneity problem may exist between corruption and poor regulation. On the one hand, governmental ill functioning, such as lags in allotting licenses and permits, lack of information, *red tape* and sluggish administration, are all likely to encourage corruption (Leff, 1964; Huntington, 1968; Acemoglu and Verdier, 1998; Mo, 2000; Méon and Sekkat, 2005). Conversely, one might also imagine that opportunistic bureaucrats deliberately create distortions in the administration in order to raise motives for bribery (Myrdal, 1968; Murphy, Shleifer, and Vishny, 1993; Kurer, 1993; Kaufmann and Wei, 2000).

In order to assess a possible causal link between corruption and governance, the dissertation applies the empirical technique developed by Granger (1969). Panel data from 117 countries worldwide over the 1996–2013 study period was used. Five governance dimensions were captured, including *absence of Voice and accountability; Political instability and violence/terrorism*; *Government inefficiency*; *Regulatory burden*; and *absence of Rule of law*.

Our investigations uncovered a unidirectional causal link from the deterioration of the quality of *absence of Voice and accountability* (i.e. citizens' ability to select their government, and freedom of expression, association and media) to increasing corruption.

Moreover, a strong bidirectional causal link clearly emerged for the relationship between corruption and the remaining governance variables (i.e. *Political instability and violence/terrorism:* the likelihood that the government will be destabilised or overthrown by unconstitutional means, including politically motivated violence and terrorism; *Government inefficiency:* quality of public services, independence of civil servants from political pressures, quality of policy formulation and implementation, and government commitment to policies; *Regulatory burden:* government's ability to implement policies and regulations that promote private sector development; *Absence of Rule of law:* agents' confidence in the rules of society, the quality of contract enforcement, property rights, police and courts, and the likelihood of crime and violence).

Our investigations show to some extent how much corruption can be difficult to pinpoint. While economic reasons seem to be the mainstream, the results highlight the fact that corruption strongly challenges the field of governance too. Moreover, interestingly, the empirical analyses yield the 'bad governance–corruption–bad governance' vicious circle. Given the connection between ill-functioning institutions and the economic sphere, one may easily understand that the battle against corruption is not led solely on the economic terrain alone.

1.5.3 Essay III. Do business cycles trigger corruption?

Although multiple studies have unambiguously found that corruption is negatively associated with income (Mauro, 1995; Knack and Keefer, 1995; Mo, 2001), little is known about its possible cyclical effects. Yet, economic disruptions exist and are inherent to economic activities. In the financial field in particular, cycles are often considered to be provoked by human opportunistic behaviours, also referred to as *Animal spirit*. Akerlof and Shiller (2009) claim that this would constitute a powerful psychological force, one that leads to disturbances at any given interval of time. However, the original idea, which highlights the existence of corruption dynamics (Minsky, 1975, 1986), comes from Keynes (1936).

More specifically, this paper empirically tests the proposition by Galbraith (1997) that '[…] At any given time there exists an inventory of undiscovered embezzlement in – or more precisely not in – the country's businesses and banks. This inventory – it should perhaps be called the bezzle – amounts at any moment to many millions of dollars. It also varies in size with the business cycle. In good times, people are relaxed, trusting, and money is plentiful. But even though money is plentiful, there are always many people who need more. Under these circumstances the rate of embezzlement grows, the rate of discovery falls off, and the bezzle increases rapidly. In depression all this is reversed. Money is watched with a narrow, suspicious eye. The man who handles it is assumed to be dishonest until he proves himself otherwise. Audits are penetrating and meticulous. Commercial morality is enormously improved. The bezzle shrinks'.

To put it simply, Galbraith (1997)'s assertion suggests that corruption conditions business cycles in such a way that, during economic booms, corrupt practices are more pervasive in society, while periods of recession, on the other hand, coincide with a decline in those types of behaviours. The study by Gokcekus and Suzuki (2011), which was based on 39 countries worldwide for the 1995–2007 period, confirms this theory.

The dissertation tackles the issue differently. Following the mainstream reasoning that corruption tends to spread in low-income contexts, one may also assume that economic booms, which are basically associated with increases in income, revenues or profit, could at the same time foster more integrity. On the other hand, during recessions, when economic benefits usually decline, one could presume that economic agents would engage in corrupt activities to compensate for the loss resulting from the decline in income-generating activities. Such analyses fundamentally go against Galbraith's assertion.

Following Gokcekus and Suzuki (2011), the study basically estimates two econometric models. First, corruption is estimated with respect to permanent income with the aim of capturing the long-term correlation between both variables. Second and most importantly, in order to determine whether there are any cyclical behaviours in corruption, changes in corruption indices are estimated with respect to transitory income.

Data on the risk of corruption were derived from the International Country Risk Guide (ICRG) dataset, and the study covered a total of 110 countries worldwide for the 1984–2011 period.

For the first model, the paper verifies the findings of Gokcekus and Suzuki (2011) and those of most empirical research on the issue: an increase of permanent income tends to reduce corruption.

For the second model, the study contradicts Gokcekus and Suzuki (2011). The results show that short-term fluctuations in income are positively correlated with integrity. That is, economic booms reduce corruption, while recessions trigger it. Our conclusion remained unchanged when the estimations strictly focused on countries covered by Gokcekus and Suzuki (2011), or when an alternative corruption measure (*Control of Corruption* (CC), from the Worldwide Governance Indicators (WGI) dataset – World Bank) was adopted.

Moreover, we dig further by considering a sample split with respect to income and the quality of rule of law. Again, our previous conclusion about the cyclical behaviour of corruption still holds. More specifically, most democratic countries, or richest countries, seem to be more sensitive to business cycles. For these countries, the growth of income-generating activities may significantly help in reducing corruption habits, and economic crises constitute an important risk for more corruption. Meanwhile, such sensitivity is very low in less democratic countries, or in poor countries – which means that expansion cycles do not necessarily yield a significant decline in corrupt practices, nor do recessions generate significant additional corruption.

Of course, this does not mean that less democratic countries, or poor countries, experience low levels of corruption – actually, it is quite the opposite. The very low elasticity could be explained by the strong corruption habits in these societies, in such a way that low income or the absence of accountability contexts, seen as natural triggers of corruption, become 'ineffective' in amplifying it further.

1.5.4 Essay IV. Does corruption affect total factor productivity? An empirical analysis

Nowadays, the issue of how corruption impacts economic activities has been explored in a significant number of studies (Mauro, 1995; Knack and Keefer, 1995). However, most seemed to concentrate on the effects of corruption on economic growth (Mauro, 1995; Mo, 2001) or investment (Mauro, 1995; Wei, 2000).

In particular, the influence of corruption on productivity (Lambsdorff, 2003) has received little attention, even though such a focus could be useful in many regards. Studies show that investment does not in itself suffice in explaining growth (Easterly and Levine, 2001; Caselli, 2005). Furthermore, productivity-based analyses have put forward that efficiency employed to transform the inputs to some extent explain economic growth (Hall and Jones, 1999). Such an efficiency is conditioned by countries' institutions, government policies and innovation. Its contribution to growth (total factor productivity (TFP), or Solow residual) symbolises the deviation between the observed output and that forecasted through human and physical capital.

Many empirical studies highlight the integrality of TFP to economic growth (Solow, 1956; Swan, 1956). By example, the quantitative analysis of Abramovitz (1956) indicates that the growth of factors of production contributed only 10% of the output growth per capita in the US during 1869–1878 and 1944–1953, which suggests that 80% of the growth came from TFP. The survey from Solow (1957), covering 1900–1949, also points out that the output growth per worker explained by capital accumulation is only 12%. Such a finding also points to the significant contribution of TFP to growth. The empirical investigations of Baier, Dwyer and Tamura (2006), while confirming earlier studies regarding the meaningful contribution of TFP to growth, also indicate that the variation in output per worker is more sensitive to variations in TFP than to variations in classical factors.

In line with Olson, Sarna and Swamy (2000), we assume that corruption could therefore channel TFP to impact growth. The foundation of this study rests on the extent to which corruption could affect TFP. In addition, we checked the possible consequences of tax burden on this possible link. Capturing the effect of tax burden might be interesting. The paper assumes that if there is any influence, it will be conditional on countries' willingness to evade taxes as a response to tax rate increase. For instance, without tax evasion, we assume that tax burden may alleviate the negative effect of corruption on TFP. More tax revenue might enable countries to invest more and invest better, e.g. by financing changes in production technology, encouraging innovation, allowing for efficiency gains and allowing for a good quality of government policies and institutions, thus increasing future production capacity. If, in contrast, an increase in taxes leads to tax evasion, this clearly would exacerbate corruption (Alm, Martinez-Vasquez and McClennan, 2016).

The empirical study was based on 90 countries worldwide over a time span of 1996–2014. Data on corruption are relative to the Corruption Perception Index (CPI) provided by Transparency International (TI). The findings show that corruption, like tax burden, has a negative effect on TFP. When TFP is exclusively estimated with its lagged variable and corruption, the regressions indicate that a one-unit increase in the corruption standard deviation leads to a decrease in productivity of 0.04%. With the influence of tax burden, the overall effect of corruption on TFP becomes positive, demonstrating that tax rate increases alleviate the negative consequences of corruption on productivity. Robustness tests, including additional determinant variables of productivity, do not change this finding.

Our investigations recommend that optimal taxation and the efficient use of tax revenues both constitute useful instruments for monitoring corruption efficiently. As such, they may encourage economic progress. Their mishandling however, could exacerbate corruption and therefore affect their economic role for the community.

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2 ESSAY I. CORRUPTION AND GOVERNANCE – SAND OR GREASE IN THE WHEELS?

KOURAMOUDOU KÉÏTA

ABSTRACT

Conventional wisdom holds that corruption is a major obstacle to economic development. A significant number of empirical studies find corruption detrimental to growth, thus regarding corruption like sand in the 'wheels of the economy'. However, though such a conclusion is widespread in textbooks, alternative claims have at the same time found that corruption can be beneficial in circumstances where governance is badly malfunctioning ('grease' the wheels hypothesis). To check the validity of the 'grease' hypothesis, the study develops a non-linear growth model over a study period of 2006–2014. Country-level data from 99 countries worldwide are used. The empirical results show that governance indicators have a negative effect on the real GDP per capita growth. However, the conclusions as to the effect of corruption on the growth of the economy are mixed. When the level of political instability, violence and terrorism is high, corruption reduces economic growth. Notably, corruption seems to exacerbate the negative effects of such bad governance on growth. On the other hand, the findings surprisingly indicate that corruption has a positive effect on growth when the quality of public administration is poor with strong political pressure and inefficient public policies. The same conclusion holds when the private sector regulatory framework is deficient, or when the quality of rule of law is poor. In those cases, corruption actually reduces the respective costs of poor governance for economic growth.

Keywords: corruption, governance, growth, investment

JEL classification: D73

2.1 INTRODUCTION

On the issue of corruption, conventional (global) wisdom unanimously suggests that it must be fought. Quite commonly, governments announce measures to combat corrupt practices, sometimes without real conviction; political opponents almost systematically put this struggle on their agenda, sometimes for electoral reasons only; the media also denounce corruption scandals. For international organisations (e.g. the UN, the IMF, the World Bank or the OECD), the battle against corruption stands high on their agenda (e.g. the 2009 Anti-Bribery Convention, the 2003 Convention against Corruption). Thus, the question of whether corruption is beneficial or harmful to economic activities may seem inappropriate, even cynical, at first sight.

The economic literature on the impact of corruption on economic activities is very extensive. Most studies are opposed to corrupt activities, which they consider to hinder the growth and economic development of countries (Shleifer and Vishny, 1993). Mauro's (1995) pioneering study provides empirical justification for this hypothesis. Making use of an older corruption index from Business International, Mauro found a negative relationship between corruption and the ratio of investment to GDP, which in turn influences economic growth. Studies like Keefer and Knack (1995), Brunetti and Weder (1998) and Mo (2001) also confirm this finding, while the conclusion of Hines (1995) and (Wei, 2000) is that corruption considerably alters countries' ability to attract foreign capital (Egger and Winner, 2005). Tanzi and Davoodi (1997) emphasise that high corruption is correlated with a bad quality of infrastructures.

In contrast, other studies suggest that corruption can nevertheless have virtues. The premises of the efficient corruption theory are put forward in Leff (1964), Leys (1965) and Huntington (1968). Overall, they claim that corruption might be beneficial in the presence of distortions caused by ineffective institutions. The conceptual analysis undertaken in Bardhan (1997) illustrates the historical context in Europe and the US where corruption significantly allowed the development of entrepreneurship. Bardhan argues that in a second-best world with pre-existing distortions, additional distortions caused by corruption may indeed improve welfare despite absorbing some resources. Beck and Maher (1986) also maintain that corruption may improve efficiency within a bureaucracy. The most widespread argument about the possible beneficial side of corruption is the famous 'grease the wheels' hypothesis (GWH). Its justifications are based on the idea that inefficient bureaucracy constitutes a 'bottleneck' for investment that money helps remedy ('grease'). In other words, bribes act as lubricants to ease, or eventually boost, the functioning of a bureaucracy in the grips of inefficiency.

However, studies that are sceptical about the presumed beneficial effects of corruption invoke the 'sand the wheels' hypothesis (SWH). SWH argues that corruption can endanger investment and growth. It is important to clarify that SWH is not radically inconsistent with the perspective of GWH, which clearly suggests that corruption may be beneficial in countries displaying shortcomings in other aspects of governance but remains detrimental when such for countries that do not experience deficient governance. Various studies have tested the effect of corruption on economic performance; with, however, mixed conclusions. Likewise, various studies have produced mixed results when assessing the relative veracity of GWH or SWH.

Mauro (1995)'s empirical approach evaluates the hypothesis against two samples (high *red tape* and low *red tape*) – however, it fails to show a significant difference between the two regimes of *red tape*. Using firm-level data, Kaufman and Wei (2000) assess the impact of bribes on administrative delays and determined that firms that pay more bribes are also those that spend more time negotiating with local administrations, a finding which drastically contrasts with the 'grease' money idea. The investigations of Méon and Sekkat (2005) to a large extent reject the alleged beneficial effects of corruption as suggested by GWH. Making use of a set of governance variables computed by the World Bank, Kaufmann, Kraay and Zoido-Lobaton (1999) determine that weak rule of law, inefficient governance or political violence contribute to exacerbating the detrimental effect of corruption on investment. Their findings further indicate that corruption diminishes growth more so in economies facing both weak rule of law and an inefficient government. Méndez and Sepúlveda (2006) estimate a quadratic model to examine the impact of corruption on growth with respect to different political freedom regimes. Broadly, their result argues for the existence of a growth-maximising level of corruption, thereby lending support to GWH. More specifically, corruption tends to have a beneficial effect on long-run growth in countries with a low degree of political freedom, whereas such an effect is negative in high political freedom frameworks. Méon and Weill (2008) also find strong evidence in favour of the efficient corruption theory. For each of the five dimensions of governance that they empirically examine, GWH holds (Cooray and Schneider, 2018). Moreover, Aidt, Dutta and Sena (2008) apply a non-linear technique that allows for the threshold effect, leading to mixed results. Their conclusion corroborates the argument that corruption hampers economic growth in countries with high-quality institutions; however, when the focus is on low- quality institutions, no statistical relevance can be found in their estimates. Although the list of empirical studies that test GWH against SWH is not exhaustive, those mentioned in this discussion are sufficient to highlight their respective controversies.

This study estimates the validity of GWH under the angle adopted in Méon and Sekkat (2005). Based on the four dimensions used in their empirical analysis, this work finds that corruption tends to reduce both changes in the real GDP per capita and capital stock. In addition, substantial evidence exists in favour of the 'greasing' effect of corruption. In fact, when the quality of rule of law decreases, corruption tends to be less detrimental to economic performance. In extreme cases of such governance deterioration, corruption clearly has a positive effect on the real GDP per capita and investment.

The rest of this study is organised as follows: *Section 2* undertakes a brief review of the literature on both claims. *Section 3* is devoted to describing the empirical methodology and data. The estimation results are reported and discussed in *Section 4*, while *Section 5* exclusively focuses on the empirical testing of GWH. The general conclusion of the study is presented in *Section 6*.

2.2 LITERATURE REVIEW OF GWH *VERSUS* SWH

The theoretical underpinning of the 'grease the wheels' hypothesis is that corruption may coexist with a poor quality of governance and even alleviate the consequences of such poor quality. While the 'sand the wheels' hypothesis claims that although corruption can be beneficial, it tends to generate additional costs in the same circumstances. Here, the core of the argument rests on the existence of these costs.

Concerning aspects of governance that corruption is likely to grease or sand, the literature mainly identifies the ill functioning of bureaucracy, and the other aspect focuses on the policy options by public authority.

Concerning bureaucratic ill functioning, due attention is paid to its slowness in procedures relating, for instance, to the negotiation of licenses, permits or signatories. Relatively long administrative delays are seen as the basis of the distortions and inefficiency of bureaucracy. Huntington (1968) summarises this as follows: '[…] in terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy'. According to some economists, corruption may considerably alleviate these distortions and make the bureaucracy more efficient (Méon and Sekkat, 2005). By example, the equilibrium queuing model of Lui (1985) shows that bribes may significantly lessen the time spent in queues, and therefore also reduce bureaucratic inefficiency. Leys (1964) suggests that corruption helps speed up processes in an otherwise sluggish administration. According to Aidt (2009), this stimulates the economy because investment is encouraged by relatively easy access of firms to the market.

On the other hand, a counterargument to the presumed existence of the distortions that corruption is postulated to reduce is highlighted in studies like Myrdal (1968), Kurer (1993) and Kaufmann and Wei (2000). They emphasise the bureaucrats' self-interest in the creation of distortions that would otherwise not appear (Reinikka and Svensson, 2004; Li and Wu, 2007; Pande, 2008; Rosenbaum, Billinger and Stiglitz, 2013). In other words, corrupt bureaucrats see these bottlenecks in the administrative machine as opportunities to extract rents; they therefore have a motive to amplify them to benefit even more. This claim is consistent with the point made by Kaufmann and Wei (2000) that corruption endogenously leads to poor governance and exacerbates associated distortions. Mankiw and Whinston (1986), however, seriously question the entry of firms in the market and its possible implications. They instead demonstrate that marginal entry is gainful to the entrant but causes an output reduction in other firms. Consequently, such a process is ineffective in terms of welfare. This viewpoint is also supported by Rose-Ackerman (1997), who suggests that when a firm is the higher bidder and pays the highest bribe, the quality of future produced goods will be compromised.

Another important argument in favour of corruption is related to its possible role in enhancing the quality of civil servants. For instance, Leff (1964) shows that licenses tend to be allocated to the most efficient firm. He then argues that the willingness to offer a bribe is associated with talent, suggesting in parallel that corruption may have a positive impact on the productivity of capital. Furthermore, using a bribery game model, where permits are illicitly issued to the private firm bidding the highest bribe, Beck and Maher (1986) conclude that, under incomplete information, the lowest-cost firm always wins the license. These works implicitly suggest that in circumstances in which officials do not have sufficient information to evaluate the quality of bidders, and thus potential investments, corruption facilitates the right decision. This is in line with Leff (1964)'s idea that 'if the government erred in its decision, the course made possible by corruption may well be the better one'. In contrast, Kurer (1993) attempts to deconstruct such an opinion, emphasising the costs of corruption in terms of the quality of officials, and of public services. Namely, he stresses the fact that corruption can prevent people (especially competent people) from accessing key positions at their level of competence. Likewise, corruption can negatively affect the normal provision of public services. For instance, such a provision can be opportunistically rationed in line with the expectations of the highest bidder.

Regarding the other aspect of governance, studies argue that bribery can help reduce risks in the economic environment. Consistent with this contention, Amundsen (1999) recalls that in the *Neo-patrimonialism*[1] political systems, individuals use corruption as a hedge to guard against expropriation or violence from higher decision-makers. Since corruption reduces those risks, it may thereby increase investments, which become less risky (Bayley, 1966). Furthermore, Nye (1967) stresses that bribery may also contribute in stabilising the political environment because it facilitates citizens' access to scarce services that they otherwise would not receive. This would to some extent increase their confidence in the political institutions they rely on to satisfy their needs. However, one may have some doubts regarding this reasoning, as corruption-tainted contracts can easily be questioned when exposed. According to Campos, Lien and Pradhan (1999) and Lambsdorff (2003), the unpredictability of the corruption environment constitutes a real risk that is not reassuring for capital inflows and investment. Bardhan (1997) also argues that the uncertainty inherent to corruption-tainted agreements may affect the possible 'grease' money effect.

[1] *Neo-patrimonialism*: In political science, *neo-patrimonialism* refers to a political system whereby the chief executive exercises authority through personal patronage instead of law or ideology. Such practices are observed in non-democratic and semi-democratic regimes and are characterised by pervasive patron–client structures, with no distinction between public and private, and political weakness (Amundsen, 1999).

2.3 METHODOLOGY

2.3.1 Model

As discussed in the above sections, the 'grease' effect hypothesises that corruption might be beneficial in the presence of ill functioning in other aspects of governance. However, the hypothesis does not reject the detrimental side of corruption. This study, therefore, does not aim to determine whether corruption fosters or impedes economic performance. The main interest is rather in examining such influences when other aspects of governance are poor. As a result, while considering the influence of other aspects of governance, we assess the effect of corruption on per capita GDP growth.

Consistently, the baseline model of the study reads:

$$G_{i,t} = \alpha_0 + \alpha_1 Y_{i,0} + \alpha_2 Z_{i,t} + \alpha_3 Gov_{i,t} + (\alpha_4 + \alpha_5 Gov_{i,t}) Cor_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the subscripts *i* and *t* stand, respectively, for individual (countries) and time (years), with *i* = 1, …, *N* and *t* = 0, …, T. The errors terms of both equations are symbolised by ε and μ, while α:s and β:s are the coefficients to be estimated.

On the left-hand side of *Equation (1),* $G_{i,t}$ measures the economic performance of country *i* at period *t*.

On the right-hand side, Y_0 symbolises the economic performance of country *i* at the initial period, 2006. Its use in the model is justified by the *conditional* convergence hypothesis (Barro, 1991; Mankiw and Weil, 1992). The hypothesis suggests that when countries possess the same technological possibilities and population growth rate, there should be convergence to the same growth rate, even if they do not display the same savings propensities and initial capital–labour ratio. In other words, poorer countries catch up to the richer ones.

Also on the right-hand side of *Equation (1),* α_2 in particular symbolises a vector of coefficients weighting $Z_{i,t}$, which is a vector of variables that takes into account classical determinants of real GDP per capita growth (see Levine and Renelt, 1992).

Moreover, in the benchmark equations, *Cor* represents the corruption variable, which aims to capture the prevalence of corruption within countries, while Gov symbolises the influence of governance. In fine, the interaction effect of both variables is considered through $Gov_{i,t}Cor_{i,t}$, as *Equation (1)* suggests.

The description of data, sources and their expected effects on the dependent variable is presented in the next sub-section (See *Table 1* and *Table 2*).

2.3.2 Data

The study focuses on panel data from 99 countries worldwide, listed in *Appendix*, for the 2006–2014 period. In the forthcoming estimations, three main data sources are used in accordance with the GWH.

First, economic data are systematically derived from Penn World Tables version 9.0 (Feenstra, Inklaar and Timmer, 2015). They, among others, include per capita real GDP growth, which is used as the dependent variable. The same variable is also used for the initial level of economic performance in 2006. We expect the growth rate of income to be negatively associated with the dependent variable, which would verify the *conditional* convergence hypothesis (i.e. $\alpha_1 < 0$). This means that the development dynamic is such that poorer countries catch up to the richer ones. The related statistics are based on the output side real GDP per capita at chained (in 2005 PPP dollars US). In their study, Méon and Sekkat (2005) instead use the average growth rate of per capita income over the sample period 1970–1998 as the dependent variable, while the index for the initial period is also used as initial income.

The rest of growth's basic control variables include physical and human capital, population growth and inflation in the time period 2006–2014. For physical capital, the capital stock (also in 2005 PPP dollars US) over the period is used, whereas Méon and Sekkat (2005) instead use the average ratio of investment to GDP over their sample period. For human capital, the index of human capital per person is used. The index is computed by combining both schooling years (Barro and Lee, 2010) and the returns to education (Psacharopoulos, 1994).[2] As a proxy variable for the human capital in their growth model, Méon and Sekkat (2005) instead use the initial level of schooling. Following Levine and Renelt (1992), investments in both physical and human capitals should enhance the growth of real per capita GDP. Furthermore, the price level of household consumption (price level of USA GDPo in 2011=1) is also taken into account. Still in line with Levine and Renelt (1992), countries that grow

[2] The index of human capital is based on the following function: $hc = e^{\emptyset(s_{it})}$, where s represents the average years of schooling in country i at time t. A standard assumption is that the marginal product of education diminishes schooling time (see also Psacharopoulos, 1994 and Caselli, 2005).

faster than the average tend to have lower inflation rates than slower-growing countries. The estimated coefficient associated with inflation is hence expected to be negative. Méon and Sekkat (2005) instead use the openness of trade, even more adopted in the estimation of growth models. Population growth rate incorporates the demographic factor of growth. When measured in terms of GDP per capita, population growth should hinder growth (Levine and Renelt, 1992). At this level, Méon and Sekkat (2005) proxy the demographic factor using the average growth rate of population over their sample period.

Furthermore, we use two indicators to capture the extent of corruption. The resulting statistics are based on surveys of more than 131,000 firms from 139 countries worldwide. The first indicator is relative to *Bribe incidence (BI)*, which measures the proportion of firms experiencing at least one bribe payment request out of six transactions dealing with utilities access, permits, licenses and taxes. The second, *Bribe depth (BD)*, captures the percentage of transactions in which a gift or informal payment was requested, again out of six transactions dealing with utilities access, permits, licenses and taxes. Noteworthy, these variables are based on facts, not on individual perceptions of corrupt activities, unlike commonly used data on corruption. They are, alongside other variables measuring the prevalence of bribery, available since 2006 through the World Bank Enterprise Survey of Business Managers (World Bank Group). The estimated coefficients of *BI* and *BD* are expected to be negative, meaning that corruption hampers the per capita GDP growth rate.

In order to capture the scope of distortions, as stressed in the 'grease' literature, the study examines five different aspects of governance over the study period.

Like in Méon and Sekkat (2005), the WB indices as described in Kaufmann, Kraay and Zoido-Lobaton (1999) are used. The relevant data have been available since 1996. However, for this study, the upgraded version, which provides statistics for the time span of 1996–2014, is used (i.e. Worldwide Governance Indicator dataset 2014). The quality aspects of governance include: (i) *Voice and accountability (VA),* which 'reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media'; (ii) *Political stability and lack of violence/terrorism (LV),* which 'reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism'; (iii) *Government effectiveness (GE),* which 'reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies'; (iv) *Regulatory quality (RQ),* which 'reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development'; (v) *Rule of law (RL),* which 'reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence'; and (vi) *Control of corruption* (CC), which 'reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand corruption, as well as 'capture' of the state by elites and private interests'. However, CC is excluded from the empirical analysis.

The original index values of these governance indicators also vary from -2.5 to 2.5, with the upper bound representing the best quality possible, and the lower bound representing the exact opposite. A simple transformation technique is applied in which governance statistics are subtracted from 3.5, which consequently makes them vary from 1 to 6, where 1 stands for the best quality a country can achieve, and 6 stands for the lowest quality.

While using the same governance indicator, the investigations of Méon and Sekkat (2005), however, use only the data point from 1998.

Following *Equation (1),* the analysis also includes interaction terms, denoted as $Gov_{i,t}Cor_{i,t}$. They were constructed by multiplying the corruption variables (*BI* and *BD*) and the transformed governance variables (*VA*, *LV*, *GE*, *RQ*, and *RL*), thus yielding 10 interaction terms in total.

More generally, this study diverges from that conducted by Méon and Sekkat (2005) in many respects.

First, from the perspective of statistical data, aside from the fact that the sources of our economic data are different, our analyses also focus on alternative corruption measures. Méon and Sekkat (2005) themselves underlines in their conclusion the need to improve their work – which, according to them, could be done namely by taking advantage of improvements in the assessment of the level of corruption and in the measurements of other aspects of governance, and using longer time series.

Second, it is important to emphasise that their quantitative analyses focus on one data point per country for both the corruption and governance variables. We believe, however, that using as many data points as possible would be statistically more informative, and would therefore help improve the quality of the estimations.

Third, our study applies a panel data model, which attempts to capture two dimensions (country and year). In the analysis of the effect of corruption, such an approach may ultimately be useful. For instance, Méon and Sekkat (2005) succeed in generating evidence for the validity of the GWH, despite using one-point data on corruption and governance. However, as such, there is no guarantee that one would yield similar findings when using another benchmark year. Panel data models, in particular, help mitigate this issue.

Fourth, in addition to using interaction terms to measure the joint influence of corruption and governance variables, the forthcoming estimations also consider the direct effects of these governance variables, which in turn sheds light on their independent effects on the dependent variable alongside those of corruption. Such an exercise is neglected in Méon and Sekkat (2005).

Table 1. Descriptive statistics of variables in logarithm

Variables	Mean	Standard deviation	Minimum	Maximum	Sources
Real GDP per capita	11.468	1.94941	7.634	16.657	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Human capital	0.8342	0.2948	0.1191	1.3176	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Population	2.480	1.6736	1.291	7.222	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Inflation	-0.5995	0.4436	-1.4705	0.5750	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Capital stock	12.547	2.0725	7.979	18.055	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Bribery incidence	2.545	1.0552	2.747	4.256	Bank Enterprise Survey of Business Managers, World Bank
Bribery depth	2.2643	1.03609	-0.3567	4.1636	Bank Enterprise Survey of Business Managers, World Bank
VA	1.2164	0.26772	1.2693	1.6630	World Development Indicators 2014, World Bank
LV	1.2720	0.2474	0.6949	1.8446	World Development Indicators 2014, World Bank
GE	1.203	0.319936	0.134	1.677	World Development Indicators 2014, World Bank
RQ	1.1928	0.2883	0.3664	1.6706	World Development Indicators 2014, World Bank
RL	1.2305	0.30815	0.3363	1.6908	World Development Indicators 2014, World Bank

Table 2. Expected sign of dependent variables

Independent variable	Expected sign on the dependent variable	Studies
Yo	−	Barro (1991), Mankiw and Weil (1992)
$Z_{(Capital\ stock)}$	+	Levine and Renelt (1992)
$Z_{(Human\ capital)}$	+	Levine and Renelt (1992)
$Z_{(Population)}$	−	Levine and Renelt (1992)
$Z_{(Inflation)}$	−	Barro (1995)
Cor	−	Mauro (1995), Mo (2000), Méon and Sekkat (2005)
Gov	−	Méon and Sekkat (2005)
Cor×Gov	+	Méon and Sekkat (2005)

Table 3. Unit-root test for stationarity

Variables	Augmented-Dickey-Fuller test		Philipps-Perron test	
	D-F statistics	p-value	D-F statistics	p-value
Real GDP per capita	-10.045	< 0.01	-32.198	0.01
Capital stock	-9.0461	< 0.01	-30.809	0.01
Bribery incidence	-9.4731	< 0.01	-33.635	0.01
Bribery depth	-9.073	< 0.01	-29.338	0.01
VA	-9.8467	< 0.01	-31.332	0.01
LV	-10.778	< 0.01	-32.583	0.01
GE	-10.035	< 0.01	-31.959	0.01
RQ	-9.9539	< 0.01	-31.645	0.01
RL	-10.821	< 0.01	-31.664	0.01
Human capital	-9.3407	< 0.01	-30.515	0.01
Population	-11.458	< 0.01	-33.032	0.01
Inflation	-10.397	< 0.01	-31.15	0.01

Notes. Series are stationary if the probabilities associated with the DF statistics are smaller than 0.05.

2.4 RESULTS

The study develops three specifications of *Equation (1)*. In the first estimation, the independent variables only include the variables of interest – that is, corruption, governance and their interaction terms. The second estimation incorporates, in addition, growth basic control variables. The third estimation includes regional dummies. The estimation results are reported in *Tables 4–7*. Like Méon and Sekkat (2005), this study did not lead to conclusive findings when estimations involved *VA*. For the sake of space, the related regressions are not displayed in the tables. Notably, time dummies were taken into account in the Fixed effects regressions. However, their estimated coefficients were not statistically significant. Likewise, their results are not shown for the sake of space.

Furthermore, all the estimations systematically use the logarithmic values of variables in the dataset, in line with Mankiw and Weil (1992). This may help in making the observations conform more to a normal distribution and thus improve the quality of predictions.

Table 4 reports the results relative to the estimations of *Equation (1)* when *LV* (now labelled *Political instability/Violence/Terrorism* due to the rescaling it was subject to, along with the other governance variables) is the governance variable.

The estimations show that the estimated coefficients associated with the variables of interest show some consistency, displaying the same signs throughout. In particular, the partial effects of corruption and *LV* are found to be negatively associated with the growth in per capita real GDP. Their respective costs *vis-à-vis* economic performance are even more obvious when one looks at their respective overall effects (the overall effect of one being the sum of its partial effect and that of the interaction variable).

The positive sign displayed by the estimated coefficients of the interaction variables (α_5) means that the negative effect of corruption on growth is exacerbated with more political instability, violence and terrorism. The same analysis applies the other way around, that the harmful influence of these types of violence on economic growth is further amplified when corruption spreads. In that respect, corruption generates an additional cost to growth – which is consistent with the 'sand the wheels' hypothesis.

Despite varying the number of independent variables from *Column 1* to *3* using the panel least square, the estimated effects of the variables of interest are not affected – their respective signs remain unchanged. Controlling for fixed (*Column 4*) effects, the conclusion stays unchanged. In both the *Bribery incidence* (*BI*)- and *Bribery depth* (*BD*)-related regressions, the estimated coefficients overall remain statistically significant at the 5% level. Moreover, the estimations also show that economic variables consistently display their expected signs, with estimated coefficients that are, overall, statistically significant at the 5% level as well.

Table 5 presents the estimation results based on *GE* (now referred to as government inefficiency). Concerning the effects of the variables of interest, the conclusion scheme slightly differs in many respects. Regardless of the specifications and estimators adopted for *Equation (1)*, the results consistently determine that the partial effect of corruption is beneficial to growth. Even when the indirect effects of corruption are considered through the interaction variables, the positive effects of corruption unexpectedly hold. Thus, the more firms are subject to bribe claims, and the more transactions are tainted by illegal payments, the greater the growth in per capita real GDP. Although this result suggests a positive influence of corruption, the negative sign of the interaction variables clearly underlines its fragility in the presence of an inefficient government. Indeed, the beneficial effects of corruption on growth gradually diminish as the quality of public administration, its independence from political pressures, the quality of policy formulation and implementation, or the credibility of government also deteriorate.

Regarding the effect of an inefficient government, the estimations unequivocally show that it directly tends to reduce the economic growth. Furthermore, the assessment of the overall effect in turn puts forward that inefficient government is seriously costly in terms of growth. In addition, concerning the governance variable, the negative sign displayed by the interaction terms implies that corruption tends to alleviate such costs – which is the guideline defended by the 'efficient' corruption theory.

Statistically, the estimated coefficients of these variables of interest are significant at the 5% level.

Tables 6 and *7* respectively report the estimation results of *Equation (1)* when Regulatory burden (*RQ*) and Absence of rule of law (*RL*) are included into regressions as governance variables. For the sake of space, we refrain from more detailed comments about them. Noteworthy, the estimation results concerning the variables of interest are obviously more consistent with the alleged lubricating role of corruption (GWH). Meanwhile, the partial effects of corruption are positive in both cases – regulatory burden, just like absence of rule of law, directly tends to reduce the growth in per capita real GDP. More interestingly, the interaction terms between corruption and governance proxies are less than 0 (α_5<0). While being beneficial, corruption does not foster additional costs, as SWH claims. On the contrary, it seems to mitigate the negative incidences of regulatory burden and absence of rule of law that affect growth. Again, the estimated coefficients of the variables of interest are generally statistically significant at the 5% standard level.

Also important, the respective overall effects of the variables of interest remain consistent with their respective partial effects, in a big picture. That is, the frequency of requests for bribes to firms or in transactions for utilities access, permits, licenses and taxes seems to have an accelerating effect on economic growth. While, on the other hand, the government's inability to formulate and implement sound policies and regulations that favour private sector development stifles the growth of the economy. Likewise, an absence of rule of law, a deficient regulatory framework to secure contracts and protect properties, a poor quality of police and courts, and the omnipresence of crime and violence pose serious threats to growth.

Table 4. Estimation of per capita GDP growth, based on *LV*

Column	(1)		(2)		(3)		(4)	
	Panel Least Squares		Panel Least Squares		Panel Least Squares		Fixed Effects	
	BI	BD	BI	BD	BI	BD	BI	BD
Corruption	-0.004***	-0.005***	-0.004***	-0.005***	-0.007***	-0.008***	-0.025***	-0.02**
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.019)	(0.019)
Violence (LV)	-0.0064*	-0.0081	-0.0036*	-0.0087*	-0.0081**	-0.006	-0.089*	-0.08**
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)	(0.058)	(0.055)
Corruption×Violence	0.002**	0.002*	0.002**	0.0025**	0.004***	0.004***	0.021***	0.019***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.015)	(0.015)
$Growth_{2006}$			-0.016**	-0.015**	-0.002*	-0.003*		
			(0.089)	(0.091)	(0.095)	(0.098)		
Capital stock			0.002***	0.002***	0.002***	0.001***	0.028***	0.027***
			(0.0006)	(0.0007)	(0.0008)	(0.0008)	(0.010)	(0.010)
Human capital			0.006**	0.0039***	0.005***	0.005***	0.255***	0.244**
			(0.005)	(0.005)	(0.006)	(0.007)	(0.088)	(0.089)
Population growth			-0.184**	-0.181**	-0.210**	-0.208**	-0.289**	-0.275
			(0.063)	(0.063)	(0.073)	(0.073)	(1.067)	(1.085)
Inflation			-0.006***	-0.006***	-0.008**	-0.008***	-0.010**	-0.01**
			(0.004)	(0.004)	(0.004)	(0.005)	(0.012)	(0.012)
Latin America					0.007***	0.006***		
					(0.008)	(0.008)		
Africa					-0.004	-0.004		
					(0.009)	(0.009)		
Middle East					0.008**	0.009***		
					(0.011)	(0.012)		
Southeast Asia					0.003***	0.004***		
					(0.010)	(0.010)		
Southwestern Asia					-0.0003**	-0.0003*		
					(0.011)	(0.011)		
Eastern Europe					0.0006***	0.001***		
					(0.009)	(0.009)		
Central Europe					-0.002	-0.001		
					(0.010)	(0.010)		
Intercept	0.044***	0.034**	0.011***	0.012*	0.012***	0.010		
	(0.0120)	(0.011)	(0.015)	(0.014)	(0.019)	(0.018)		
Adj.-R^2	0.1801	0.1923	0.6359	0.6375	0.6693	0.6686	0.5063	0.5185
N	78	77	76	75	70	69	76	75

Notes. Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

Table 5. Estimation of per capita GDP growth, based on *GE*

Column	(1)		(2)		(3)		(4)	
	Panel Least Squares		Panel Least Squares		Panel Least Squares		Fixed Effects	
	BI	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.003*** (0.004)	0.006*** (0.005)	0.002*** (0.004)	0.006*** (0.006)	0.002*** (0.006)	0.01*** (0.007)	0.007*** (0.019)	0.01*** (0.019)
Government inefficiency (GE)	-0.008*** (0.009)	-0.003** (0.009)	-0.008*** (0.010)	-0.002*** (0.010)	-0.005*** (0.012)	-0.003*** (0.011)	-0.03** (0.066)	-0.054** (0.065)
Corruption×GE	-0.001*** (0.003)	-0.003** (0.004)	-0.001*** (0.003)	-0.003** (0.004)	-0.001*** (0.004)	-0.004*** (0.005)	-0.001** (0.015)	-0.003* (0.015)
Growth2006			-0.011*** (0.086)	-0.007*** (0.087)	-0.031** (0.093)	-0.033* (0.094)		
Capital stock			0.002*** (0.0006)	0.003*** (0.0007)	0.003*** (0.001)	0.004*** (0.001)	0.023*** (0.01)	0.023** (0.010)
Human capital			0.004*** (0.005)	0.004*** (0.005)	0.004*** (0.007)	0.003*** (0.006)	0.022** (0.086)	0.02*** (0.086)
Population growth			-0.193** (0.062)	-0.190* (0.062)	-0.213** (0.072)	-0.214* (0.072)	0.484 (1.051)	0.497 (1.054)
Inflation			-0.006** (0.004)	-0.0070* (0.004)	-0.007** (0.005)	-0.0087* (0.005)	-0.013** (0.012)	-0.013** (0.012)
Latin America					0.0057** (0.01)	0.006*** (0.006)		
Africa					-0.003* (0.009)	-0.004* (0.009)		
Middle East					0.005*** (0.011)	0.01*** (0.012)		
Southeast Asia					0.002** (0.010)	0.004** (0.01)		
Southwestern Asia					-0.003 (0.011)	-0.001 (0.011)		
Eastern Europe					0.001** (0.009)	0.002* (0.009)		
Central Europe					-0.002** (0.01)	-0.001* (0.01)		
Intercept	0.004*** (0.010)	0.004** (0.011)	0.001** (0.015)	0.001*** (0.015)	0.004** (0.018)	0.0012 (0.017)		
Adj.-R^2	0.2003	0.2057	0.6128	0.6298	0.6401	0.6318	0.5110	0.5243
N	78	77	70	76	76	69	76	75

Notes. Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

Table 6. Estimation of per capita GDP growth, based on *RQ*

Column	(1)		(2)		(3)		(4)	
	Panel Least Squares		Panel Least Squares		Panel Least Squares		Fixed Effects	
	BI	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.004*** (0.004)	0.006*** (0.006)	0.002*** (0.005)	0.005*** (0.006)	0.002*** (0.006)	0.007*** (0.007)	0.002** (0.014)	0.004* (0.015)
Regulatory burden (RQ)	-0.004*** (0.009)	-0.002** (0.01)	-0.003*** (0.01)	-0.0006** (0.015)	-0.004*** (0.012)	-0.008* (0.011)	-0.038* (0.055)	-0.038* (0.053)
Corruption×RQ	-0.001** (0.003)	-0.003*** (0.004)	-0.003*** (0.004)	-0.002** (0.004)	-0.001*** (0.005)	-0.004*** (0.005)	-0.002** (0.011)	-0.003* (0.014)
Growth$_{2006}$			-0.006*** (0.087)	-0.005*** (0.100)	-0.026*** (0.100)	-0.028*** (0.093)		
Capital stock			0.007*** (0.006)	0.011*** (0.006)	0.0002** * (0.001)	0.0002** * (0.0008)	0.023** (0.010)	0.037** (0.015)
Human capital			0.005*** (0.005)	0.004*** (0.005)	0.006** (0.007)	0.005* (0.006)	0.221** (0.086)	0.413** (0.081)
Population growth			-0.194** (0.062)	-0.192** (0.063)	-0.221** (0.073)	-0.223** (0.073)	-0.480* (1.028)	-0.488* (1.027)
Inflation			-0.006** (0.004)	-0.007* (0.004)	-0.008** (0.005)	-0.009** (0.005)	-0.013* (0.012)	-0.034 (0.013)
Latin America					0.007*** (0.01)	0.008*** (0.009)		
Africa					0.004* (0.01)	0.005** (0.01)		
Middle East					0.007 (0.011)	0.011 (0.012)		
Southeast Asia					0.003* (0.010)	0.005** (0.010)		
Southwestern Asia					0.0004 (0.011)	0.002* (0.011)		
Eastern Europe					-0.0002* (0.009)	0.001 (0.009)		
Central Europe					-0.001*** (0.010)	-0.001*** (0.010)		
Intercept	2.e-05** (0.010)	0.003** (0.010)	0.006** (0.015)	0.008** (0.014)	0.007** (0.017)	0.010* (0.017)		
Adj.-R^2	0.1844	0.1823	0.5090	0.5156	0.5731	0.5716	0.4452	0.4534
N	78	77	76	75	70	69	76	75

Notes. Robust standard errors are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

Table 7. Estimation of per capita GDP growth, based on *RQ*

Column	(1)		(2)		(3)		(4)	
	Panel Least Squares		Panel Least Squares		Panel Least Squares		Fixed Effects	
	BI	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	0.006***	0.010***	0.005***	0.010***	0.005***	0.011***	0.006**	0.007***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.017)	(0.018)
Absence of Rule of law (RL)	-0.002***	-0.003***	-0.004***	-0.012**	-0.028***	-0.022***	-0.046***	-0.045**
	(0.009)	(0.008)	(0.017)	(0.008)	(0.012)	(0.011)	(0.070)	(0.069)
Corruption×RL	-0.003***	-0.006***	-0.023***	-0.005**	-0.002***	-0.005***	-0.004**	-0.006**
	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)	(0.013)	(0.013)
$Growth_{2006}$			-0.002***	-0.005***	-0.028***	-0.02***		
			(0.086)	(0.087)	(0.093)	(0.130)		
Capital stock			0.001***	0.004***	0.038***	0.053***	0.024**	0.072***
			(0.006)	(0.0006)	(0.001)	(0.001)	(0.010)	(0.031)
Human capital			0.004**	0.003***	0.004***	0.003***	0.228**	0.226**
			(0.005)	(0.007)	(0.019)	(0.007)	(0.087)	(0.086)
Population growth			-0.184**	-0.177**	-0.209**	-0.211**	-0.579*	-0.570
			(0.062)	(0.062)	(0.073)	(0.072)	(0.108)	(0.10)
Inflation			-0.006**	-0.007**	-0.008*	-0.01**	-0.012**	-0.01***
			(0.004)	(0.004)	(0.005)	(0.005)	(0.013)	(0.034)
Latin America					0.005*	0.006*		
					(0.018)	(0.009)		
Africa					0.003***	0.005**		
					(0.01)	(0.01)		
Middle East					0.0049**	0.010		
					(0.011)	(0.012)		
Southeast Asia					0.001**	0.004*		
					(0.010)	(0.010)		
Southwestern Asia					-0.001	-0.001		
					(0.011)	(0.011)		
Eastern Europe					-0.001	-0.0006		
					(0.01)	(0.01)		
Central Europe					-0.002	-0.002		
					(0.010)	(0.010)		
Intercept	0.001***	0.032***	0.045**	0.005***	0.001***	0.003***		
	(0.010)	(0.01)	(0.014)	(0.013)	(0.017)	(0.016)		
Adj.-R^2	0.2119	0.2247	0.5141	0.5202	0.5363	0.5398	0.4550	0.4661
N	78	77	76	75	70	69	76	75

Notes. Robust standard errors are in parentheses. The superscripts ***, ** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

As can be seen, our empirical analyses give credit to SWH, which claims that corruption fosters additional costs to economic growth, when the estimations include political instability or violence/terrorism. Whereas, the opposite claim, GWH, prevails when the estimations involve government inefficiency, regulatory burden or absence of rule of law – thus stressing that corruption has virtues, as it mitigates the consequences of these poor qualities of governance.

We test the robustness of these results in a simple way: by controlling the dependent variable with one of its determinants. Our results are considered relatively robust if the estimations following the introduction of the new determinant variable do not affect our previous conclusion about the validity or the rejection of GWH.

Following Méon and Sekkat (2005), we introduce into regressions an interaction variable between $Growth_{2006}$ and *Human capital*, based on the regression in *Column 2* of *Tables 4–7*. The results are shown in *Table 8*. The findings show a relative overall decrease in the significance of estimated coefficients. For instance, estimated coefficients of human capital are now negative, but statistically insignificant.

More importantly, the new estimations remain robust about the validity of SWH in the regression including *LV* (*Regression 2.1*), while GWH in turn holds when the focus is on *GE*, *RQ* and *RL* (*Regressions 2.2–2.4*, respectively). The estimated coefficients of the variables of interest are generally statistically significant at the 5% level.

Table 8. Robustness test

Column	(2.1)		(2.2)		(2.3)		(2.4)	
	LV		*GE*		*RQ*		*RL*	
	BI	*BD*	*BI*	*BD*	*BI*	*BD*	*BI*	*BD*
Corruption	-0.007**	-0.008**	0.004***	0.007**	0.004**	0.006***	0.007**	0.011**
	(0.0051)	(0.005)	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)	(0.006)
Violence (LV)	-0.005**	-0.007*	-0.0004**	-0.002*	-0.001**	-0.002**	-5.6e-5**	- 0.002**
	(0.0106)	(0.001)	(0.010)	(0.010)	(0.010)	(0.009)	(0.016)	(0.008)
Corruption×Violence	0.003**	0.004*	-0.001**	-0.003*	-0.001**	-0.002**	-0.003**	-0.005**
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
Growth$_{2006}$	-0.939**	-0.919**	-0.935**	-0.903**	-0.957**	-0.925**	-0.912**	-0.862*
	(0.337)	(0.338)	(0.343)	(0.342)	(0.334)	(0.332)	(0.337)	(0.336)
Capital stock	7.1e-05*	6.4e-05	0.0003*	0.0003*	0.0001**	0.0001*	0.0002**	0.0002*
	(0.0006)	(6.8e-04)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Human capital	-0.017	-0.016	-0.017	-0.016	-0.017	-0.016	-0.016	-0.015
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Growth$_{2006}$×Human cap	1.703**	1.6711**	1.655**	1.598**	1.694**	1.634**	1.628**	1.542**
	(0.581)	(0.584)	(0.595)	(0.592)	(0.576)	(0.571)	(0.583)	(0.579)
Population growth	-0.201**	-0.200**	-0.210**	-0.205**	-0.209***	-0.206**	-0.201**	-0.195**
	(0.061)	(0.062)	(0.060)	(0.060)	(0.060)	(0.061)	(0.061)	(0.061)
Inflation	-0.006*	-0.007*	-0.007*	-0.0073**	-0.006*	-0.007*	-0.006*	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Intercept	0.0154	0.025*	0.0159*	0.017**	0.018**	0.018	0.016*	0.017**
	(0.0154)	(0.015)	(0.0160)	(0.0157)	(0.015)	(0.014)	(0.014)	(0.014)
Adj.-R^2	0.6455	0.6569	0.6605	0.6652	0.6795	0.6831	0.6878	0.6914
N	78	77	76	75	76	75	76	75

Notes. Robust standard errors of PLS estimators are in parentheses. The superscripts ***, ** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

Table 9. Signs associated with estimated coefficients of the variables of interest

	LV	*GE*	*RQ*	*RL*
α_3 *(Gov)*	−	+	+	+
α_4 *(Cor)*	−	−	−	−
α_5 *(Gov×Cor)*	+	−	−	−
Decision (effect)	sand	grease	grease	grease

2.5 ALTERNATIVE TESTING OF GWH

Our estimates of *Equation (1)* yielded mixed results about the role of corruption, where, on the one hand, it increases the cost of poor governance (*LV*); and, on the other, it helps to mitigate the cost (*GE*, *RQ* and *RL*) (see *Table 8*).

We delve further into this first conclusion by performing recursive estimations based on the partial effects of corruption and governance indicators. These partial effects are computed as follows:

$$\Delta G_{i,t} / \Delta Gov_{i,t} = \alpha_3 + \alpha_5 Cor_{i,t} \quad \text{(2a)}$$

$$\Delta G_{i,t} / \Delta Cor_{i,t} = \alpha_4 + \alpha_5 Gov_{i,t} \quad \text{(2b).}$$

For *Equation (2a)*, if $\alpha_5 \prec 0$, then this implies that a one-percentage point increase in the corruption index leads to a greater decrease in per capita GDP growth with a further deterioration in the quality of governance. In this equation, α_5 indicates how much poor governance costs to growth in terms of corruption.

For *Equation (2b)*, if $\alpha_5 \prec 0$, then this implies that a one-percentage point increase in the poor governance index generates a greater decrease in the level of growth with a higher level of corruption. On the other hand, α_5 assesses what corruption costs to growth in terms of poor governance.

In this regard, Méon and Sekkat (2005) provide recursive estimations as 'preliminary investigations' of the impacts of corruption with respect to sub-samples built based on qualities of rule of law. That is, in their GWH validity test, their recursive estimations are limited to checking the effects of corruption on different *RL* regimes, i.e. *Equation (2a)*. They do not evaluate the potential additional costs of corruption (costs of poor governance), i.e. *Equation (2b)*. If there are costs, it is unclear whether corruption alleviates them. Yet, this is an essential point of the 'grease' argument, as we pointed out at the beginning of *Section 2*.

Equations (2a) and *(2b)* are estimated with respect to several levels of governance and corruption, respectively. We follow Méon and Sekkat (2005)'s approach to determine the different levels (or sub-samples) of governance and corruption. Countries in the whole sample are ranked from the highest to the lowest average quality of governance/corruption over the 2006–2014 study period. For instance, we consider the first and best level of *LV* to include the 70 countries with the best average levels of *LV* over this time span. The second level covers observations from the 2nd best to the 71st, and so on. In other words, the average level of *LV* gradually falls. The same procedure is applied for the other governance indicators, and then for *BI*, which was alone used as a corruption variable throughout the recursive estimations. Then, new equations were estimated using the Fixed effects estimators with respect to successive sub-samples.

The findings are summarised through *Figure (1)*, which plots the successively estimated coefficients. *Figures 2a.1* to *2a.4* relate to the estimations of *Equation (2a)*, including *LV*, *GE*, *RQ* and *RL*, respectively. *Figures 2b.1* to *2b.4* show the estimations of *Equation (2b)*, also including governance variables in the same order.

- GWH *vs LV*: Overall, the testing shows a negative effect of corruption on economic growth (*Figure 2a.1*). More specifically, these harmful effects on the economy tend to worsen as political instability increases, the level of violence is high, and terrorism is omnipresent. However, *Figure 2b.1* goes in the same direction, clearly showing that corruption generates additional costs. In other words, political instability, violence and terrorism tend to hinder the emergence of the economy. On the other hand, the higher the level of corruption, the greater the negative effects of political instability, violence and terrorism on growth. Such a finding suggests that corruption produces a 'sand' effect – which is consistent with the estimations including *LV* in *Table 4*.

- GWH *vs GE*/*RQ*/*RL*: The results concerning the other governance variables are almost similar. The partial effects of corruption are all positive, and *Figures 2a.2–2a.4* plot downward – nonetheless meaning that the beneficial effects of corruption for growth gradually dissipate as the quality of governance deteriorates. On the other hand, when analysing the potential costs of poor governance (*Figures 2b.2–2b.4*), the figures plot upward, with negative estimated coefficients for the poor governance indicators. These estimations imply that flaws in the governance captured by these indicators reduce economic growth. Interestingly, this negative influence on economic performance gradually declines as corruption increases. As a result, in addition to not favouring additional costs, corruption helps to mitigate those costs caused by weak governance. Our findings therefore show that corruption, in this other frame, produces a 'grease' effect, to the benefit of the economy. Our previous estimations including the same governance indicators (*Tables 5–7*) also led to the same conclusion.

Figure 1. Effects of poor governance/corruption on per capita real GDP growth

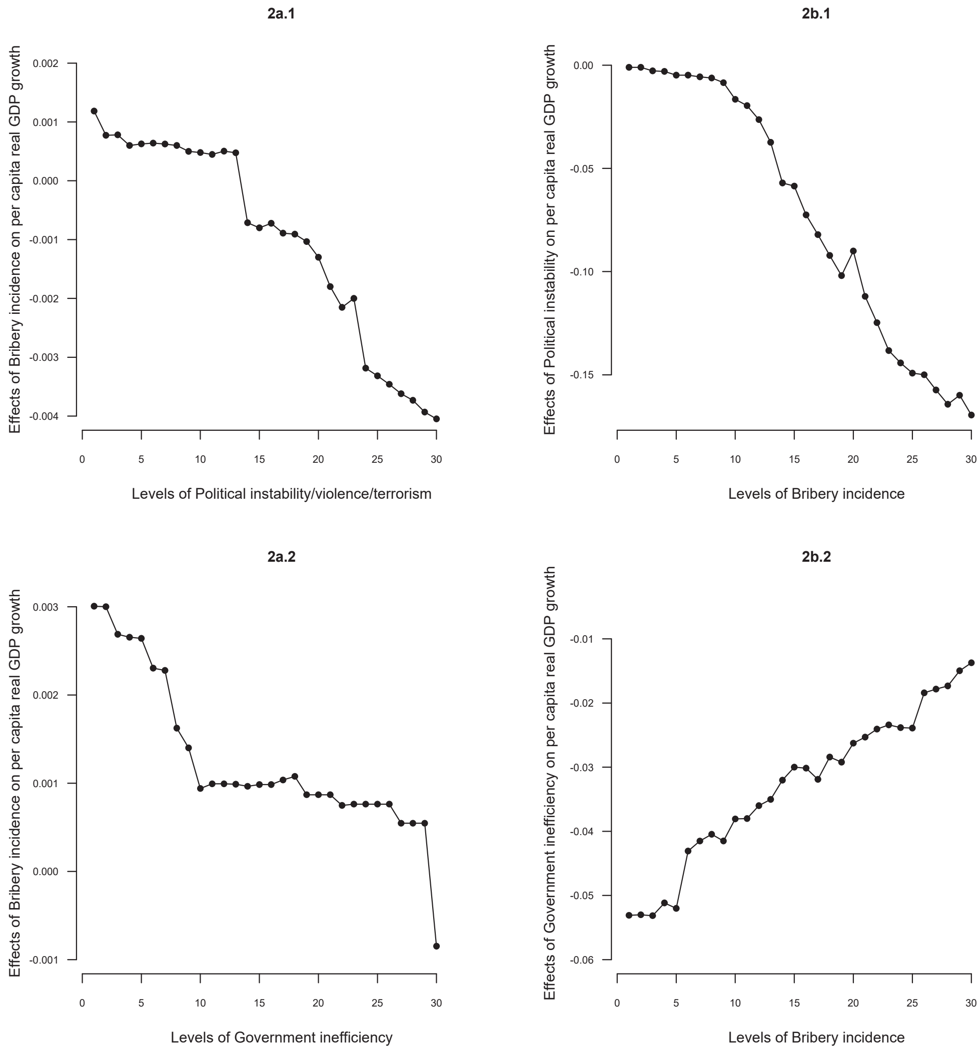
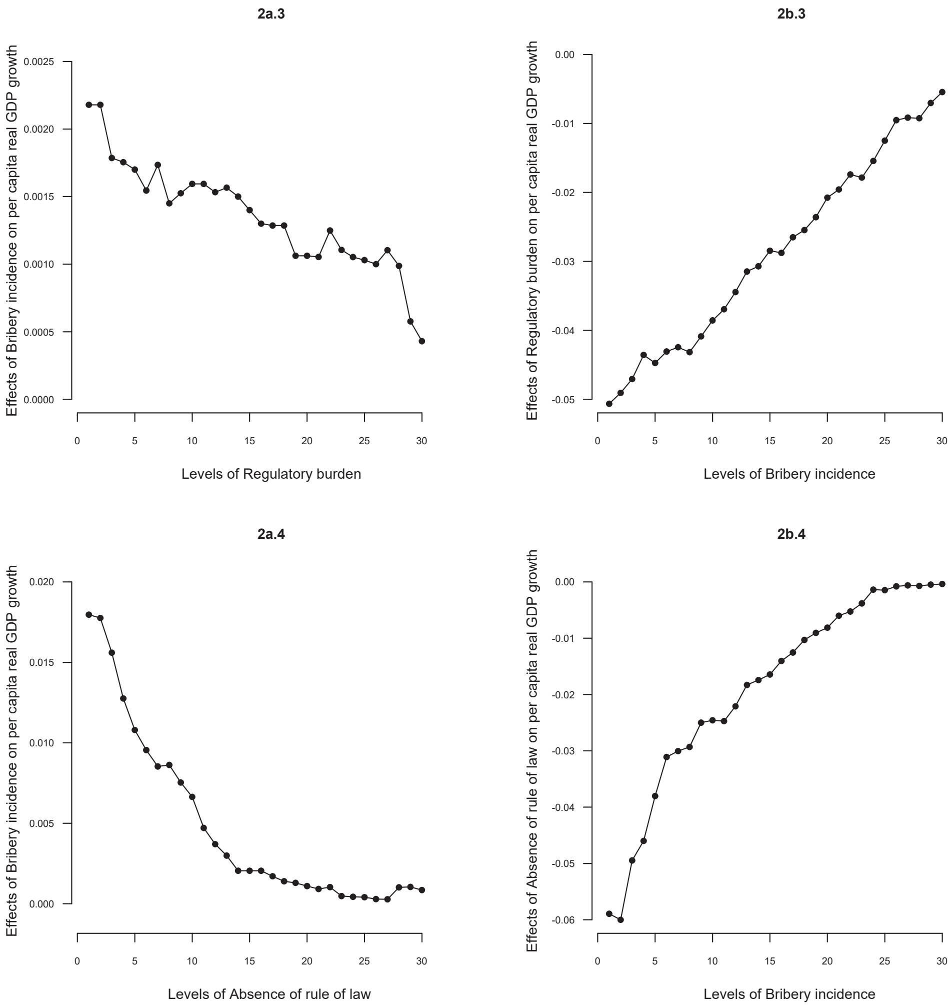


Figure 2. (Figure 1 continued) Effects of poor governance/corruption on per capita real GDP growth



2.6 CONCLUSIONS

The paper attempts to test the validity of GWH on a database of 99 countries over a time span of 2006–2014. The study is based on a basic economic growth model, tested using the statistics of four governance indicators (Political instability, violence/terrorism; Government inefficiency; Regulatory burden; Absence of Rule of law) and two indicators that assess the prevalence of corruption to which firms are subject (Bribe incidence; Bribe depth).

The results unambiguously show that these governance indicators have negative effects on per capita real GDP growth. The empirical analysis thus shows that a politically unstable environment, strongly marked by violence and terrorism, slows down economic growth. In the same way, our results show that public administrations of low quality, with a strong grip of the political system, and inefficient public policies with a weak government also reduce economic performance. It also appears that the growth of economies is affected when they fail to formulate effective policies or put in place regulatory mechanisms that promote the development of their private sector. The study also shows that the absence of rule of law, which seriously compromises the security and protection of contracts and properties, reduces economic growth.

Regarding corruption, our data highlight a double influence. Our results show that corruption clearly hampers economic growth in the presence of political instability or violence/terrorism. In these circumstances, corruption is costlier for the economy because it tends to exacerbate the impact of this instability on GDP – which sheds further light on the detrimental side of corruption. On the other hand, corruption tends to be more virtuous in contexts of inefficient public policies, absence of sound policies and a regulatory framework aimed at boosting private sector development, or when the quality of the rule of law is seriously questionable. In addition to having a beneficial effect on GDP growth, corruption does not generate costs elsewhere. Our study shows that it even helps to mitigate the negative consequences of such poor qualities of governance on the economy – a finding which is in line with the alleged 'grease' effect of corruption.

These findings remain robust despite the use of an alternative empirical approach.

In a rather original way, the study is in line with the conclusions made by new theories of economic growth. These theories emphasise the need for effective institutions. By perceiving effective institutions as factors of capital or labour production, these approaches suggest that traditional factors of production cannot alone guarantee the development of countries. Institutions play a central role: that of guaranteeing the efficiency of the use of collective resources.

More specifically, the conclusions of the study challenge countries on governance, and therefore also on the quality of these institutions. More financial and technical efforts should be geared, in particular, to the prevention of internal conflicts or to the fight against terrorism. In the same way, important reforms of the public sector are essential to ensure economic development. These reforms should particularly focus on areas such as improving the quality of public services and promoting sound public, as well as private sector development, policies. The reform of judicial institutions is, in the same way, an inescapable task if development is to be ensured. The fight against corruption, the security of people and their property, and the strict application of laws must be relentless, because such initiatives have a real positive effect on the economic development of countries.

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APPENDIX

Table 10. List of countries/territories in the dataset

Albania, Argentina, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Cyprus, Democratic Republic of the Congo, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Laos People’s, Liberia, Lesotho, Malawi, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Niger, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Republic of Congo, Republic of Korea, Romania, Rwanda, Senegal, Sierra Leone, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, Uruguay, Venezuela, Vietnam, Zambia.

3 ESSAY II. TESTING FOR GRANGER CAUSALITY TEST BETWEEN CORRUPTION AND GOVERNANCE

KOURAMOUDOU KÉÏTA

ABSTRACT

This paper tackles the endogeneity issue between corruption and ill functioning within institutions. While malfunctioning bureaucracy makes firms turn to corruption, it is also known that rent-seekers deliberately provoke institutional malfunctioning in order to extract private gains. While following the Granger causality test, the study uses dynamic panel data from 117 countries worldwide over a study period of 1996–2013. Using the Two-step System Generalised Method of Moments estimator, the paper finds substantial evidence for causal effects between poor governance and corruption. A one-directional causal link was found from the absence of Voice and accountability to corruption. Meanwhile, a nexus was identified between corruption and other examples of ill-functioning governance, such as political instability, violence and terrorism, government inefficiency, regulatory burden, or absence of rule of law, points to a bidirectional causality.

Keywords: endogeneity, governance indicators, institutions

JEL classification: D73

3.1 INTRODUCTION

The economic theory of regulation is the subject of an important discussion of public economics. The theory is essentially of two kinds. On the one hand, the 'private interest theory of regulation' suggests that benevolent regulators pursue their own interests, which might or might not be consistent with public interest. On the other hand, the 'public interest theory of regulation' postulates that regulations as well as their implementations proceed with totally disinterested initiatives and actions. In their approach, benevolent regulators are assumed to have sufficient information and enforcement power to effectively promote the public interest. The latter case is the rationale of government intervention for correcting market failures, such as externalities or monopolies (Allais, 1947; Meade, 1948; Lewis, 1949; Shleifer, 2005). As a result, governments tend to control prices in natural monopoly frameworks, impose safety standards to prevent accidents such as fires or mass poisonings, regulate security issuances so investors are not cheated, regulate jobs, etc.

However, the main line of attack against the 'public interest theory of regulation' was developed by the *Chicago School of Law and Economics*. According to the school, regulations might make things even worse, as regulators are incompetent, compromised or corrupt. The justification of this essay lies in the possible nexus between the fact that government intervenes to regulate sectors and the possible opportunistic behaviours that might simultaneously result.

A larger number of studies argue that the quality of regulation matters. In fact, good regulations help to prevent market failures and encourage economic performance (North and Thomas, 1973; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu, Johnson and Robinson, 2001). In particular, empirical studies find that good regulations encourage economic development (Djankov, McLiesch and Ramalho, 2006; Gillanders and Whelan, 2014), increase productivity and output (Barseghyan, 2008; Aghion, Bundell and Griffith, 2009), stabilise the macroeconomy (Loayza, Oviedo, and Serven, 2005), promote trade (Freund and Bolaky, 2008) and enhance entrepreneurism (Klapper, Laeven and Rajan, 2006). Conversely, excessive regulations likely stifle economic development. Huntington (1968) argues that too much regulation, which leaves little room for flexibility, can be *in fine* harmful to economic activities. He then puts forwards that '[…] in terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy'.

That observation clearly raises the important issue of the appropriate 'stock' of regulations needed to avoid triggering adverse effects detrimental to economic performance. Noteworthy, excessive regulations or poor regulation may increase corruption through *red tape*. As stressed above, the regulators may well pursue their own interests, which are not necessarily consistent with those of the public. It is also possible that regulators may intentionally deregulate in order to provoke incentives from bypassing it. Kurer (1993) and Guriev (2004) show that when investors face long queues and delays, they may bribe regulators in order to bypass these distortions.

In this section, we hypothesise and empirically test the existence of a potential causality nexus between poor regulation (or poor governance) and corruption. Up until now, studies have theorised a two-directional causality nexus between corruption and bad governance (Leff, 1964; Khan, 2004; Rose-Ackerman, 1999; Kaufmann, 2000, 2005; La Porta, Lopez-de-Silaned, Shleifer and Vishny, 1999; Méon and Sekkat, 2005; Méndez and Sepúlveda, 2006). To the best of our knowledge, there is no empirical investigation on this possible causality. So far, the existing literature has instead investigated the causal effects between corruption and the level of GDP, or growth (Husted, 1999; Treisman, 2000; Paldam, 2001; Lambsdorff, 2007; Brown and Shackman, 2007; Lučić, Radisić and Dobromirov, 2016), aid (Menard and Weill, 2016), healthcare satisfaction (Habibov, 2016), income inequality (Apergis, Dincer and Payne, 2010; Huang, 2013) and poverty (Negin, Abd Rashid and Nikopour, 2011).

Yet, the conclusion of such a study may contribute to the debate – in particular, the argument against the public interest theory of regulation, which states that regulation may also lead to perverse effects, such as corruption. In particular, any causality between poor regulation and corruption would at the same time strengthen the viewpoint defended by the Chicago School of Law and Economics – and overall, the questioning of the effectiveness of government intervention.

The rest of the paper is organised as follows: *Section 2* is dedicated to a literature review on the nexus between poor regulation and corruption; *Section 3* focuses on the method and data description; the empirical findings are shown and commented upon in *Section 4*; *Section 5* concludes and suggests some policy recommendations.

3.2 LITERATURE REVIEW

Regarding the link between poor regulation, or distortion, and corruption, one of the prevalent lines of economic research starts from the assumption that distorted bureaucracy causes corruption. Basically, administrative ill functioning is often relative to its sluggishness, which in turn explains the long delay associated with procedures. According to Bardhan (1997), administrative lags in allotting licenses, permits or signatories make governance sluggish and inefficient. In order to speed up the process, corruption seems to be the most effective means (Guriev, 2004). Another form of inefficiency in the administration is associated with the amount of *red tape*. It is not rare to see in countries strongly influenced by corruption that the normal administrative procedure is unnecessarily split into many other sub-steps – with the implication that a bribe is paid at each level (Shleifer and Vishny, 1993). Beyond bribes, one may underline the important impact of excessive *red tape*, which also constitutes a motive of corruption. Guriev (2004) argues that actors tend to bribe to either reduce *red tape* or circumvent it altogether. Taking this approach, Bardhan (1997) states that corruption in fact mitigates the pre-existing distortions caused by malfunctioning governance. Since corruption conveys virtues that foster a better provision of public services, smooth operations and a more efficient economy, it therefore becomes desirable (Leff, 1964; Huntington, 1968; Acemoglu and Verdier, 1998; Mo, 2000; Méon and Sekkat, 2005). In other words, corruption acts as a lubricant with a 'greasing' effect on the economy in the presence of ill functioning ('*greasing the wheels hypothesis*' (Méon and Sekkat, 2005; Aidt, Dutta and Sena, 2008; Méndez and Sepúlveda, 2006).

This view is opposed to the '*sanding the wheels hypothesis*,' which sees corruption as a hindrance to economic development (Mauro, 1995; Knack and Keefer, 1995; Méon and Sekkat, 2005; Aidt, 2009; Mo, 2000).

The other way around, Kaufmann and Wei (2000) reject the idea that corruption can be helpful in mitigating pre-existing distortions, arguing instead that the latter is endogenous to poor governance. This is consistent with Myrdal (1968), who contends that it is in the bureaucrats' self-interest to create distortive tediousness in order to raise motives for bribery (see also Kurer, 1993). That suggests that corruption is inclined to exacerbate pre-existing distortions in the economy. This perspective is backed up by a global survey on over 3000 multinational firms (Kaufmann and Wei, 2000), whose results suggest that bribery increases bureaucratic sluggishness. This implies that corruption would be likely to influence and explain the state of administrative processes, and more broadly the quality of governance and institutions. The empirical analysis of Méndez and Sepúlveda (2006) show that the effect of corruption on economic growth is conditional on the quality of governance (Méon and Sekkat, 2005; Méon and Weill, 2008; Aidt, Dutta and Sena, 2008; Aidt, 2009). Independent of the quality of regulation, the authors simply find corruption to be detrimental to growth. Murphy, Shleifer and Vishny (1993), for instance, demonstrate that private innovators are more subject to heavy bribes and expropriations, which negatively affect private investments and producible inputs in the long run (Mo, 2000). Mauro (1995)'s empirical investigation also concludes that corruption hinders growth and investment ratio.

In short, there seems to be a profound distinction in viewpoints: some explain the effects of corruption by the exogenous state of governance, whereas others assess the interplay between corruption and the quality of governance endogenous. By no means does either viewpoint reject the other, but the distinction raises the important question of causality between corruption and bad regulation (or more broadly, poor governance, or even deficient institutions).

3.3 METHOD AND DATA

The relationship between the quality of governance and corruption, as described in the above section, is a typical example of a 'chicken–egg' paradox. In addressing such cases, the Granger method is commonly used in economics (Granger, 1969). When investigating the causality between corruption and aid, Menard and Weill (2016) also applied the Granger technique. This paper intends to largely follow the empirical methodology used in their study. There is Granger causality from corruption (*Corr*) to poor governance (*PoorGov*) when the utilisation of the histories of both *Corr* and *PoorGov* predicts *PoorGov* better than the history of *PoorGov* alone. Such causal relationships can in both ways be formalised by the following baseline models:

$$Corr_{i,t} = \gamma_0 + \sum_{j=1}^{J} \gamma_j Corr_{i,t-j} + \sum_{k=1}^{K} \gamma_k PoorGov_{i,t-k} + U_{i,t} \; : (1)$$

$$PoorGov_{i,t} = \gamma'_0 + \sum_{k=1}^{K} \gamma'_k PoorGov_{i,t-k} + \sum_{j=1}^{J} \gamma'_j Corr_{i,t-j} + U'_{i,t} \; : (2)$$

There is Granger causality from *PoorGov* to *Corr*, if *Model 1* fits better than

$$Corr_{i,t} = \gamma_0 + \sum_{j=1}^{J} \gamma_j Corr_{i,t-j} + U_{i,t} : (1').$$

On the other hand, there is Granger causality from *Corr* to *PoorGov*, if model (2) fits better than

$$PoorGov_{i,t} = \gamma'_0 + \sum_{k=1}^{K} \gamma'_k PoorGov_{i,t-k} + U'_{i,t} : (2'),$$

in terms of overall statistical significance. In the different equations, λ, λ', γ and γ' denote the coefficients to be estimated, *u* and *u'* denote the error terms, the subscript *i = 1, …, N* denotes cross-sections, *t =1, …, T* denotes time, and *J* and *K* denote the number of lag periods. Following this Grangerian view, bad governance would cause corruption, if the coefficients of the lagged indicator values of the quality of governance yield statistically significant non-zero estimates in a regression, where corruption is the dependent variable. The causality from corruption to the deterioration of governance can be examined in the alternative way.

In the estimations of the baseline *Equations (1)* and *(2),* main attention is paid to γ and γ', as their estimates point to the possible existence of causality. The choice of lag periods is critical, because too few lags provoke autocorrelated errors and thus spurious test statistics, while too many lags reduce the power of the test. Here, the choice of lag periods obeys the rule of Dumitrescu and Hurlin (2012), which says that the minimum time extent for *J* and *K* should be chosen according to $T>5+2z$ (where *T* is the number of time periods and z is the number of lags). In this study, we set this number of lags at 3. The error terms *u* and *u'* are assumed to follow a one-way error component model. Since the study is based on balanced panel data (i.e. no unobserved specific effects), the error term in *Model 1*, for example, is reduced to the following equation: $u_{i,t} = \mu_i + v_{i,t}$, where $\mu_i \sim IID(0, \sigma_\mu^2)$ stands for period-specific effects and $v_{i,t} \sim IID(0,\sigma_v^2)$ represents the error term. The same applies for *Model 2*, as well.

Dynamic panel data regressions are basically subject to estimation bias over time. Since the lagged dependent variable $PoorGov_{i,t-k}$ in *Equation (1),* or

$Corr_{i,t-j}$ in *Equation (2),* could also be endogenous, their presence among explanatory variables in the respective models may cause correlations with the error term. Furthermore, individual effects caused by heterogeneity among the study units may also appear. With dynamic and endogenous regressors, the use of the Generalised Least Squares (GLS) estimators, or the Fixed Effects (FE) estimators, would lead to inconsistent estimates (Baltagi, 1995). Knowing that at least the asymptotic orthogonality condition between the regressor and the error is not met, it is wiser to use the instrumental variables method (Reiersøl, 1941). We adopted the two-step System Generalised Method of Moments (GMM) estimator proposed by Blundell and Bond (1998). This estimator is an augmented version of the Difference GMM estimator of Arellano and Bond (1991) that considers all orthogonality conditions and allows rigorous control over an instrument's matrix.

Referring to the baseline *Models 1* and *2*, as already mentioned, the variable *PoorGov* refers to poor governance, while the variable *Corr* refers to the extent of corruption. Data on these variables come from the Worldwide Governance Indicators (WGI) 2014 dataset published by The World Bank. The dataset includes balanced panel data from 117 countries, listed in *Appendix 1*. The time span is from 1996 to 2013, with statistics missing for the years 1997, 1999 and 2001. To keep the dataset balanced, statistics for these years were skipped for the other variables. Thus, the study includes 15 periodical observations in total on corruption and five other aspects of the quality of governance. The aggregated indicators for the quality of governance, as developed in Kaufmann, Kraay and Zoido-Lobaton (1999a, 1999b, 2002), are as follows:

*Voice and accountability (*denoted *VA)*, which "reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media"

Political stability and absence of violence/terrorism (PS), which "reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism";

Government effectiveness (GE), which "reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality if policy formulation and implementation, and the credibility of the government's commitment to such policies";

Regulatory quality (RQ), which "reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development";

Rule of law (RL), which "reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence"; and

Control of corruption (Corr).

The *Corr* indicator is used for the corruption variable, since it attempts to capture the extent to which bureaucrats behave opportunistically for private ends. More precisely, the indicator is defined to reflect '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'. Consistent with earlier research on the corruption issue, such as Méon and Sekkat (2005), we use *Control of Corruption* (CC) as a corruption variable, as it attempts to capture meaningful aspects that characterise corruption. Originally, all governance indicators scored from -2.5 to 2.5, with the upper bound indicating the best possible quality of governance, and full integrity for *Corr* as a corruption variable. For ease of interpretation, the indicators are transformed by subtracting their original values from 3.5. As a result, the transformed indicator values vary from 1 to 6, with the upper bound standing for the worst quality of governance, and for utmost corruption with *Corr*. The implication of rescaling the indices is that the increase in the statistics means further deterioration of the integrity and the quality of governance.

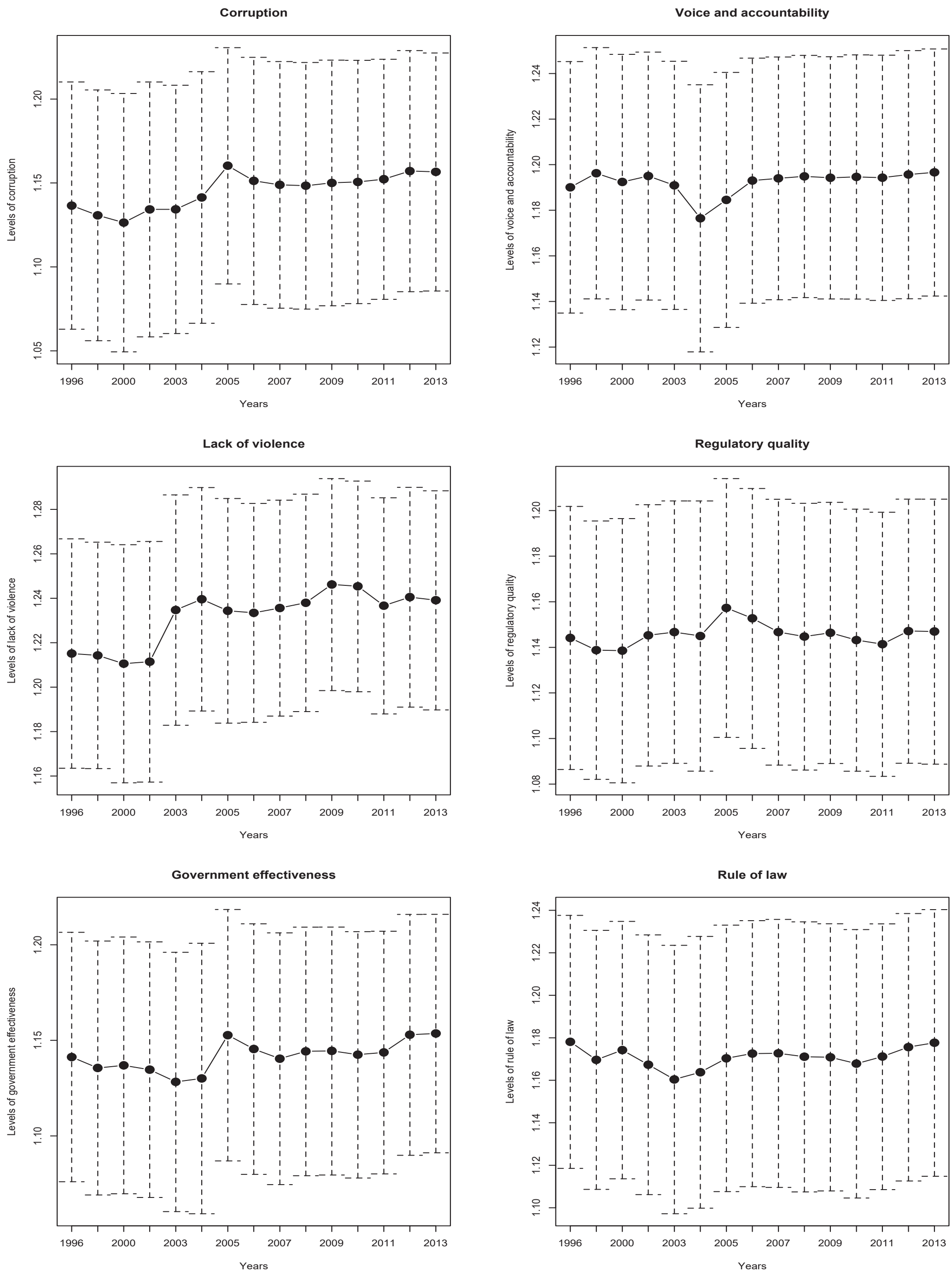
Figure 1 plots the average variations in the level of corruption and governance over 1996–2013. The graphs show an increasing trend that is relatively weak in some cases and rather high in others. In any cases, *Figure 1* on average points to a certain deterioration in governance and more broadly to a decline in the effectiveness of the institutions. More specifically, one notices that graphics related to the average variations in *Corr*, *GE* and *RQ* are, to some extent, similar to a significant variation in the observations between 2004 and 2006, and a peak in 2005. This indicates *a priori* a relatively high correlation link between these variables.

Table 1. Descriptive statistics of variables

Variables	Mean	Standard deviation	Minimum	Maximum	Sources
Corr	1.1453	0.3995	-0.0895	1.7151	World Development Indicators 2014, World Bank
VA	1.1922	0.2970	0.5150	1.7121	World Development Indicators 2014, World Bank
PS	1.2317	0.2732	0.6054	1.8998	World Development Indicators 2014, World Bank
GE	1.1418	0.3571	0.0679	1.7014	World Development Indicators 2014, World Bank
RQ	1.1457	0.3139	0.2253	1.7771	World Development Indicators 2014, World Bank
RL	1.1709	0.3393	0.4057	1.7457	World Development Indicators 2014, World Bank

Notes. The descriptive statistics are based on the logarithmic values of the variables.

Figure 1. Average variations with confidence intervals in corruption and poor governance over 1996–2013



3.4 RESULTS

The first thing is to ensure that the time series are stationary, meaning that their distribution neither follows any trend nor changes over time, which is a key requirement for the validity of time series regressions. The Augmented Dickey-Fuller (ADF) method is used with the null hypothesis that all panels contain a unit root, indicating that the series are nonstationary. The alternative hypothesis of stationarity is accepted if the probability is less than the critical value of 0.05. As can be seen from *Appendix 2*, the conclusion is that all series are stationary. This is also confirmed by the Philipps-Perron (PP) unit-root test, the result of which is also reported in *Appendix 2*. Likewise, its null hypothesis suggests that the series are nonstationary, and the decision rule is also the same as with the ADF test. The PP method is widely applied along with the ADF, as it makes it possible to consider both the autocorrelation and the heteroskedasticity of the errors. It is based on the same models as those of the Dickey-Fuller test but offers a non-parametric correction of the *t* statistic.

To test the existence of Granger causality between the quality of governance and the extent of corruption, the Two-step System GMM is used. GMM yields asymptotically robust estimators, and all variables enter regression with their logarithmic values. The lag length of 3 seems optimal since it overall enables the elimination of serial correlation in the residuals (Arellano, 2003). The autoregressive tests of order 1 (AR (1)) and order 2 (AR (2)) are used to respect the condition of Dumitrescu and Hurlin (2012). The diagnostic statistics are conclusive: AR (2) indicates that there is a second-order autocorrelation, and the Sargan test suggests that the null hypothesis that instruments are valid cannot be rejected.

In *Equation (1)*, the test of whether poor governance causes corruption is based on the Wald test for coefficients, about which the null hypothesis indicates that the values of the lagged variables of poor governance are zero, i.e. $\gamma_1=\gamma_2=\ldots=\gamma_K=0$. These regressors have predictive contents for $Corr_{i,t}$ – the estimated coefficient of the sum of the lagged governance variables is always statistically significant, at least at 5% level. This therefore means that the failures in governance, 'Granger-causes' corruption. These results remain true for each of the five governance variables. As for *Equation (2)*, it is the other way around, i.e. corruption also seems to cause poor governance. Likewise, the null hypothesis of the Wald test for coefficients claims the reverse direction that $\gamma'_1=\gamma'_2=\ldots=\gamma'_K=0$; likewise meaning that corruption cannot predict poor governance. In all cases, attention is paid to the strict statistical significance of the coefficient of the sum of the lagged corruption variables. In this case, too, the coefficient of corruption is always statistically significant, at least at the 5% level. Again, the conclusion remains valid for the five governance variables.

However, when dealing with causality, whether coefficients are positive or negative does not matter, as it has the same interpretation.[3]

The estimates' result relative to possible Granger causality links between corruption and the five governance indicators are summarised in *Table 2*, with a focus on the sum of the lagged corruption and governance variables. However, further details on this nexus are afterwards reported in *Tables 3–10*. In each of the tables, two tests are presented: first 'does $PoorGov_{i,t-k}$ cause $Corr_{i,t}$?'; then, 'does $Corr_{i,t-j}$ cause $PoorGov_{i,t}$?'

Table 3 reports the general causality test between corruption and the different governance variables. As for whether poor governance Granger-causes corruption, the null hypothesis of no causality is clearly rejected. The respective estimated coefficients associated with the sums of lagged governance variables are all statistically significant. The findings indicate that *VA*, which is captured in the extent to which citizens can freely choose their government, freedom of expression/association and free media, causes corruption at the 1% level. More specifically, their past information helps improve the prediction of corruption. Whereas, the other way around, the findings suggest the absence of a causal link from corruption to *VA*. The coefficient of the sum of lagged corruption variables is not statistically significant at the standard level of 5%.

Unlike the previous case, our estimations lead to a bidirectional causal link between corruption and political instability, violence and terrorism *(LV)* – meaning that previous statistics from one can predict the current information of the other, and *vice versa*. The null hypothesis of the Wald test for coefficients, which postulates non-predictive contents for $Corr_{i,t}$ and $PoorGov_{i,t}$, respectively, is rejected in both cases. In the respective estimations of *Equations (1)* and *(2)*, the estimated coefficients associated with the sum of lagged $PoorGov_{t-1}$ and $Corr_{t-1}$ are all statistically significant at the 1% level.

Likewise, a bidirectional causal link is found regarding the nexus between corruption and the remaining governance variables (*GE*, *RQ* and *RL*). In all cases, our results show that past information on these governance failures can predict the

[3] Note that the signs of the estimated coefficients tell about effects rather than causes. Yet, the interpretation in this case is similar.

current state of corruption. Similarly, corruption predicts these failures in governance.

We checked the robustness of these major results by smoothing out fluctuations in the variables via the adoption of a three-year average. This helped verify whether our findings were driven by some extreme values. Even though one may expect a loss of information on some of our variables, the method is nevertheless known to eliminate first-order autocorrelation. As a second robustness check, we applied alternative estimations: One-step GMM and Fixed effects estimators. The results of these tests are respectively summarised in *Tables 4, 5* and *6*. Overall, the estimations lead to a similar conclusion, with a statistically significant bidirectional causality between WGI and the last four governance variables, i.e. *LV*, *GE*, *RB* and *RL*. Meanwhile, the nexus between corruption and *VA* was seldom significant throughout the study.

Table 3. Results for Granger causality tests using the Two-step System GMM

	(1)		(2)		(3)		(4)		(5)	
	VA ⟶ WGI	WGI ⟶ VA	LV ⟶ WGI	WGI ⟶ LV	GE ⟶ WGI	WGI ⟶ GE	RB ⟶ WGI	WGI ⟶ RB	RL ⟶ WGI	WGI ⟶ RL
$Corr_{t-1}$	0.236***	-0.052	-0.106**	-0.10***	0.006***	-0.062***	-0.005**	-0.18***	-0.299**	0.163***
	(0.339)	(0.03)	(0.52)	(0.106)	(0.27)	(0.06)	(0.52)	(0.08)	(0.53)	(0.259)
$Corr_{t-2}$	0.528**	-0.004*	0.479*	-0.021**	0.713***	-0.046*	0.479**	0.122*	-0.242**	0.014*
	(0.348)	(0.02)	(0.655)	(0.11)	(0.462)	(0.05)	(0.591)	(0.081)	(0.54)	(0.169)
$Corr_{t-3}$	-0.061	-0.008	-0.069	-0.167	-0.012**	-0.016*	-0.128	-0.15**	-0.40*	-0.03*
	(0.34)	(0.02)	(0.39)	(0.18)	(0.44)	(0.07)	(0.39)	(0.09)	(0.413)	(0.172)
$\sum_{j=1}^{3} Corr_{t-j}$	0.590**	**-0.007**	0.515*	**0.081****	0.553**	**-0.06****	0.547**	**-0.05****	0.092	**-0.03****
	(0.27)	**(0.02)**	(0.33)	**(0.12)**	(0.29)	**(0.04)**	(0.32)	**(0.04)**	(0.33)	**(0.09)**
$PoorGov_{t-1}$	0.041**	0.572**	0.079**	0.841*	-0.059***	0.137	0.105***	0.715*	0.092**	-0.632*
	(0.123)	(0.18)	(0.075)	(0.36)	(0.13)	(0.22)	(0.196)	(0.33)	(0.32)	(1.08)
$PoorGov_{t-2}$	0.041***	-0.122*	-0.037***	-0.51*	-0.179***	0.177	-0.119	-0.318	0.126**	-0.095*
	(0.127)	(0.14)	(0.12)	(0.66)	(0.15)	(0.189)	(0.26)	(0.28)	(0.297)	(0.95)
$PoorGov_{t-3}$	-0.103	0.024	0.001	0.976	0.022*	0.198	-0.053**	0.644*	0.181*	0.102
	(0.13)	(0.116)	(0.092)	(1.077)	(0.166)	(0.238)	(0.22)	(0.28)	(0.355)	(0.651)
$\sum_{k=1}^{3} PoorGov_{t-k}$	**-0.15****	0.063*	**-0.05****	0.167*	**-0.116*****	0.178	**-0.135****	0.045	**-0.07****	0.192*
	(0.06)	(0.079)	**(0.06)**	(0.28)	**(0.1)**	(0.21)	**(0.12)**	(0.194)	**(0.18)**	(0.615)
Observations	936	936	936	936	936	936	936	936	936	936
Sargan test (*p*-value)	0.512	0.253	0.537	0.730	0.515	0.801	0.512	0.761	0.729	0.304
Autocorrelation(1) (*p*-value)	0.031	0.049	0.0478	0.084	0.0655	0.052	0.0463	0.0429	0.054	0.069
Autocorrelation(2) (*p*-value)	0.154	0.818	0.437	0.412	0.166	0.502	0.377	0.027	0.660	0.0983
Wald test for coef. (*p*-value)	0.005	0.014	0.0055	0.00125	0.00071	0.00647	0.00103	0.00052	0.00432	0.00994

Wald test for time dummies (*p*-value)	0.00661	0.00941	0.000911	0.000775	0.00740	0.00156	0.00914	0.00425	0.00934	0.00437

Notes. Robust standard errors of Two-step System GMM are in parentheses.
a. Statistical significance at 0.1 percent level (***)
b. Statistical significance at 1 percent level (**)
c. Statistical significance at 5 percent level (*)
d. Statistical significance at 10 percent level (.)

Table 4. Robustness test: Results for Granger causality tests using three-year average

	(1)		(2)		(3)		(4)		(5)	
	VA ⟶ WGI	WGI ⟶ VA	LV ⟶ WGI	WGI ⟶ LV	GE ⟶ WGI	WGI ⟶ GE	RB ⟶ WGI	WGI ⟶ RB	RL ⟶ WGI	WGI ⟶ RL
$Corr_{t-1}$	-0.141*** (0.35)	-0.09** (0.05)	0.302** (0.507)	-0.09*** (0.12)	0.059* (0.359)	-0.077** (0.10)	0.142* (0.525)	-0.021*** (0.10)	0.233* (0.42)	-0.39*** (0.1)
$Corr_{t-2}$	-0.82** (0.49)	0.047 (0.049)	-0.603 (0.77)	0.012*** (0.134)	-0.983* (0.71)	-0.072** (0.14)	-0.489** (0.74)	-0.15* (0.104)	-0.144** (0.52)	-0.17*** (0.13)
$Corr_{t-3}$	0.420** (0.358)	0.035 (0.059)	0.416 (0.327)	0.074*** (0.166)	0.398* (0.508)	0.051 (0.127)	0.579 (0.385)	0.297* (0.123)	0.623 (0.446)	0.215** (0.14)
$\sum_{j=1}^{3} Corr_{t-j}$	-0.47* (0.27)	**-0.12** **(0.04)**	-0.37 (0.30)	**0.04***** **(0.100)**	-0.483* (0.36)	**0.105**** **(0.081)**	-0.245* (0.29)	**0.135**** **(0.07)**	-0.062* (0.39)	**0.09***** **(0.07)**
$PoorGov_{t-1}$	-0.032* (0.21)	-0.35* (0.154)	-0.057** (0.12)	-0.683* (0.48)	-0.090*** (0.21)	-0.148** (0.21)	0.119*** (0.218)	-0.49 (0.343)	0.121*** (0.308)	1.18** (0.72)
$PoorGov_{t-2}$	-0.188* (0.17)	0.077** (0.106)	0.117** (0.161)	0.270 (0.694)	0.053** (0.233)	-0.205 (0.24)	0.247* (0.394)	0.492 (0.301)	- 0.118*** (0.34)	0.20* (0.46)
$PoorGov_{t-3}$	-0.443 (0.31)	-0.077* (0.123)	-0.071 (0.10)	-0.247** (0.43)	-0.212* (0.23)	-0.171* (0.27)	-0.267 (0.21)	-0.71** (0.26)	-0.332** (0.38)	-0.26 (0.42)
$\sum_{k=1}^{3} PoorGov_{t-k}$	**0.141*** **(0.11)**	-0.001* (0.08)	**-0.016**** **(0.12)**	-0.185* (0.22)	**0.295**** **(0.17)**	-0.169* (0.26)	**0.087**** **(0.150)**	-0.014** (0.18)	**-0.18***** **(0.26)**	-0.36 (0.26)
Observations	312	312	312	312	312	312	312	312	312	312
Sargan test (*p*-value)	0.447	0.1026	0.5642	0.5677	0.531	0.803	0.4813	0.7917	0.7416	0.3669
Autocorrelation(1) (*p*-value)	0.00319	0.0314	0.0199	0.00313	0.004565	0.00526	0.019408	0.0303	0.005682	0.003604
Autocorrelation(2) (*p*-value)	0.2414	0.7449	0.8358	0.7584	0.3586	0.5823	0.9126	0.027	0.6845	0.9267
Wald test for coef. (*p*-value)	1.5549e-05	6.6426e-12	5.4e-15	0.3315	0.0055	2.22e-16	2.1444e-06	2.22e-16	3.533e-05	4.6611e-14

Wald test for time dummies (*p*-value)	0.00695	0.00096	0.008912	0.00712	0.006513	0.00136	0.00721	0.00314	0.00908	0.003654

Notes. Robust standard errors of Two-step System GMM are in parentheses.
a. Statistical significance at 0.1 percent level (***)
b. Statistical significance at 1 percent level (**)
c. Statistical significance at 5 percent level (*)
d. Statistical significance at 10 percent level (.)

Table 5. Robustness test: Results for Granger causality tests using the One-step GMM estimators

	(1)		(2)		(3)		(4)		(5)	
	VA ⟶ WGI	WGI ⟶ VA	LV ⟶ WGI	WGI ⟶ LV	GE ⟶ WGI	WGI ⟶ GE	RB ⟶ WGI	WGI ⟶ RB	RL ⟶ WGI	WGI ⟶ RL
$Corr_{t-1}$	0.151*** (0.349)	-0.022* (0.03)	-0.301*** (0.52)	-0.03*** (0.10)	-0.003** (0.34)	-0.03*** (0.06)	-0.227* (0.53)	-0.14** (0.08)	-0.304** (0.43)	0.241*** (0.15)
$Corr_{t-2}$	0.481 (0.387)	-0.002 (0.02)	0.242** (0.671)	-0.057** (0.12)	0.647 (0.612)	-0.029* (0.05)	0.155 (0.640)	0.128* (0.08)	-0.119* (0.50)	0.074** (0.12)
$Corr_{t-3}$	-0.184* (0.36)	-0.006* (0.02)	-0.247 (0.33)	-0.076 (0.14)	-0.197* (0.51)	-0.012 (0.08)	-0.400** (0.37)	-0.16 (0.08)	-0.421 (0.43)	-0.02 (0.10)
$\sum_{j=1}^{3} Corr_{t-j}$	0.491* (0.258)	**0.006 (0.021)**	0.415** (0.299)	**0.019* (0.08)**	0.502** (0.345)	**-0.074* (0.05)**	0.317 (0.287)	**-0.07** (0.04)**	0.132* (0.36)	**-0.04** (0.05)**
$PoorGov_{t-1}$	0.042* (0.159)	0.453** (0.147)	0.090*** (0.075)	0.738** (0.429)	-0.053** (0.16)	0.109** (0.197)	0.13** (0.149)	0.639** (0.33)	0.073** (0.25)	-0.92** (0.73)
$PoorGov_{t-2}$	0.108 (0.133)	-0.121* (0.107)	0.014*** (0.115)	-0.125 (0.67)	-0.10 (0.162)	0.152** (0.202)	0.035** (0.227)	-0.345 (0.27)	0.093 (0.269)	-0.18*** (0.46)
$PoorGov_{t-3}$	-0.059 (0.14)	0.008 (0.09)	0.036** (0.085)	0.271 (0.401)	0.088** (0.192)	0.171 (0.271)	0.115 (0.179)	0.627** (0.246)	0.188** (0.351)	0.044 (0.35)
$\sum_{k=1}^{3} PoorGov_{t-k}$	**-0.103 (0.05)**	0.027** (0.068)	**-0.04** (0.065)**	0.151 (0.203)	**-0.105** (0.14)**	0.195* (0.228)	**-0.058** (0.09)**	0.105* (0.16)	**-0.075* (0.18)**	0.187 (0.26)
Observations	936	936	936	936	936	936	936	936	936	936
Sargan test (p-value)	0.447	0.1026	0.5642	0.5677	0.531	0.803	0.4813	0.7917	0.7416	0.3669
Autocorrelation(1) (p-value)	0.00319	0.0314	0.0199	0.00313	0.004565	0.00526	0.019408	0.0303	0.005682	0.003604
Autocorrelation(2) (p-value)	0.2414	0.7449	0.8358	0.7584	0.3586	0.5823	0.9126	0.027	0.6845	0.9267
Wald test for coef. (p-value)	1.5549e-05	6.6426e-12	5.4e-15	0.3315	0.0055	2.22e-16	2.1444e-06	2.22e-16	3.533e-05	4.6611e-14

Wald test for time dummies (*p*-value)	0.00695	0.00096	0.008912	0.00712	0.006513	0.00136	0.00721	0.00314	0.00908	0.003654

Notes. Robust standard errors of One-step GMM are in parentheses.
a. Statistical significance at 0.1 percent level (***)
b. Statistical significance at 1 percent level (**)
c. Statistical significance at 5 percent level (*)
d. Statistical significance at 10 percent level (.)

Table 6. Robustness test: Results for Granger causality tests using the Fixed effects estimators

	(1)		(2)		(3)		(4)		(5)	
	VA ⟶ WGI	WGI ⟶ VA	LV ⟶ WGI	WGI ⟶ LV	GE ⟶ WGI	WGI ⟶ GE	RB ⟶ WGI	WGI ⟶ RB	RL ⟶ WGI	WGI ⟶ RL
$Corr_{t-1}$	0.268***	-0.047**	-0.121***	-0.102*	0.049	-0.059***	-0.0005**	-0.20**	-0.249**	0.161***
	(0.361)	(0.03)	(0.52)	(0.11)	(0.305)	(0.06)	(0.5)	(0.10)	(0.41)	(0.118)
$Corr_{t-2}$	0.513***	0.002**	0.391***	-0.006**	0.689	-0.046***	0.452*	0.093***	-0.164**	0.027***
	(0.348)	(0.025)	(0.59)	(0.11)	(0.441)	(0.05)	(0.52)	(0.091)	(0.48)	(0.128)
$Corr_{t-3}$	-0.055	-0.01	-0.095	-0.225	0.021	-0.001***	-0.075**	-0.176*	-0.37**	-0.051**
	(0.33)	(0.027)	(0.35)	(0.21)	(0.423)	(0.07)	(0.38)	(0.12)	(0.34)	(0.11)
$\sum_{j=1}^{3} Corr_{t-j}$	0.58**	**-0.012***	0.473**	**0.078***	0.553*	**-0.076*****	0.58*	**-0.071****	0.119**	**-0.023****
	(0.271)	**(0.02)**	(0.301)	**(0.114)**	(0.27)	**(0.04)**	(0.298)	**(0.04)**	(0.304)	**(0.04)**
$PoorGov_{t-1}$	0.031**	0.523**	0.095***	0.782**	-0.084***	0.133	0.126***	0.743*	0.081***	-0.635
	(0.128)	(0.19)	(0.078)	(0.29)	(0.14)	(0.218)	(0.21)	(0.41)	(0.247)	(0.49)
$PoorGov_{t-2}$	0.062**	-0.130	-0.026*	-0.581	-0.176**	0.142	-0.113	-0.242	0.111**	-0.145
	(0.142)	(0.141)	(0.11)	(0.52)	(0.15)	(0.19)	(0.26)	(0.29)	(0.283)	(0.41)
$PoorGov_{t-3}$	-0.081	-0.014	0.013	1.140	0.008*	0.147	-0.077*	0.686*	0.184	0.150
	(0.14)	(0.117)	(0.09)	(1.12)	(0.165)	(0.261)	(0.23)	(0.38)	(0.302)	(0.407)
$\sum_{k=1}^{3} PoorGov_{t-k}$	**-0.15***	0.075**	**-0.055***	0.171	**-0.124****	0.222	**-0.159****	0.123	**-0.086****	0.136
	(0.06)	(0.083)	**(0.06)**	(0.35)	**(0.09)**	(0.219)	**(0.14)**	(0.25)	**(0.16)**	(0.258)
Observations	635	635	635	635	635	635	635	635	635	635
Adjusted-R2	0.2467	0.2534	0.2254	0.2722	0.3021	0.3108	0.3227	0.3350	0.26107	0.2529

Notes. Robust standard errors of Fixed effects are in parentheses.
a. Statistical significance at 0.1 percent level (***)
b. Statistical significance at 1 percent level (**)
c. Statistical significance at 5 percent level (*)
d. Statistical significance at 10 percent level (.)

3.5 CONCLUSIONS

The paper empirically examines the causal nexus between corruption and other aspects of regulation, including Absence of Voice and accountability; Political instability, violence and terrorism; Government inefficiency; Regulatory burden; and Absence of rule of law. The study covered a total of 117 countries worldwide, over the period 1996–2013. Data relative to key variables, i.e. corruption and governance, were gathered from the Worldwide Governance Indicators (WGI) dataset 2014 (The World Bank).

Following the methodology à la Granger (1969), econometric regressions were carried out based on dynamic panel data models using the GMM system estimators.

Throughout the study, the investigations did not yield a statistically significant causal link between the deterioration of aspects of Absence of Voice and accountability (citizens' ability to select their government, and freedom of expression, association and media) and increasing corruption.

Moreover, for the relationship between corruption and governance indicators, including Political instability, violence and terrorism (the likelihood that the government will be destabilised or overthrown by unconstitutional means, including politically motivated violence and terrorism); Government inefficiency (quality of public services, independence of civil servants from political pressures, quality of policy formulation and implementation, and government's commitment to policies); Regulatory burden (government's ability to implement policies and regulations that promote private sector development); and Absence of rule of law (agents' confidence in the rules of society, quality of contract enforcement, property rights, police and courts, and the likelihood of crime and violence), our findings yield a strong bidirectional causal link. This finding remained consistent to different robustness tests, including the year averaging, or to the use of alternative estimation techniques, such as the One-step GMM and Fixed effects methods.

Regarding the main criticism from the Chicago School of Law and Economics against government intervention, the findings likewise show that regulations that constitute the rationale of such an intervention are an important source of corruption, and thus of deregulation. This, in fine, seriously questions the important issue of the effectiveness of regulations, in line with the viewpoint defended by the Chicago School of Law and Economics.

3.6 POLICY RECOMMENDATIONS

The study emphasises that poor regulations, to a large extent, are very likely to trigger corruption. This seems particularly true in contexts of political instability, violence and terrorism, or of weak rule of law. From the economic perspective, too, governments should in particular pay attention to their approaches for regulating businesses as well as the conduct on their political economy. Regulations aiming to boost private sector development, the quality of public services, policy formulation and implementation all matter. When poorly implemented, they generate corruption.

Regarding the subject of corruption, which remains the primary focus of this study, the phenomenon is markedly complex and difficult to pin down. Although economic and socio-cultural reasons are regularly mentioned to explain its causes, a large part of the literature on the subject critically points to shortcomings in governance. Our investigation, in addition to confirming this specific point, reveals in most cases a vicious circle of ‘bad governance–corruption–bad governance’. The fight against corruption cannot be waged on economic terrain alone, but must be conducted on other fronts as well, including that of governance.

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APPENDIX 1

Table 2. Result of the Augmented Dickey-Fuller Test

Variable	AD-F Statistics	*P*-value
COR	-10.814	< 0.01
VA	-9.8521	< 0.01
PS	-9.8957	< 0.01
GE	-9.9102	< 0.01
RQ	-8.5446	< 0.01
RL	-10.374	< 0.01
Income	-13.367	< 0.01
Inflation	-8.547	< 0.01
Unemployment	-8.956	< 0.01

Notes. The series are stationary if all probabilities (*P*-values) associated with the D-F statistics are smaller than the critical value 0.05.

Result of the Philipps-Perron Unit-Root Test

Variable	D-F Statistics	*P*-value
COR	-31.900	0.01
VA	-30.974	0.01
PS	-33.097	0.01
GE	-30.407	0.01
RQ	-32.014	0.01
RL	-31.423	0.01
Income	-36.725	0.01
Inflation	-32.846	0.01
Unemployment	-31.604	0.01

Notes. The Phillips-Perron test is a variation of the basic Dickey-Fuller test, and the D-F statistics differ from the AD-F statistics. The null hypothesis is that the series will have a unit root against a stationary alternative. It is rejected if all probabilities (*P*-values) associated with the D-F statistics are smaller than the critical value 0.05.

4 ESSAY III. DO BUSINESS CYCLES TRIGGER CORRUPTION?

KOURAMOUDOU KÉÏTA

ABSTRACT

In the economic literature, the nexus between economic growth and corruption is well covered, but there are only a few empirical studies on cyclical variations of corruption. In one such study, Gokcekus and Suzuki (2011) find that transitory income and corruption vary in parallel, thus confirming the famous claim of Galbraith (1997) that embezzlement flourishes in business booms and withers in recessions. This paper tests the general validity of the finding by using a more extensive dataset. The results are conflicting: corruption is found to shrink with the increase in transitory income. In other words, economic booms foster integrity, and recessions make corruption bloom. In addition, the results show that this negative effect of short-term changes in income on corruption is greater in high-income countries, or in those with good quality of rule of law. While in low-income or poor rule of law countries, such a beneficial effect on integrity overall is relatively low.

Keywords: embezzlement, permanent income, transitory income

JEL classification: D73, E32

4.1 INTRODUCTION

In the economic literature on corruption, there are many empirical studies on the correlation between economic development and corruption. Most of these studies also show that corruption tends to diminish as national income rises (e.g. La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1999; Mauro, 1995; Treisman, 2000; Mo, 2001; Pande, 2008; Mallik and Saha, 2016). Still, only a few empirical studies have tackled the question of the correlation between business cycles and corruption. In recent years, this viewpoint has become increasingly important due to the growing understanding that cycles and the behavioural patterns of economic agents are organically intertwined.

This original idea came early on from Keynes (1936), and e.g. Minsky (1975, 1986), while Akerlof and Shiller (2009) represent more recent contributions to the discussion. Behavioural analyses emphasise that the thought patterns of individuals, their constant ‘rational’ calculus, to a large extent dictates rent-seeking, which in turn considerably contributes to economic disruptions at given intervals of time (Cooray and Schneider, 2018). Quiggin (2010) and Varoufakis (2011) highlight the role of such biased behaviour during business cycles, which occasionally burst into earth-shattering economic crises, like that since the 2008 crash.

The famous proposition by Galbraith (1997, p. 133) is that there always exists a considerable amount of undiscovered embezzlement in business life, and that it varies with economic cycles. In good times, people are not only trusting but also greedy, which makes the ‘bezzle’ grow. In depressions, people become cautious and suspicious, and money is audited meticulously. Improving business morality makes the ‘bezzle’ shrink.

Gokcekus and Suzuki (2011) performed one of the few studies on the nexus between business cycles and corruption. Taking Galbraith (1997) as a starting point, they build on the fact that embezzlement is a key element of corruption and test the proposition by using comprehensive measures of perceived corruption. The study also finds substantial proof for the proposition: The results show that while long-term growth and integrity develop in parallel, corruption tends to accelerate in times of short-term booms, and shrink during economic recessions. This is exactly what Galbraith means in terms of the ‘bezzle’.

The core idea of this paper is to examine whether the findings offered by Gokcekus and Suzuki (2011) on the intuitively appealing proposition of Galbraith

(1997) are valid in general. This is done simply by replicating the original study but also by using a more extensive dataset. The dataset includes both considerably more numerous country observations and a somewhat longer and more up-to-date time coverage. In line with the original study, both economic growth (namely changes in permanent income) and business cycles (namely changes in transitory income) are tested as possible determinants of corruption.

The paper is organised as follows. *Section 2* specifies the model as well as the data used. *Section 4* describes the estimation techniques and reports the estimation results. Alternative measures of corruption are used to check the robustness of the results and to secure exact comparability of the results to those of Gokcekus and Suzuki (2011). *Section 5* discusses the findings and maps paths for further study.

4.2 MODEL AND DATA

4.2.1 Model

The aim of the paper is to test the effects of changes in national income on corruption. Both the effects of long-term changes in permanent income and short-term fluctuations in transitory income are studied. The modelling technique follows Gokcekus and Suzuki (2011), which in turn is an application of the original formulation of Mélitz and Zumer (2002). The basic model can be written as follows:

$$(1)\quad Cor_{i,t} = \gamma_0 + \gamma_1 PI_i + \gamma_2 TI_{i,t} + \mu_{i,t}.$$

In *Equation (1)*, all country variables are expressed in relation to the whole sample. $Cor_{i,t}$ stands for the level of corruption in country i ($i = 1,\ldots, N$) in period t ($t = 1,\ldots,T$) relative to the average level of corruption over all countries in the sample. Thus, $Cor_{i,t}$ is derived by dividing the value of the corruption indicator for country i in period t by its average indicator value over the whole period T. On the right-hand side, parameters γ denote the coefficients to be estimated, and μ is the disturbance term.

Furthermore, PI_i denotes country i's permanent income, and $TI_{i,t}$ denotes transitory income, which captures temporary deviations from permanent income. Both PI_i and $TI_{i,t}$ are measured in terms of GDP per capita, relative to the whole sample. Thus, PI_i is derived by dividing country i's GDP per capita value at period t by the average of GDP per capita values over the time span $t = 1, \ldots, T$. To put it simpler, PI_i is the average of country *i's* income shares over time. Then, $TI_{i,t}$ is simply the possible difference between country *i's* income share and PI_i in any period *t*.

Note that γ_1 reflects the response of corruption to the development of long-run average income PI_i. Thus, it captures permanent changes in $Cor_{i,t}$. Likewise, γ_2 reflects the response of corruption to the transitory income variations, thus capturing changes in the time profile of $Cor_{i,t}$. These two effects can be separated, since the permanent effect remains even when there are no deviations in the time series, whereas the transitory impact hinges entirely on such movements. Decomposing *Equation (1)* yields

$$(2)\quad Cor_i = \gamma_0 + \gamma_1 PI_i + \eta_i$$

$$(3)\quad Cor_{i,t} - Cor_i = \gamma_2 TI_{i,t} + \varepsilon_{i,t},$$

where Cor_i is the average of $Cor_{i,t}$ over the time span $t = 1,\ldots,T$, and $\eta_{i,t}$ and $\varepsilon_{i,t}$ are the new disturbance terms. Since *Equations (2)* and *(3)* add up to *Equation (1),* it follows that $\eta_{i,t} + \varepsilon_{i,t} = \mu_{i,t}$. Furthermore, as it is quite plausible that the effects from changes in transitory income to corruption are not instant, possible lags in these influences should be considered, too. In order to do this, *Equation (3)* can be re-written as follows:

$$(4)\quad Cor_{i,t} - Cor_i = \sum_{j=0}^{K} \gamma_{2,t-j} TI_{i,t-j} + \nu_{i,t},$$

where $j = 0, \ldots, K$ denotes the number of lags, the cumulative sum of the time-specific coefficients $\gamma_{2,t-j}$ captures the cyclical behaviour of corruption, and $\nu_{i,t}$ is the error term.

Moreover, note that as well known in panel data econometrics, the estimates of γ_1 and γ_2 in *Equations (2)* and *(3)* are identical to those resulting from the estimation of *Equation (1)*. The two parameters γ_1 and γ_2 are respectively referred to as 'between' and 'within' coefficients and can be interpreted as different estimators of a single parameter γ. For this reason, *Equations (2)* and *(3)* are usually estimated separately.

4.3 Data

We use balanced panel data from 110 countries around the world over the time span 1984–2011 for the estimations of *Equations (2)*, *(3)* and *(4)*. These countries are listed in *Appendix 1* in the end of the study. Country-wise time series of gross domestic product (GDP) per capita, constant prices (in Purchasing Power Parity; 2011 international dollar) are used to calculate the economic variables of the baseline models, i.e. permanent and transitory incomes, as described above. Data are collected from the World Economic Outlook 2014 (from the IMF website).

On the other hand, for the corruption variable, we use the International Country Risk Guide (ICRG)'s index, which attempts to capture, at the same time, several dimensions of corruption. Even though it is principally concerned with actual and potential corruption within the political system, such as excessive patronage, political party financing, nepotism, suspicious ties between politics and business and job reservations, it also takes into account the most common dimension encountered in the sphere of business, which is connected to specific payments and bribes related to import/export licenses, permits, fiscal controls, etc. We equally use data for the same time span (i.e. 1984–2011) and for the risk of corruption, varying from 0 to 6, with the lower bound indicating utmost risk of corruption, and the upper bound, perfect integrity. For ease of future interpretations of empirical findings, we rescaled the data so that higher risk means higher corruption. The ICRG's indices are merely subtracted from 7 – thus making them vary from 1 to 7, symbolising the minimum and maximum risks of corruption, respectively.

Moreover, in their similar study, Gokcekus and Suzuki (2011) adopt the Corruption Perception Index (CPI) from Transparency International (TI) and the per capita GDP of 39 countries from the World Bank's World Development Indicators databases (in constant US dollars) over the time span of 1995–2007 (i.e. 13 periods). Nevertheless, note that our two studies use the same method to calculate the income and corruption variables, namely their respective level at a given time as well as their respective short- and long-term change.

Finally, we use instrumental variables – their use being justified *a priori* by a serious suspicion of endogeneity between corruption and income. A bidirectional causality might exist between the two variables. Studies agree that corruption can cause a drop in GDP, and therefore a decline in income and wages (Mauro, 1995; Shleifer and Vishny, 1993). At the same time, a common reasoning is that low incomes are one of the main reasons why agents are corrupt. Moreover, empirical evidence shows that low-income countries are also those with a relatively strong tendency towards corrupt behaviour (Mauro, 1995; Knack and Keefer, 1995; Mo, 2000; Swaleheen, 2011).

Since the asymptotic orthogonality between the error and regressor is not met, the OLS estimators become inconsistent. In such a case, an instrumental variable technique provides suitable estimators that may correct for the endogeneity bias. In dealing with the same issue, Chowdhury (2004), Keefer (2007) and Gokcekus and Suzuki (2011) use the absolute geographic distance (*Latitude*) from the equator to instrument GDP per capita. However, this variable can be intuitively problematic given the standards associated with the selection of instruments. In particular, it would be difficult to guarantee the exogeneity of this instrument *vis-à-vis* corruption in the first-stage regressions. We think that *Latitude* as an instrument could, at the same time, influence corruption through channels like colonial history, legal origin, etc.

In this study, instruments used for permanent and transitory income are gross national savings, in percentage of GDP (*Savings*), and rainfall variation (*Rainfall*) from one year to the next.

Savings data also come from the World Economic Outlook 2014. In the first-stage estimation for this study, *Savings* may certainly not be the perfect variable for instrumenting income. The exogeneity hypothesis may not be fulfilled, as savings may well influence corruption through channels such as investment or GDP. The literature argues that the level of corruption is closely related to income (Shleifer and Vishny, 1993; Mauro, 1995; Knack and Keefer, 1995). For example, high-income countries tend to have a low tendency towards corruption. Therefore, one can also imagine that in these countries, national savings is more important, because agents have a greater capacity for saving, unlike in the low-income countries. Indeed, the partial correlation coefficient between income and savings is 0.38, which is relatively important for a correlation that should ideally be zero.

Rainfall data come from the monthly estimates of the Global Precipitation Climatology Centre (GPCC). From these series are derived the annual rainfall data recorded in country *i*, for year *t*, denoted $Rainfall_{i,t}$. With these series, we precisely evaluate the proportional variations in rainfall, referred to as $\Delta Rainfall_{i,t} = (Rainfall_{i,t} - Rainfall_{i,t-1})/Rainfall_{i,t-1}$. In seeking to estimate the impact of economic conditions on the probability of civil conflict for 41 African countries, Miguel, Satyanath and Sergenti (2004) also uses rainfall variation as an instrument for economic growth. One can intuitively imagine that the precipitation recorded may, to a certain extent, condition good agricultural results. This economic sector significantly contributes to growth in many countries. Thus, a correct level of precipitation can afford suitable conditions for high future agricultural production. Of course, this hypothesis is very relative – because while it may seem, for instance, consistent for sub-Saharan African countries, which are generally located in semi-arid tropical regions, these regions are sometimes threatened by drought; for other countries, such as those from Western Europe, the hypothesis may be false because of parameters such as agricultural techniques, crops, etc., which can do without a certain amount of precipitation while still maintaining agricultural production. In some countries, and depending on the type of agriculture, high precipitation can even have an adverse effect, causing damage. Given the very varied origins of countries in the dataset – and given the rainfall volatility from one region to another – it would not be surprising that $\Delta Rainfall_{i,t}$ is not sufficiently correlated with PI_i and $TI_{i,t}$. Yet such a correlation is important (here, it is 0.205 with *PI*, and 0.259 with *TI*). In addition, it is also feared that the exogeneity of the instrument is not perfect. Rainfall could also influence corruption through channels such as geographical latitude, as the highest rainfall totals are recorded near the equator, which is subject to strong heating by the Sun and hence prolonged heavy showers and frequent thunderstorms. At the same time, the literature suggests a relatively strong correlation between countries' proximity to the equator and their corruption levels.

Nevertheless, we think that despite intuitive assumptions on the instruments' relevance, diagnostic tests associated with the instruments are worth considering.

The OLS estimations of the supposedly endogenous variables (*PI* and *TI*) against instruments in the first stage are shown in *Table a*. The estimated coefficients associated with the instruments are statistically significant at the 5% level – meaning that they provide a good deal of information on the endogenous variables, which is crucial. Nevertheless, the significance level of $\Delta Rainfall_{i,t}$ is weak compared to that of $Savings_{i,t}$. Note that the significance of coefficients overall remains robust with Fixed effects estimations (but not shown here). Furthermore, the null hypothesis of the F-test on instruments, which postulates that the latter are weak, is systematically rejected (*p*-value being always less than 0.05).

The exogeneity test (the second step of instrument tests) is shown in *Table b*. The latter shows that residuals in the first-stage estimations, introduced in the basic models as independent variables, are seldom statistically significant. When significant, this points to the rejection of the exogeneity hypothesis. Since endogeneity is present, OLS is biased towards the IV estimators that are consistent. In *Table b*, the *p*-value associated with the Wu-Hausman test is less than 5%. When statistically insignificant, on the other hand, endogeneity does not appear to be a big problem, hence the OLS and IV estimates are similar. The *p*-value associated with the Wu-Hausman test is greater than 5% in those cases.

The Sargan test, the third and last diagnostic test on instruments (also referred to as J-statistic), checks the exogeneity hypothesis of instruments against the endogeneity hypothesis. In this specific case, we have two instruments against a single endogenous variable – the Sargan test is only applicable when both instruments are simultaneously used. For *Equation (2)*, the test indicates a probability lower than 5% (*p*-value = 4.79e-05), which rejects the exogeneity hypothesis of instruments. As a result, the findings invalidate at least one of the instruments used. While for *Equation (3)*, most importantly, such a probability is greater than 5% (*p*-value = 0.288), meaning the instruments are exogenous, and therefore valid.

Table a. First-stage regressions

Dependent variables:	Permanent income			Transitory income		
	First-stage 1	First-stage 2	First-stage 3	First-stage 4	First-stage 5	First-stage 6
Constant	8.208[a]	9.096[a]	8.205[a]	0.053[a]	0.007[a]	0.101[a]
	(0.042)	(0.022)	(0.042)	(0.007)	(0.007)	(0.018)
$Savings_{i,t}$	0.042[a]		0.042[a]	0.002[a]		0.001[a]
	(0.001)		(0.001)	(0.0003)		(0.0006)
$\Delta Rainfall_{i,t}$		0.005[b]	0.000[b]		0.001[b]	0.001[c]
		(0.0007)	(0.0000)		(0.0001)	(0.0001)
Adjusted-R^2	0.1589	0.0811	0.1591	0.0494	0.065	0.0594
F-test (*p*-value)	6.22e-08[a]	7.36e-12[a]	<2e-16[a]	2.09e-12[a]	<2e-16[a]	<2e-16[a]
Number of obs.	3080	3080	3080	3080	3080	3080

Notes. Estimation based on OLS
a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level

Table b. Exogeneity test

	Equation (2)	*Equation (2)*	*Equation (2)*	*Equation (3)*	*Equation (3)*	*Equation (3)*
Constant	0.596[a] (0.149)	3.500[a] (3.869)	0.602[a] (0.148)	0.653[a] (0.009)	0.346[a] (0.009)	0.523[a] (0.009)
Permanent income	0.1747[a] (0.016)	0.494 (0.425)	0.175[a] (0.016)			
Transitory income				0.613[c] (0.324)	1.921[c] (1.696)	0.515[b] (0.317)
Residuals (First-stage 1)	0.047[b] (0.017)					
Residuals (First-stage 2)		0.279[a] (0.4254)				
Residuals (First-stage 3)			0.046 (0.017)			
Residuals (First-stage 4)				0.295[a] (0.327)		
Residuals (First-stage 5)					1.559 (1.696)	
Residuals (First-stage 6)						0.896 (0.437)
Adjusted-R^2	0.6607	0.6591	0.5802	0.4824	0.3997	0.3219
Wu-Hausman (*p*-value)	0.0478[c]	0.0348[b]	0.439	0.0012[b]	0.112	0.125
— (conclusion)	IV	IV	OLS/IV	IV	OLS/IV	OLS/IV
Number of observations	3080	3080	3080	3080	3080	3080

Notes. Estimation based on OLS
a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level

4.4 RESULTS

Basically, the estimations aim to test whether permanent and cyclical changes in national income have statistically significant effects on corruption. In the estimations, all data are log-transformed, which might make them conform more closely to normal distribution and possibly correct for skewed data.

Consistent with the tests on instruments, *Equations (2)*, *(3)* and *(4)* are estimated with appropriate techniques using the full sample. Then, constraints are included regarding the estimations of our basic models to further push the investigations. At first, the same estimations are carried out by focusing on countries covered by Gokcekus and Suzuki (2011) only. Then, the study again tests the cyclical behaviour of corruption, depending on whether the countries are rich or poor, and on the quality of their rule of law.

The estimations' results on the full sample are reported in *Table 1*. The effect of long-run income changes on corruption is tested with the Ordinary Least Squares (OLS) estimator and Instrumental Variable - Two-Stage Least Squares (IV-2SLS) *(Columns 2 and 3*). The Wu-Hausman test shows that both methods are similar. Meanwhile, the estimations of the influence of short-term changes in income on corruption use the estimators of IV-2SLS and 2SGMM proposed by Blundell and Bond (1998) (*Columns 4–8*). Likewise, the Wu-Hausman test (*Table b*) concludes that endogeneity does not constitute a big problem: The OLS and IV-2SLS methods remain similar. However, we only show the estimation results from IV-2SLS. Along with it, 2SGMM is also displayed for comparison purposes. Also, whether IV-2SLS or 2SGMM, our instruments are always used simultaneously. However, in the latter case, they are added to the automatically generated instruments.

The results (OLS and IV-2SLS) show a negative relationship between permanent income and corruption. In other words, integrity improves with an increase in permanent income – which is consistent with the findings of Gokcekus and Suzuki (2011). Substantial research on the relationship between economic growth and corruption also leads to a similar conclusion (see e.g. Shleifer and Vishny, 1993; Mauro, 1995; Knack and Keefer, 1995; Mo, 2001).

Although the literature on the long-term effects of incomes on corruption is very rich, there are much fewer studies under the prism of business cycles. The estimation of *Equations (3)* and *(4)* aims to tackle these economic realities. IV-2SLS and 2SGMM yield results that suggest a negative link between transitory income and corruption. Moreover, the clearly negative estimated coefficients for *Equation (3)* (-0.362 with IV-2SLS and -0.452 with 2SGMM) are highly significant – indicating that an increase in transitory income unambiguously dampens corruption. In other words, it implies that business booms reduce rather than increase corruption. This is in strict contrast to the belief that booms should stimulate rent-seeking opportunities and pump up the 'bezzle', as described by Galbraith (1997), and as supported by Gokcekus and Suzuki (2011). The estimations of *Equation (4)* test whether the lagged effects of the changes in transitory income predict variations in corruption. Gokcekus and Suzuki (2011) also follow the same approach, but with only one period lag (that is, *K=1*). Here, *Equation (4)* is estimated separately with one, two and three period lags. The 2SGMM method is used, and the results are presented in *Columns 6* (with *K = 1*), *7* (with *K = 2*) and *8* (with *K = 3*). Recall that the effect of the transitory deviations in income on corruption is appraised through the cumulative sum of the estimates of the coefficient γ_2 in *Equation (4)*.

Starting from the regression results in *Column 6*, the estimated coefficient of transitory income at period *t* is $\gamma_{2,t}$= -0.398, while that in period *t-1* is $\gamma_{2,t-1}$= -0.058. Both are statistically significant at the 0.1% and 1% levels. It follows that the aggregate effect of transitory income (that is, the cumulative sum of the two estimates) is -0.456. Likewise, with *K = 2*, the cumulative effect is -0.521, with the lagged estimated coefficients of transitory income always statistically significant. With *K = 3*, the cumulative impact is -0.553, and the coefficients are seldom significant (significant at 1% and 5% levels in *t* and *t-2* at 10% level), but the cumulative sum is still always negative. This is in line with the estimation results of *Equation (3)*, thus supporting the previous conclusion on how business booms influence corrupt activities.

Furthermore, we want to delve further, carrying out the same empirical investigations but focusing only on the 39 countries (listed in *Table 2)* investigated by Gokcekus and Suzuki (2011). At this level, we seek to check whether our main results still hold even when the estimations exclusively focus on those countries. If so, that would to some extent suggest a certain robustness of our estimations results. In addition, one would be able to argue that the difference between our respective results has a different explanation than the difference in the data. Our own estimation results for these countries are also reported in *Table 2*. These estimates are consistent with the conclusions of the regressions on the total sample (*Table 1*). Here again, and more specifically, the estimation results of *Equation (3)* show that the estimated coefficients of transitory income are all negative and statistically significant at the 0.1% level. Again, the aggregate effects of transitory income on corruption also remain negative for all three values of K in the estimations of *Equation (4)*. This means that the increase in transitory income tends to reduce corruption, or that business booms have a positive effect on integrity.

Table 1. Full sample estimation

Columns	Equation (2)		Equation (3)		Equation (4)		
	2	3	4	5	6	7	8
	OLS	IV-2SLS	IV-2SLS	2SGMM	2SGMM	2SGMM	2SGMM
Constant (γ_0)	0.959[a] (0.060)	0.596[a] (0.169)	1.115[a] (0.004)				
Permanent income (γ_1)	-0.214[a] (0.006)	-0.174[a] (0.018)					
Transitory income (γ_2)			-0.362[a] (0.054)	-0.452[a] (0.401)	-0.456	-0.521	-0.553
Transitory income ($\gamma_{2,t}$)					-0.398[a] (0.464)	-0.410[b] (0.325)	-0.263[b] (0.421)
Transitory income ($\gamma_{2,t-1}$)					-0.058[b] (0.351)	-0.27[c] (0.320)	0.122 (0.293)
Transitory income ($\gamma_{2,t-2}$)						0.160[c] (0.312)	-0.442[c] (0.257)
Transitory income ($\gamma_{2,t-3}$)							0.030 (0.203)
Year 2006				0.018[c] (0.053)	0.026[d] (0.063)	0.015 (0.026)	0.035 (0.033)
Year 2008				0.031 (0.058)	0.042 (0.052)[d]	0.025 (0.041)	0.046 (0.050)
Year 2010				0.036[d] (0.042)	0.047 (0.058)	0.018 (0.072)	0.057 (0.085)
Year 2012				0.021 (0.062)	0.020 (0.037)	0.036[d] (0.046)	0.024 (0.092)
Year 2014				0.062 (0.003)	0.053 (0.030)	0.022 (0.052)	0.065[d] (0.036)
Number of observations	110	110	110	5830	5830	5521	5384
Adjusted-R^2	0.4592	0.4358	0.0627				
Wald test[e]		90.5[a]	102.43[a]	164.465[a]	174.47[a]	159.27[a]	143.14[a]
Sargan test[f] (*p*-value)				0.438	0.274	0.762	0.348

Notes. The robust standard deviations are in parentheses below the estimated coefficients of the explanatory variables. OLS = ordinary least squares; IV-2SLS = instrumental variables - two-stage least squares; 2SGMM = two-stage generalised method of moments.
a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level
e. The null hypothesis of the Wald test checks whether permanent income (PI_i) = 0 for *Equation (2)* is rejected.
f. The over-identifying restrictions test (Sargan test) postulates in its null hypothesis that instruments are not correlated with residuals. Here, the test is robust to autocorrelation (*p*-value > 0.05), thus the instruments are valid.

Table 2. Estimations based on the 39 countries used by Gokcekus and Suzuki (2011)

Columns	Equation (2)		Equation (3)		Equation (4)		
	2	3	4	5	6	7	8
	OLS	IV-2SLS	IV-2SLS	2SGMM	2SGMM	2SGMM	2SGMM
Constant (γ_0)	0.264[a] (0.072)	0.947[a] (0.274)	0.837[a] (0.291)				
Permanent income (γ_1)	-0.538[a] (0.004)	-0.283[a] (0.016)					
Transitory income (γ_2)			-0.904[a] (0.563)	-0.743[a] (0.249)	-0.759	-0.783	-0.801
Transitory income ($\gamma_{2,t}$)					-0.452[a] (0.103)	-0.529[b] (0.231)	-0.402[b] (0.135)
Transitory income ($\gamma_{2,t-1}$)					-0.307[c] (0.391)	0.328 (0.214)	-0.635 (0.246)
Transitory income ($\gamma_{2,t-2}$)						-0.582[c] (0.632)	0.197[c] (0.134)
Transitory income ($\gamma_{2,t-3}$)							0.039 (0.259)
Number of observations	39	39	39	3821	3821	3570	2350
Adjusted-R^2	0.4247	0.3970	0.0968				
Wald test[e]		24.721[a]	38.034[a]	42.515[a]	35.26[a]	41.781[a]	56.429[a]
Sargan test[f] (*p*-value)				0.133	0.473	0.284	0.425

Notes. The robust standard deviations are in parentheses below the estimated coefficients of the explanatory variables. OLS = ordinary least squares; IV-2SLS = instrumental variables - two-stage least squares; 2SGMM = two-stage generalised method of moments.

a. Statistical significance at 0.1 percent level

b. Statistical significance at 1 percent level

c. Statistical significance at 5 percent level

d. Statistical significance at 10 percent level

e. The null hypothesis of the Wald test checks whether permanent income (PI_i) = 0 for *Equation (2)* is rejected.

f. The over-identifying restrictions test (Sargan test) postulates in its null hypothesis that instruments are not correlated with residuals. Here, the test is robust to autocorrelation (*p*-value > 0.05), thus the instruments are valid.

In addition, the study also considers sample split, in particular with respect to wealth and rule of law of the country. It might be interesting to know more about the cyclical behaviours of corruption from the perspectives of income and rule of law (*RL*). One would expect from the estimated coefficient of transitory income to stay negative, no matter the regime of rule or the level of income. This is supported by the fact that economic booms mean more generated surplus by firms in the economy, which is also consistent with higher wages, dividends and profits paid. One may therefore expect such an increase in income to enhance, in turn, integrity. But it is also possible that in countries where governance standards are missing, corruption nevertheless remains high, even in good times. In fact, in those countries where other dysfunctions of the state are very perceptible, corruption is deeply rooted in habits (Reinikka and Svensson, 2005; Asongu, 2013; Rosenbaum, Billinger and Stiglitz, 2013). However, one can also imagine that when the practices of such countries are rooted in cultures to the point of being erected as a management system, an increase in income may not lead to a decline in these practices. In these circumstances, it might be interesting to pinpoint the cyclical behaviour of corruption, and what that eventually implies. From an income perspective, such analyses might help reveal whether countries with more wealth can better withstand recessions without a decline in their integrity (Li and Wu, 2007; Mallik and Saha, 2016). The findings regarding the estimations with respect to rule of law (strong and poor quality) and income (high and low) are respectively summarised in *Tables 3* and *4*.

In order to pinpoint countries with respect to these criteria, for *RL,* we use for each country the average *RL* index from the World Bank's Worldwide Governance Indicators (WGI) dataset over the 1996–2014 period. Whereas for income, we make use of average GDP per capita (already calculated in this study) over the study period. Then, countries in the sample are sorted according to both factors. The estimations will now be based on four sub-samples, each including 39 countries. The *Strong RL* sub-sample includes the top 39 countries in terms of good quality in the ranking; whereas the *Poor RL* includes the bottom 39. The same applies for income.

Unlike the previous tables, *Tables 3* and *4* skip the estimation results based on the OLS method. Even when the new constraints are taken into account, the previous conclusion remain unchanged. Regarding the focus of this study, the estimations overall show that corruption tends to be less pervasive with business cycles. The estimated coefficients of corruption of transitory income stayed negative. In particular, the results show, on the one hand, that in the most democratic countries, or the richest countries, corruption is much more sensitive to business cycles. This is justified by the higher estimated coefficients (in absolute values). In other words, economic booms significantly help to reduce corruption habits in these countries, while depressions appear to be a considerable source of risk for more corruption. On the other hand, the findings suggest, in the case of less democratic countries, or poor countries, that the negative effect of business cycles on corruption is clearly lower. The estimated coefficients of transitory income are smaller, and sometimes not statistically significant. This means that, in these countries, expansion cycles do not lead to a significant decline in corrupt practices, nor do recessions generate significant additional corruption. Of course, this does not mean that corruption is not at an already very high level in these regions. As well known in those countries, the standards of governance are indeed already sufficiently missing, with high levels of corruption in some cases. As we hint at above, one might explain this relatively low elasticity with the assumption that corruption practices are so rooted in those societies that it is difficult for another factor to significantly amplify them.

Moreover, the study also considers an alternative corruption measure as a robustness test, using the *Control of Corruption* (CC) statistics provided by The World Bank for 94 countries (listed in *Appendix 1*) over the study period. The estimations results are reported in *Table 5* (*Appendix 2*). More generally, the results challenge the intuitively appealing argument of Galbraith (1997) that economic booms should pump up the 'bezzle', and especially its empirical verification by Gokcekus and Suzuki (2011).

4.5 CONCLUSIONS

This paper is an econometric study on the possible correlation between the level of corruption and national income. The estimations concern the effects of permanent and transitory income on the risk of corruption for a maximum of 110 countries worldwide over 28 periods from 1984–2011. The benchmark for these investigations is Gokcekus and Suzuki (2011), which finds a positive correlation between permanent income and integrity, but a negative correlation between transitory income and integrity. In particular, the latter correlation would suggest that economic booms trigger corruption, and that recessions dampen it. This result is noteworthy, because the important question about the link between business booms and corruption is rarely studied empirically, and because it confirms the famous description on the evolution of the 'bezzle' by Galbraith (1997).

This paper verifies the findings of Gokcekus and Suzuki (2011), as well as those of most of the empirical research on the issue, that an increase of permanent income tends to reduce corruption. However, it contradicts the important finding that changes in transitory income and integrity should be negatively correlated. In contrast, the results show that short-term fluctuations in income are also positively correlated with integrity. That is, economic booms reduce corruption, while recessions trigger it. The conclusion remains robust even when the focus is on countries covered by Gokcekus and Suzuki (2011) – and also even when an alternative corruption measure is adopted.

In addition, the study also considers a sample split based on countries' wealth and the quality of rule of law to determine whether the initially observed cyclical effect of corruption is modified. Overall, our conclusion remains unchanged in this regard. In particular, we find that in the most democratic countries, or richest countries, corruption is much more sensitive to business cycles, with the implication that economic booms significantly help to reduce corruption habits in these countries, while depressions constitute, at the same time, a considerable risk for more corruption. For less democratic countries, or poor countries, on the other hand, one can observe that corruption is weakly sensitive to business cycles; this suggests that in those countries, expansion cycles do not necessarily mean a significant decline in corrupt practices, nor do recessions generate significant additional corruption. However, this does not mean that corruption is at relatively low levels in these countries – indeed it is quite the opposite. Our results point to a strong habit of corruption, to the point that 'natural triggers' of corruption, such as low income or a low accountability framework, seem almost 'ineffective' in amplifying it.

Moreover, the result that corruption diminishes during economic upturns and increases during downturns has several implications. In particular, it means that the issue is highly data-dependent. The fact that the results of this paper are generated from more extensive data than those from Gokcekus and Suzuki (2011) does not necessarily justify rejection of the latter's findings. Moreover, the setting shared by both studies has not yielded solid proof for the proposition by Galbraith (1997). Embezzlement is only one character of corruption among other, perhaps more visible, factors. It may well be that the extent of the 'bezzle' in the hidden operation of firms and banks is not properly monitored by the corruption indices.

There are alternative explanations for corruption, too. For example, from the 'grease the wheels' viewpoint (Méon and Sekkat, 2005), it might be reasonable to suggest that such corruptive greasing would be especially necessary in downturns, but not so important when business is booming in any case. The power of alternative explanations may also differ between countries. The 'bezzle' explanation might be relevant in more developed countries, while the 'grease the wheels' explanation might fit better in less developed countries. In the latter countries, the role of economic booms in yielding resources to anti-corruption activities may also be crucial (Khan, 2004; Davigo and Mannozi, 2007). Consistent with this idea, the paper examines the issue under prisms such as rule of law and income. The paper to some extent suggests that whether strong or poor rule of law countries, or high-income or low-income countries, business booms are also associated with a decline in corruption, but with different magnitudes. In the richest countries, or those ranked first in terms of rule of law, the effect of business booms and recessions in respectively encouraging integrity and triggering corruption is much higher. Conversely, such an effect is lower in the poorest countries, or in those with other serious shortcomings in the field of rule of law.

Finally, the setting shared by Gokcekus and Suzuki (2011) and this paper might also be inappropriate from the beginning. First, the application of the model of Mélitz and Zumer (2002) might be misleading. The original model is used to study regional redistribution, which makes it reasonable to express all variables in relation to the whole sample of countries. For the present purpose, this may be too confusing, thus blurring the findings. Second, the interpretation of e.g. Quiggin (2010) and Varoufakis (2011) is that corrupted behaviour and embezzlement, particularly in the financial sector, cause business cycles, rather than the other way around. In other words, corruption is a major driver of financial crises, which occasionally develop into economic catastrophes. Therefore, the direction of causality between business cycles and corruption should be examined carefully. Third, the perception-based measures might be a particular problem in this context, as one can imagine people thinking, 'This country is booming! Its leaders must be honest and effective!' or 'That economy is in recession, so it must have been destroyed by corrupt leaders!' All in all, there certainly is a need to dig deeper.

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APPENDIX 1

List of countries/territories in the sample

Albania*	Ethiopia	Lebanon	Sierra Leone*
Algeria	Finland*	Luxembourg*	Singapore *
Angola	France*	Madagascar	South Africa*
Argentina*	Gabon*	Malawi*	Spain*
Australia	Germany*	Malaysia*	Sri Lanka*
Austria*	Ghana*	Mali*	Sudan*
Bahrain*	Greece*	Malta*	Sweden*
Bangladesh*	Guatemala*	Mexico*	Switzerland*
Belgium*	Guinea	Morocco*	Syrian Arab Rep.*
Bolivia*	Guinea Bissau	Mozambique*	Taiwan (China
Botswana*	Guyana	Netherlands*	province)*
Brazil*	Haiti	New Zealand*	Tanzania*
Bulgaria*	Honduras*	Nicaragua	Thailand*
Burkina Faso	Hong Kong SAR*	Niger*	The Bahamas
Cameroon*	Hungary*	Norway*	The Gambia*
Canada*	Iceland*	Oman	Togo*
Chile*	India*	Pakistan*	Trinidad and Tobago*
China*	Indonesia*	Panama*	Tunisia*
Colombia*	Iran*	Paraguay*	Turkey*
Costa Rica*	Ireland*	Peru*	Uganda*
Cote d’Ivoire*	Israel*	Philippines*	United Arab Emirates
Cyprus*	Italy*	Poland*	United Kingdom*
Democratic Rep. of	Jamaica*	Portugal*	United States*
Congo*	Japan*	Qatar*	Uruguay*
Denmark*	Jordan*	Republic of Congo*	Venezuela*
Dominican Republic*	Kenya*	Romania*	Vietnam*
Ecuador	Korea, Republic of*	Saudi Arabia*	Zambia*
Egypt*	Kuwait*	Senegal*	
El Salvador*			

Notes. The full sample of 110 countries.
*Countries (94 in total) covered by robustness tests with alternative ‘*Control of Corruption*’ (CC) index from the World Bank.

APPENDIX 2

Table 3. Estimations with respect to rule of law

	Equation (2), IV-2SLS		Equation (3), 2SGMM		Equation (4), 2SGMM (K=3)	
	Strong *RL*	Poor *RL*	Strong *RL*	Poor *RL*	Strong *RL*	Poor *RL*
Permanent income (γ_1)	0.421[a] (0.034)	0.472[a] (0.331)				
Transitory income (γ_2)	-0.320[a] (0.124)	-0.374[a] (0.164)				
Transitory income ($\gamma_{2,t}$)			-0.662[a] (0.301)	-0.008[c] (0.138)	-0.632	-0.012
Transitory income ($\gamma_{2,t-1}$)					0.272 (0.302)	-0.001[c] (0.324)
Transitory income ($\gamma_{2,t-2}$)					-0.160 (0.242)	0.328 (0.473)
Transitory income ($\gamma_{2,t-3}$)					-0.744 (0.335)	-0.339 (0.373)
Number of observations	39	39	39	1092	1063	982
Adjusted-R^2	0.3921	0.3782				
Wald test[e]	29.47[a]	40.40[a]	42.54[a]	41.18[a]	38.82[a]	43.20[a]
Sargan test[f] (*p*-value)			0.486	0.240	0.315	0.253

Notes. The robust standard deviations are in parentheses below the estimated coefficients of the explanatory variables.

OLS = ordinary least squares; IV-2SLS = instrumental variables - two-stage least squares; 2SGMM = two-stage generalised method of moments.

a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level
e. The null hypothesis of the Wald test checks whether permanent income (PI_i) = 0 for *Equation (2)* is rejected.
f. The over-identifying restrictions test (Sargan test) postulates in its null hypothesis that instruments are not correlated with residuals. Here, the test is robust to autocorrelation (*p*-value > 0.05), thus the instruments are valid.

Strong RL countries: Finland, Norway, Denmark, Sweden, Switzerland, New Zealand, Austria, Iceland, Luxembourg, Netherlands, Canada, United Kingdom, Germany, Ireland, Singapore, United States, Australia, Malta, France, Hong Kong, Japan, Chile, Spain, Portugal, Belgium, Cyprus, Israel, Republic of Korea, Taiwan, Hungary, Greece, Qatar, Botswana, Kuwait, Italy, Poland, Argentina, Morocco, Ghana.

Poor RL countries: Uganda, Zambia, Mexico, Colombia, Dominican Republic, Mozambique, Peru, El Salvador, Niger, Bolivia, Indonesia, Islamic Republic of Iran, Albania, Pakistan, Bangladesh, Togo, Honduras, Gabon, Kenya, Paraguay, Guatemala, Senegal, Sierra Leone, Nicaragua, Cameroon, Republic of Congo, Venezuela, Cote d'Ivoire, Madagascar, Sudan, Guinea, Vietnam, Jamaica, Guinea Bissau, Guyana, Ecuador, Democratic Republic of the Congo, Angola, Haiti.

Table 4. Estimations with respect to income

	Equation (2), IV-2SLS		Equation (3), 2SGMM		Equation (4), 2SGMM (K=3)	
	High income	Low income	High income	Low income	High income	Low income
Permanent income (γ_1)	0.266[a] (0.014)	0.251[a] (0.037)				
Transitory income (γ_2)	-0.431[a] (0.220)	-0.313[b] (0.201)				
Transitory income ($\gamma_{2,t}$)			-0.340[a] (0.164)	-0.012[c] (0.024)	-0.473	-0.008
Transitory income ($\gamma_{2,t-1}$)					-0.138 (0.214)	-0.014[c] (0.104)
Transitory income ($\gamma_{2,t-2}$)					0.210 (0.410)	0.101 (0.120)
Transitory income ($\gamma_{2,t-3}$)					-0.545 (0.122)	-0.095 (0.135)
Number of observations	39	39	39	1092	1063	982
Adjusted-R^2	0.4218	0.3129				
Wald test[e]	34.60[a]	46.29[a]	57.41[a]	41.18[a]	44.76[a]	39.37[a]
Sargan test[f] (*p*-value)			0.193	0.152	0.193	0.107

Notes. The robust standard deviations are in parentheses below the estimated coefficients of the explanatory variables.
OLS = ordinary least squares; IV-2SLS = instrumental variables - two-stage least squares; 2SGMM = two-stage generalised method of moments.
a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level
e. The null hypothesis of the Wald test checks whether permanent income (PI_i) = 0 for *Equation (2*) is rejected.
f. The over-identifying restrictions test (Sargan test) postulates in its null hypothesis that instruments are not correlated with residuals. Here, the test is robust to autocorrelation (*p*-value > 0.05), thus instruments are valid.

High-income countries: Qatar, United Arab Emirates, Luxembourg, Kuwait, Norway, Switzerland, Singapore, Saudi Arabia, Bahrain, United States, Denmark, Oman, Netherlands, Austria, Germany, Canada, Sweden, Belgium, Australia, France, Italy, Iceland, Hong Kong SAR, Japan, Finland, United Kingdom, The Bahamas, Ireland, Cyprus, Spain, New Zealand, Greece, Israel, Malta, Taiwan Province of China, Portugal, Gabon, Hungary, Trinidad and Tobago.

Low-income countries: Mozambique, Ethiopia, Democratic Republic of the Congo, Malawi, Niger, Burkina Faso, Sierra Leone, Uganda, Guinea Bissau, Togo, Guinea, Mali, Madagascar, The Gambia, Tanzania, Bangladesh, Haiti, Senegal, Ghana, Vietnam, India, Kenya, Zambia, Cameroon, China, Cote d'Ivoire, Sudan, Nicaragua, Pakistan, Angola, Honduras, Guyana, Bolivia, Philippines, Morocco, Sri Lanka, Republic of Congo, Syria, Albania.

Table 5. Robustness test using 'Control of corruption' (CC) indices from Worldwide governance indicators

Columns	Equation (2)		Equation (3)		Equation (4)		
	2	3	4	5	6	7	8
	OLS	IV-2SLS	IV-2SLS	2SGMM	2SGMM	2SGMM	2SGMM
Constant (γ_0)	0.115[a] (0.314)	0.763[a] (0.147)	0.621[a] (0.138)				
Permanent income (γ_1)	-0.225[a] (0.002)	-0.164[a] (0.029)					
Transitory income (γ_2)			-0.644[a] (0.306)	-0.592[a] (0.302)	-0.614	-0.637	-0.671
Transitory income ($\gamma_{2,t}$)					-0.371[a] (0.214)	-0.477[a] (0.205)	-0.521[b] (0.126)
Transitory income ($\gamma_{2,t-1}$)					-0.243[b] (0.158)	0.175 (0.186)	0.249 (0.164)
Transitory income ($\gamma_{2,t-2}$)						-0.335[c] (0.412)	-0.376[c] (0.128)
Transitory income ($\gamma_{2,t-3}$)							-0.023 (0.259)
Number of observations	94	94	94	1222	1222	984	927
Adjusted-R^2	0.4473	0.4106	0.1034				
Wald test[e]		52.85[a]	46.479[a]	39.248[a]	43.71[a]	47.25[a]	61.253[a]
Sargan test[f] (*p*-value)				0.211	0.395	0.138	0.213

Notes. The robust standard deviations are in parentheses below the estimated coefficients of the explanatory variables.

OLS = ordinary least squares; IV-2SLS = instrumental variables - two-stage least squares; 2SGMM = two-stage generalised method of moments.

a. Statistical significance at 0.1 percent level
b. Statistical significance at 1 percent level
c. Statistical significance at 5 percent level
d. Statistical significance at 10 percent level
e. The null hypothesis of the Wald test checks whether permanent income (PI_i) = 0 for *Equation (2)* is rejected.
f. The over-identifying restrictions test (Sargan test) postulates in its null hypothesis that instruments are not correlated with residuals. Here, the test is robust to autocorrelation (*p*-value > 0.05), thus the instruments are valid.

5 ESSAY IV. DOES CORRUPTION AFFECT TOTAL FACTOR PRODUCTIVITY? AN EMPIRICAL ANALYSIS

KOURAMOUDOU KÉÏTA

ABSTRACT

Although the economic research strongly claims the negative role of corruption in economies, mixed evidence persists about how corruption specifically affects growth. The motivation of this study is that volumes of research show that growth of output to a large extent results from growth in total factor productivity (TFP), also referred to as the Solow residual. This paper therefore examines the effect of corruption on TFP as a potential channel through which corruption could influence growth. It then measures the impact related to an increase in tax rates on such an effect. The study uses data from 90 countries, for a time span of 1996–2014. Via the System GMM estimators, the estimations suggest that corruption, well as tax burden, have a negative effect on TFP. Our findings also highlight that a tax rate increase in turn induces a decline in the negative effect of corruption on TFP, implying that tax burden alleviates the negative consequences of corruption on productivity. These findings remain robust to the introduction of TFP determinant variables or alternative regressions.

Keywords: total factor productivity, corruption, tax burden

JEL classification: D7, O4, H2

5.1 INTRODUCTION

When examining the relationship between corruption and economic performance, most studies mainly focus on how corruption influences investment or economic growth. The pioneering assessments of the economic consequences of corruption are Knack and Keefer (1995) and Mauro (1995). Their respective investigations conclude that corruption reduces economic growth. According to Knack and Keefer (1995) in particular, the negative relationship between corruption and economic growth holds even when the investment ratio is included among explanatory variables. This suggests that besides its negative effect on capital accumulation, corruption also has a direct effect on growth. This result is subsequently confirmed by the empirical work of Mo (2001). However, his study states in addition that the significant negative effect of corruption on growth disappears when human capital is used as independent variable. In the empirical findings of Mauro (1995), corruption is found to have no significant effect on growth when the latter is controlled for investment. Along the same lines, Pellegrini and Gerlagh (2004) find that corruption affects growth through investment, trade, schooling and political instability, by importance. Shleifer and Vishny (1993) also provide a thorough analysis to grasp the detrimental implications of corruption in the economy (see also Bardhan, 1997; Ades and Di Tella, 1999). Tanzi and Davoodi (1997), in turn, while making the assumption that the quality of investments may constitute an enhancing factor to the productivity of capital, conclude that corruption affects the quality of the infrastructures, in line with Gillanders (2013). However, few studies focus on the impact of corruption on human capital, albeit the mainstream view, again, argues for its detrimental aspects (Reinikka and Svensson, 2005; Seka, 2013; Dridi, 2014; Bryant and Javaldi, 2016).

Note on the other hand that the literature on corruption also records an alternative view to the one previously claimed. This view argues that corruption might have a beneficial effect on economic dynamism in the presence of deficient governance or ineffective institutions – otherwise, it overall reduces economic growth. The following work shed light on this issue: Leff (1964), Leys (1965), Huntington (1968), Méon and Sekkat (2005), Méndez and Sepúlveda (2006) and Aidt, Dutta and Sena (2008).

On the other hand, the impact of corruption on productivity has received less attention within the literature. Yet, the analysis of productivity levels seems to be an emerging field, as compared to growth rates.

Given the scarcity of resources, to be more effective, countries are working more to improve productivity than to provide immense resources, which tend to run out. Important studies have shown the positive correlation between high productivity and the economic growth of countries (Nordhaus, 2002; Auzina-Emsina, 2014). Such a nexus is based on the hypothesis that the efficiency with which a country's inputs are transformed may explain its economic growth, as well as disparities in economic growth across countries (Hall and Jones, 1999).

Such efficiency is determined by the 'social infrastructure', which groups all its institutions, and government policies, which in turn determine the economic environment and drive incentives for individuals and firms to invest, to create, to innovate and to transfer ideas (Hall and Jones, 1999; Salinas-Jiménez and Salinas-Jiménez, 2011). From the quality of the 'social infrastructure' results a given level of efficiency that influences human and physical capital. Consistent with this reasoning, the study by Hall and Jones (1999) illustrates that countries may attain a high level of output per worker in the long run when their high levels of investment in human and physical capital are used with a high level of productivity.

The issue of how much of growth in output results from growth in physical and human capital is an essential point of Solow's growth theory (Solow, 1956; Swan, 1956). Contributions on the subject show that under the assumptions of constant returns to scale and competitive factor markets, such an exercise (also termed as growth accounting) is possible (Abramovitz, 1956; Baier, Dwyer and Tamura, 2006). In particular, the investigations of Abramovitz (1956) show that the growth of factors of production contributed only 10% of output growth per capita in the US during 1869–1878 and 1944–1953. Over the time span of 1900–1949, the output growth per worker explained by capital accumulation was 12% (Solow, 1957). That is, both studies suggest that the growth of output per worker is explained more than average by sources other than human/physical capital. This deviation between the observed output and that forecasted through human and physical capital is total factor productivity (TFP), also referred to as the 'Solow residual'. This *a priori* unknown productivity, actually, would come from sources like innovation or improvements in the institutional context: i.e. our so-called 'social infrastructure'.

Moreover, even though the results from later work lead to lower TFP levels, they nevertheless remain very far from zero (Kendrick, 1961; Jorgenson, Frank and Barbara, 1987; Abramovitz and David, 2000). For example, the empirical work of Baier, Dwyer and Tamura (2006) on 143 countries, 23 of which encompassed a time span of 100 years, finds TFP to contribute about 14% of the growth of the output per worker on average in these countries, representing strikingly 26% of economic growth for Southern Europe, 26% for Newly Industrialised Countries, and 34% for Western countries. However, for Sub-Saharan Africa and Middle East countries, the effect of TFP is negative. More interesting, their study also reveals that variations in output per worker are more sensitive to variations in TFP than to variations in classical factors, i.e. human and physical capital.

Thus, one may presume that any factors whatsoever might channel TFP to impact economic growth. This becomes even more likely when the growth of the economy is found to be highly elastic to TFP (Abramovitz, 1956; Baier, Dwyer and Tamura, 2006). By example, Olson, Sarna and Swamy (2000), using several measures of institutional quality (one of them being corruption) to assess their contribution to TFP growth across countries, note that poor institutions significantly hinder productivity growth.

Our paper empirically focuses on the hypothesis that corruption should be one of the determinant factors of TFP. This reasoning is also consistent with Paldam (1999), who suggests that the absence of corruption may constitute a growth factor (also supported by Lambsdorff, 1999). Following the studies supporting the detrimental side of corruption to growth or investment, we assume that corruption should also impede TFP growth.

Furthermore, the paper in addition assesses the consequences of tax burden on the extent to which corruption could affect TFP. The justification behind this is that taxation and corruption are two intertwined topics, often linked through tax evasion. For instance, bribe payments by individuals and firms to tax officials are common practice within corrupt bureaucracies. In addition, corruption by its effect inevitably resembles taxation. Indeed, it is sometimes defined as a form of taxation, with the difference being that the resulting payments do not end up in the coffers of the State (Sanyal, Gang and Goswami, 2000). This thus deprives the government of revenue which would have made possible the financing of productive goods (Fisman and Svensson, 2007). Being illegal, corrupt activities are deeply uncertain and shrouded in secrecy (Shleifer and Vishny, 1993), which is incompatible with investment. Hence, Wei (2000) finds taxation less damaging. His empirical study shows that bribery has a much stronger negative impact on foreign direct investment than taxation. Fisman and Svensson's (2007) empirical investigations also leads to a similar conclusion. Adopting data on the estimated bribe payments of Ugandan firms, they find that both taxation and bribery are negatively associated with firm growth – with bribery having a significantly higher effect than taxation (Fisman and Svensson, 2007).

Regarding the expected effect of tax burden in our study, one can assume that tax burden increases can influence the effect of corruption on TFP in one way or another. The rationale for such an interest is based on the following idea: If the increase in taxes does not trigger more corruption (namely through tax evasion and other opportunistic behaviours (Dzhumashev, 2014; Alm, Martinez-Vasquez and McClennan, 2016), then one can imagine that this increase may help reduce the negative effect of corruption on TFP. Indeed, with more tax revenue, the state can invest more, namely by financing changes in production technology, allowing more support for innovation, allowing for efficiency gains and allowing for good quality of government policies and institutions. On the other hand, if opposing agents find refuge in illegal activities in order to flee strong taxation, like bribing tax officials, then this should exacerbate the negative effect of corruption on TFP. Our assumption therefore suggests that the quality of governance to some extent conditions such a relationship. For instance, in Lambsdorff's (2003) empirical study, which examines the effect of corruption on the productivity of capital, corruption reduces the ratio of GDP to the capital stock – and *that* is channelled by its correlation with poor bureaucracy.

The paper is organised as follow: following this section, *Section 2* presents the baseline model and data to be used, and explains the empirical method applied. *Section 3* presents and discusses the empirical findings, while *Section 4* is dedicated to conclusions and policy recommendations.

5.2 DATA AND METHOD

5.2.1 Data

The paper develops an empirical study that covers a total of 90 countries worldwide for a time span of 1996–2014. The list is reported in the *Appendix* (*Table A2*). The choice of countries included in the sample is conditional on the availability of data.

Following the discussions in the previous section, the paper focuses on *Equation (1)* below as the baseline model for the empirical analyses. The model reads:

$$TFP_{i,t} = \beta Corruption_{i,t} + \gamma TaxBurden_{i,t} + \lambda Z_{i,t} + \varpi_i + \eta_t + \varepsilon_{i,t} \quad (1),$$

On the left-hand side of *Equation (1)*, $TFP_{i,t}$, symbolises the levels of TFP at constant purchasing power parity (PPP) rates, relative to the United States in terms of the prices in that period, for country i in period t. It represents the dependent variable of the model. The associated statistics hereby come from Penn World Table version 9.0. (Feenstra, Inklaar and Timmer, 2015). On the right-hand side, $TFP_{i,t}$ is estimated, among others, against $Corruption_{i,t}$ and $TaxBurden_{i,t}$. The study uses the Corruption Perception Index (*CPI*) from Transparency International (TI) as a proxy variable to capture the prevalence of corruption. However, note that as its name indicates, *CPI* is based on the perception of how widespread corruption is within the country. Put another way, such an assessment is likely to be biased because of its subjectivity. Since corruption is an illegal activity and therefore usually hidden deliberately, the statistics related to proven cases do not suffice to evaluate it. *CPI* ranges from 0 to 10, where 0 stands for the highest possible level of corruption and 10 indicates full integrity in the country. However, for ease in interpreting estimations, we have rescaled the corruption figures so that their increase also indicates further corruption in the country. The rescaling method is as follows: $Corruption_{i,t} = 11 - CPI_{i,t}$. The variable of interest, $TaxBurden_{i,t}$, assesses the level of fiscal burden borne by taxpayers. Its measurement includes both marginal tax rates and the overall level of taxation (both direct and indirect taxes) imposed by the government (both central and local levels) as a percentage of gross domestic product (GDP). Here, we use fiscal freedom statistics provided from the Economic Freedom Index database (The Heritage Foundation).

A-more-than optimal taxation surtax is likely to discourage investment and encourage tax evasion. This could result in lower public investment due to lower state revenues and FDI due to the low attractiveness of the country. Ultimately, this contributes to reducing the competitiveness of the economy. β and γ stand for the respective coefficients of corruption and tax burden; they are expected to be negative ($\beta \prec 0$, $\gamma \prec 0$). *Figures 1.1–1.3* plot the nature of the nexus between the variables of interest. *Figure 1.1* suggests a strong negative correlation between TFP and corruption. The paper also provides for a possible comparison of regional graphics plotting this relationship (see *Appendix*). *Figure 1.2* at first glance also indicates a negative relationship between TFP and tax burden. However, the regression line representing fitted values is practically horizontal, which suggests a weak correlation between both variables. *Figure 1.3* shows a positive linkage of corruption and tax burden. Textbooks also argue that over-taxing may encourage agents to avoid paying taxes by bribing tax officials or resorting to frauds and black markets. These are known to considerably foster a shadow economy, which in turn leads to a decline in public revenue and implies, *in fine*, a less-than-optimal allocation of public resources, all things being equal.

Furthermore, the modelling also includes a set of other explanatory variables. They are accounted for by $Z_{i,t}$, which is their vector of variables, and λ, which is their vector of coefficients. Meanwhile, ϖ_i and η_t capture the respective country-specific effect and the relevant time effect. In the end, $\varepsilon_{i,t}$, represents a random error term that takes into account the influence of all omitted variables in the estimation.

Descriptive statistics relative to the variables as well as the sources are reported in *Table 1*. Since our data feature the time dimension, we first ensured that the time series are stationary, meaning that their distribution neither follows any trend nor changes over time. The Fisher type unit-root test was applied – with the null hypothesis that all panels contain a unit root, i.e. non-stationarity, against the alternative hypothesis that at least one panel is stationary. *Table A1* in the *Appendix* reports the chi-squares and *p*-values associated with both Augmented Dickey-Fuller (AD-F) and Phillips-Perron (P-P) methods. In both cases, the non-stationarity hypothesis is systematically rejected.

Figure 1. Total factor productivity (TFP) with respect to corruption

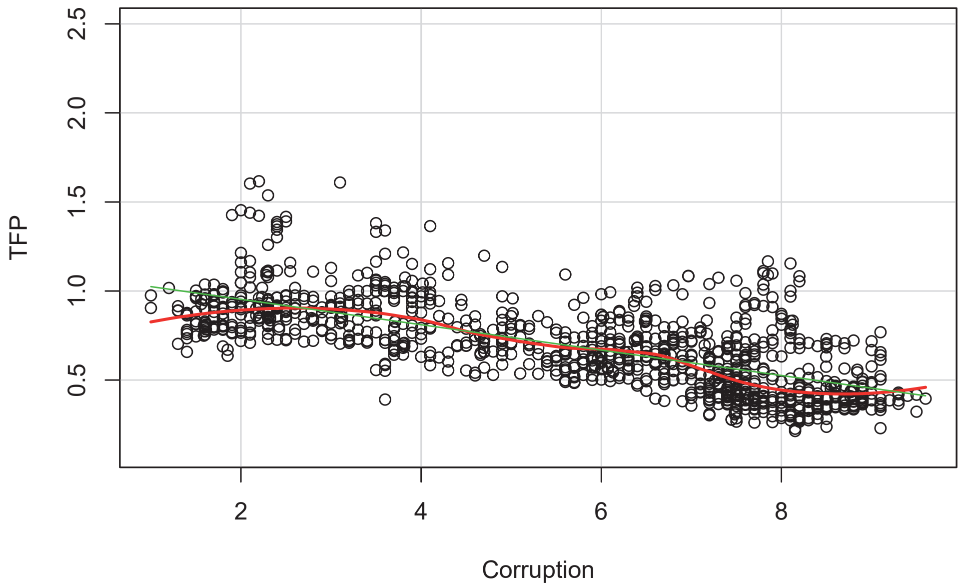

Figure 2. Total factor productivity (TFP) with respect to tax burden

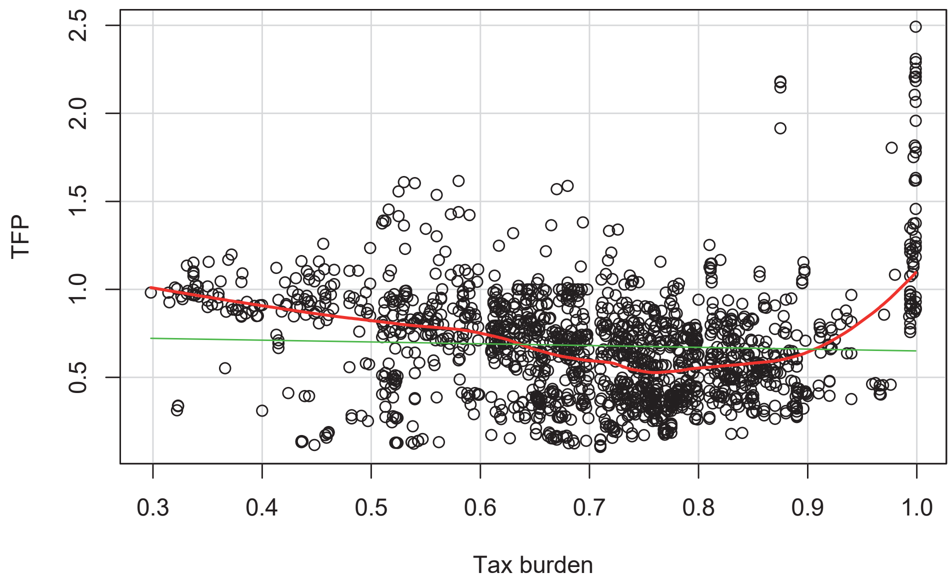

Figure 3. Corruption with respect to tax burden

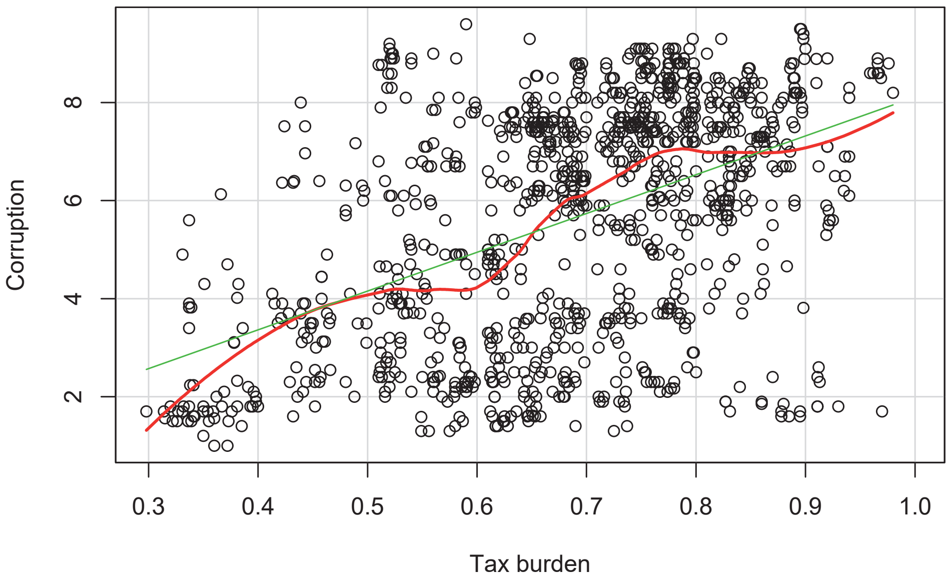

Table 1. Descriptive statistics and data sources

Variables	Mean	Standard deviation	Minimum	Maximum	Sources
TFP (level at current PPPs, in million 2011 US dollars)	0.680	0.324	0.105	2.492	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Inflation (price level of household consumption, US GDP in 2011=1)	0.615	0.311	0.143	1.713	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Openness (sum of shares of merchandise exports and imports in GDP, at current)	-0.042	0.162	-0.846	0.588	Feenstra, Inklaar, Timmer, (2015), Penn World Table 9.0
Corruption (Corruption Perception Index)	5.633	2.373	1.000	9.600	Transparency International
Property rights/100 (overall quality of legal framework)	0.561	0.242	0.100	0.950	The Heritage Foundation
Tax burden/100 (% of tax revenue to GDP)	0.703	0.145	0.298	0.999	The Heritage Foundation
Government spending (government consumption and all transfer)/100	0.663	0.219	0.100	0.993	The Heritage Foundation
Improved sanitation/100, rural (facilities, % of rural population with access)	0.683	0.339	0.021	1.000	World Development Indicators, World Bank
Energy use/10,000 (kg of oil equivalent per capita)	0.297	0.338	0.0009	2.276	World Development Indicators, World Bank
Transport service (% of commercial services exports/100)	0.236	0.149	0.0007	0.880	World Development Indicators, World Bank
Electricity (Electric power consumption (in kWh per capita)/10000)	1.030	3.786	1.030	55.578	World Development Indicators, World Bank
Military expenditure (% GDP)	2.612	3.943	0.000	63.100	World Development Indicators, World Bank

5.2.2 Method

To estimate *Equation (1)*, the paper sequentially proceeds by using Fixed effects estimation, Two-Stage Least Squares (2SLS) and Two-Stage System Generalised Method of Moments (System GMM). To determine which estimator best fit our data, we carried out the classical specification tests (or homogeneity tests) for panel data. First, a Fisher-type test for *poolability* was used. Its null hypothesis (H_0) argues for a pool data structure against the existence of Fixed effects as an alternative hypothesis (H_1). With an observed *p*-value (<2.2e-16), also less than the standard threshold of 5%, the null hypothesis is rejected, pointing to the existence of Fixed effects. Expressed in a different way, this implies that countries in the sample exhibit distinctive features. The OLS estimators are not appropriate, as we cannot assume an identical TFP function for all the countries in the sample, nor identical elasticities for corruption or for tax burden, for instance. Second, the paper performs the Hausman test to determine whether the individual effects are random (H_0), or fixed (H_1). Likewise, the *p*-value associated with the test is very low (<2.2e-16) – which is less than the standard 5% level. The null hypothesis, which suggests the presence of Fixed effects, is thus rejected. The Fixed effects method in such circumstances is suitable, as it provides consistent estimators.

Even though the conclusion of the homogeneity test holds for the use of Fixed effects, some doubts may remain, mainly related to the possible existence of an endogeneity problem. Following the discussion on TFP in the first section, one may have serious reasons to suspect corruption to be endogenous. If proven, this would then make the Fixed effects estimators inconsistent (Baltagi, 1995). Given the literature discussed in the first section, which shows a strong connection between TFP and matters such as efficiency, institutions, and more generally, governance, and given the literature on corruption and more specifically its link with ill-functioning institutions (Méon and Sekkat, 2005), one may increasingly consider an endogeneity problem. This might justify the use of the instrumental variable (IV-2SLS) and System GMM methods. Their estimators are more qualified in controlling for such problems. In particular, the System GMM proposed by Blundell and Bond (1998) provides consistent estimators that are likely to fulfil the orthogonality conditions while allowing rigorous control over the instruments.

When the dependent variable (TFP) and the endogenous regressor (Corruption) directly influence each other, it could be difficult to guarantee that the instrument will be strictly exogenous, which may at the same time compromise the good quality of instruments. For this study, the variables used to instrumentally assess corruption are corruption at the initial period (denoted $Corruption_{1996}$), $Government\ spending_t$, $Military\ expenditure_t$, and lags corruption ($Corruption_{t-1}$ and $Corruption_{t-2}$).

According to Dzhumashev (2014), corruption is generally nestled in public expenditures. Empirical evidence shows that corruption is positively associated with military expenditures (Mauro, 1998; Delavallade, 2006). These instruments are therefore likely to be strongly correlated with $Corruption_t$; which is one requirement of the good quality of an instrument.

As noted in *Section 1*, TFP gains could be explained by innovation efforts or improvements to institutional contexts. As such, instruments relative to *Government Spending* or *Military Expenditure* may have weaknesses if they fund innovation or the acquisition of technologies that can enhance productivity gains. So it goes for instruments related to corruption. Likewise, the quality of institutions may impact at the same time corruption behaviours, as dysfunctional institutions are usually singled out as a cause of corruption. However, based on the criteria related to a good instrument, it is difficult to expect variables from lagged corruption to be strictly exogenous, since we think that corruption itself is endogenous. In any cases, the Sargan test should specify whether instruments are exogenous, thus pointing to their possible validity.

The first-stage regressions in *Appendix (Table A3)* show that the estimated coefficients of instruments are all highly statistically significant, at the 0.1% level, using the OLS method. These correlations remain robust with Fixed effects estimators, also when determinant variables are included among explanatory variables. The findings therefore show that instruments are strongly correlated with the endogenous variable. The conclusion of the Fisher test on instruments also corroborates this finding. The null hypothesis that instruments are weak is clearly rejected, with a *p*-value systematically less than the 5% level.

Moreover, in order to determine whether endogeneity exists (which actually underpins the use of the IV method), we carried out the exogeneity test (Wu-Hausman). Residuals in the first-stage regressions were introduced as explanatory variables in the basic model. The estimations results, based on the OLS method, are reported in *Table A4*. One notices that the estimated coefficients associated with the residuals are all statistically significant at the 5% level – which suggests that the null hypothesis of exogeneity is rejected. Hence, an endogeneity problem certainly exists. The *p*-value of the Wu-Hausman test is consistently very low and always less than 5%. This result is aligned with the statistical significance of the estimated coefficients of residuals that indicate OLS to be biased towards the IV method.

As a last diagnostic on the instruments, we applied the Sargan test. The null hypothesis postulates that instruments are exogenous, while the alternative hypothesis indicates that they are in fact endogenous. In our case, the test is only applicable when there are more instruments than endogenous variables. For IV-2SLS, $Corruption_{1996}$, *Government spending* and *Military expenditure* are used to instrument *Corruption*. The probability associated with the Sargan test equals 0.0079; which is lower than the standard 5% level. As a result, the null hypothesis that instruments are exogenous is rejected – meaning that since one instrument is not valid, all of them probably show this weakness. When the System GMM technique is applied, on the other hand, the full list of instruments is used alongside those generated by default, this time with more satisfactory results.

5.3 RESULTS

Our empirical analyses of *Equation (1)* commence with preliminary estimations. These results are reported in *Table 2* (*Model 1* to *3*). TFP is solely estimated with respect to corruption, except in *Model 3*, which also includes the lagged dependent variable. The estimators used are those relative to Fixed effects, IV-2SLS and System GMM, respectively – with more attention on the latter method. Besides, in line with Isaksson (2007), several additional determinant variables are used for controlling TFP (*Model 4* to *6* in *Table 2*, and *Model 7* to *12* in *Table 3*). Such an approach could assess the robustness of the relationship between the variables of interest (corruption and TFP). On the other hand, but less importantly, one could also appraise the influence of TFP's determinant variables in the estimations. The latter estimations would in turn use the System GMM estimators. *Table 4* includes regressions (*Model 13* to *18*) taking into account the influence of a relatively strong tax burden on TFP. These estimations include, occasionally, interaction variables between corruption and tax burden (denoted *Corruption×Tax burden*), thus capturing their indirect effect on the dependent variable. Likewise, the estimation technique applied is System GMM. Note that the introduction of time dummy variables as regressors in the preliminary estimations was not conclusive: their estimated coefficients stayed non-significant throughout the estimations.

Preliminary findings from *Table 2* suggest that corruption has a negative influence on TFP. The estimated coefficients of corruption are negative and statistically very significant with all three estimation methods. This confirms the first trends drawn by *Figure 1*: that corruption is associated with a decline in productivity. In *Model 1*, which uses the Fixed effects estimators, the estimation suggests that a one-unit increase in corruption would reduce TFP by 0.024%, all things being equal. Meanwhile, such a decline in TFP is about 0.26% based on *Model 2*. In both cases, the measure of the general quality of the model (R-squared) is very low, which means that important determinants of TFP are not taken into account in the estimation. As already mentioned, the Sargan test seems to question the validity of at least one of the instruments used for the IV-2SLS regression.

Model 3, however, predicts a smaller negative effect of about 0.041% when corruption increases in the same proportions. The Sargan test for over-identifying restrictions, with the null hypothesis that instruments are not correlated with the residuals, is robust to autocorrelation (*p*-value>0.05). Hence, instruments are valid. The Arrelano–Bond tests for first (AR (1)) and second (AR (2)), whose null hypotheses suggest that the residual from the estimations is first-order, but not second-order, correlated. Here the tests are conclusive, with the observed *p*-values respectively equal to 0.0048 (<0.05) and 0.17 (>0.05). The null hypothesis of the Wald test for coefficients argues that all coefficients are set equal to 0. Since the associated *p*-value is less than the standard probability level of 5%, the alternative hypothesis holds – i.e. that at least some variables are non-zero.

Likewise, when one considers the estimations including more explanatory variables (i.e. *Model 4–6* in *Table 2* and *Model 7–12* in *Table 3*), the findings also confirm that corruption constitutes a serious impediment to economic dynamism. The estimated coefficients of corruption are all negative while showing the best statistical significance standard. More specifically, over the nine regressions, it can be seen that the predicted drop in TFP is about 0.17% when corruption practices increase by one unit. Such results corroborate the preliminary estimations. The previously commented diagnostic tests, which display their expected *p*-values, again hold.

Concerning the other explanatory variables, the results overall seem consistent with the textbook. Following this, we used variables related to tariff/non-tariff barriers, imports and openness within regressions in order to capture the 'Creation-transmission and absorption of knowledge' dimension as a TFP determinant. The variables all displayed positive and significant influence on TFP. *Openness* has been used as benchmark for this dimension, as it presents the most satisfactory results. Its estimated coefficients stay positive and are always statistically significant. In particular, *Openness* can also capture integration and competition as factors that may strongly encourage TFP growth (Maddison, 1997, 1999; Frankel and Romer, 1999).

Using access to *Improved sanitation* facilities as percentage of rural population as a *proxy* for health variables, our results clearly confirm the alleged positive relationship between health and TFP. Alternatively, access to *Improved sanitation* facilities as percentage of urban population and *Health expenditure* as percentage of GDP are also included in the regressions as explanatory variables. The estimated coefficients of the *proxy* overall have a positive effect on the dependent variable. However, the findings were not always as relevant as they are with our benchmark health variable. Cole and Neumayer (2006)'s empirical study on 52 developing countries over 1965–1996 also finds a negative correlation between the proportion of undernourished and the workforce. Furthermore, the incidence of malaria and other waterborne diseases is also found to negatively affect both human capital and labour productivity.

To account for the institutional dimension, another highly influential factor for TFP, *Property rights*, is included among the explanatory variables. Surprisingly, our findings suggest that better legal frameworks would actually hamper TFP growth. According to Ulubasoglu and Doucouliagos (2004), institutions embody rules and organs driving the production climate. Their research concludes that democracy has a positive effect on TFP and human capital. However, a negative pattern clearly reappears with capital accumulation or labour force growth (see also Przeworski and Limongi, 1993; Isaksson, 2007).

Furthermore, variables that proxy the infrastructure factor (*Energy use*, *Electricity* and *Transport service*) do not seem to have a significant effect in explaining the dependent variable. Estimated coefficients are overall positive, but seldom statistically significant. For example, Aschauer (1989) shows that infrastructures have a high return in terms of private capital productivity. However, this is possible only when their funding and management are more efficient (Aschauer and Lachler, 1998). Based on 46 developing countries with a 1970–1990 time span, their data highlight a positive effect from infrastructure when financed through lower current government spending, in contrast to funding causing further increases in public debt. That probably explains our results regarding infrastructures. In addition, note that more than 2/3 of the countries in our sample are developing countries.

In the end, our findings also confirm the common reasoning regarding the pernicious effect of inflation on economic performance (Romer, 1993; Lane, 1997). The estimated coefficients of *Inflation* in *Table 2* are constantly negative and highly statistically significant, which unequivocally points to a decline in TFP. Moreover, corruption has been partly identified as one of the causal chains of high inflation (Al-Marhubi, 2000). Given that corruption at the same time tends to increase transaction costs, we thus hypothesise that together, they reinforce each other and seriously hinder TFP.

Government spending is also found to reduce TFP. However, this indicator includes the level of government consumption and all transfer payments. Such expenditures are not truly productive; they are even perceived to be responsible for budget deficits and public debt; hence, they would tend to reduce economic dynamism. Moreover, Mauro (1998) finds evidence of the influence of corruption in favouring some sectorial budgets more than others. Thus, corruption indeed seems to be associated with a fall in expenditures in health, education or social protection spending (Delavallade, 2006) but also with an increase in military, energy, culture, order or public services spending. Dzhumashev (2014) empirically shows that expenditures related to social security are positively associated with corruption.

Table 2. Preliminary estimations of TFP with respect to corruption

	Dependent variable: Total factor productivity (TFP)					
	Fixed effects	IV-2SLS	System GMM			
	1	2	3	4	5	6
Corruption	-0.024*** (0.005)	-0.264*** (0.063)	-0.041*** (0.024)	-0.319*** (0.073)	-0.463*** (0.091)	-0.383*** (0.073)
TFP_{t-1}			1.094*** (0.027)	1.305*** (0.092)	1.760*** (0.104)	1.514*** (0.261)
Openness				0.174** (0.184)	0.106** (0.317)	0.384** (0.258)
Property rights				-0.273*** (0.056)	-0.153** (0.042)	-0.559** (0.069)
Improved sanitation				0.092** (0.195)	0.219** (0.395)	0.407** (0.201)
Energy use				-0.031* (0.039)		
Electricity					0.025 (0.107)	
Transport service						0.001 (0.038)
Intercept		2.434*** (0.069)				
R-Squared	0.018	0.031				
Sargan test (*p*-value)			0.268	0.325	0.195	0.271
AR (1) (*p*-value)			0.0048	0.001	0.000	0.003
AR (2) (*p*-value)			0.170	0.371	0.309	0.103
Wald test, coefficients (*p*-value)		0.000	0.000	0.000	0.000	0.000
Wald test, dummies (*p*-value)			0.000	0.000	0.000	0.000
Number of observations	1088	1088	1984	1877	1606	1828

Notes. Robust standard errors of System GMM estimator are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

Table 3. System GMM estimations of TFP including more control variables

	Dependent variable: Total factor productivity (TFP)					
	System GMM					
	7	8	9	10	11	12
Corruption	-0.043***	-0.074***	-0.067***	-0.068***	-0.084***	-0.055***
	(0.012)	(0.024)	(0.021)	(0.034)	(0.017)	(0.022)
TFP_{t-1}	0.946***	0.984***	0.961***	0.904***	0.917***	0.984***
	(0.032)	(0.020)	(0.034)	(0.031)	(0.024)	(0.038)
Openness	0.071***	0.077***	0.068***	0.069***	0.072**	0.081**
	(0.031)	(0.035)	(0.027)	(0.031)	(0.030)	(0.032)
Property rights	-0.061***	-0.057**	-0.071**	-0.038**	-0.064***	-0.051**
	(0.023)	(0.024)	(0.038)	(0.044)	(0.028)	(0.032)
Improved sanitation	0.071**	0.073**	0.061***	0.063**	0.071***	0.083***
	(0.047)	(0.041)	(0.034)	(0.051)	(0.063)	(0.074)
Energy use	0.017	0.008*				
	(0.005)	(0.005)				
Government spending		-0.012*		-0.043*		-0.014*
		(0.025)		(0.031)		(0.045)
Inflation	-0.016**	-0.027***	-0.034***	-0.039***	-0.041***	-0.051***
	(0.036)	(0.024)	(0.031)	(0.042)	(0.031)	(0.042)
Electricity			0.015	0.027		
			(0.027)	(0.061)		
Transport service					0.053**	0.049*
					(0.041)	(0.038)
Sargan test (*p*-value)	0.732	0.537	0.342	0.479	0.529	0.268
AR (1) (*p*-value)	0.003	0.001	0.028	0.019	0.010	0.008
AR (2) (*p*-value)	0.695	0.720	0.648	0.746	0.681	0.539
Wald test, coeffic. (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
Wald test, dumm. (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
Number of observations	1877	1846	1606	1586	1828	1803

Notes. Robust standard errors of System GMM estimator are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

5.3.1 The influence of tax burden

In the analysis of *Table 4*, the focus is on the role played by tax burden in the relationship between corruption and TFP. Again, the analysis starts with a basic estimation (*Model 13*) involving these variables of interest only. In particular, TFP is controlled for TFP_{t-1}, *Corruption*, *Tax burden* and *Corruption×Tax burden*. The estimation results regarding the effect of variables of interest on TFP indicate that their respective main effects are negative and statistically significant, while the effect associated with their interaction term is positive and statistically significant as well. This implies that the negative main effect of corruption on TFP is greater when tax burden is reduced (and *vice versa*). In other words, an increase in tax rates alleviates the detrimental impact of corruption.

A scrutiny of *Model 3* compared to *Model 13* also strengthens that argument. The difference between both estimations is that the former ignores the influence of taxes on TFP, whereas the latter does not. As previously mentioned, *Model 3* predicts a 0.041% drop in TFP when the corruption level increases by one unit. However, by taking into account the influence of taxes in *Model 13*, the overall estimated effect of corruption (the sum of the estimated coefficient of corruption and that of interaction between corruption itself and tax burden) on TFP becomes positive (0.019), which represents a considerable variation, as compared to its previously estimated effect of -0.041 in *Model 3*.

Moreover, the paper considers other regressions, including several alternative determinants of TFP among regressors (*Model 14* to *19*). When the interaction variable *Corruption×Tax burden* is excluded from the regression (*Model 14* and *18*), the estimations show that the effects of corruption and tax burden on productivity are all negative and statistically significant. On the other hand, when *Corruption×Tax burden* is introduced in the estimation alongside the main effects of corruption, tax burden and the other determinants of TFP (*Model 15, 16, 17* and *19*), the same conclusion holds. Just like with *Model 3*, the estimated coefficients related to *Corruption* and *Tax burden* are negative and statistically significant, with *Corruption×Tax burden* displaying statistically significant positive coefficients. Again, the findings suggest that tax rate increases mitigate the negative consequence of corruption on productivity.

Table 4. System GMM estimations of TFP including more control variables: The influence of tax burden

	Dependent variable: Total factor productivity (TFP)						
	System GMM						
	13	14	15	16	17	18	19
Corruption	-0.023***	-0.011***	-0.015***	-0.022***	-0.021***	-0.017***	-0.023***
	(0.004)	(0.002)	(0.002)	(0.007)	(0.006)	(0.002)	(0.006)
TFP_{t-1}	0.945***	0.956***	0.964***	0.971***	0.977***	0.963***	0.960***
	(0.012)	(0.013)	(0.014)	(0.011)	(0.013)	(0.016)	(0.014)
Openness		0.063***	0.050***	0.089***	0.081***	0.062**	0.071**
		(0.019)	(0.017)	(0.024)	(0.025)	(0.025)	(0.021)
Property rights		-0.081***	-0.094**	-0.068**	-0.047**	-0.084***	-0.082**
		(0.015)	(0.018)	(0.017)	(0.020)	(0.019)	(0.017)
Improved sanitation		0.052**	0.041**	0.037*	0.038**	0.039**	0.040**
		(0.014)	(0.016)	(0.018)	(0.016)	(0.016)	(0.017)
Energy use		0.011*	0.012				
		(0.012)	(0.013)				
Inflation		-0.061***	-0.042***	-0.051**	-0.063***	-0.075**	-0.082**
		(0.033)	(0.032)	(0.031)	(0.043)	(0.057)	(0.061)
Tax burden	-0.033***	-0.031***	-0.018***	-0.024***	-0.023***	-0.037***	-0.022***
	(0.063)	(0.06)	(0.066)	(0.072)	(0.081)	(0.059)	(0.061)
Corruption×*Tax burden*	0.042***		0.023***	0.028***	0.025***		0.027**
	(0.017)		(0.006)	(0.007)	(0.006)		(0.007)
Corruption×*Inflation*				0.006**			0.006**
				(0.005)			(0.004)
Electricity				0.007	0.006*		
				(0.006)	(0.003)		
Transport service						0.047*	0.033**
						(0.019)	(0.020)
Sargan test (*p*-value)	0.250	0.536	0.438	0.594	0.749	0.631	0.537
AR (1) (*p*-value)	0.002	0.005	0.005	0.018	0.019	0.010	0.001
AR (2) (*p*-value)	0.427	0.841	0.980	0.958	0.974	0.850	0.964
Wald test, coeffic. (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wald test, dumm. (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Number of observations	1980	1877	1873	1602	1602	1828	1824

Notes. Robust standard errors of System GMM estimator are in parentheses. The superscripts ***,** and * represent statistical significance at 0.1, 1 and 5% levels, respectively.

5.4 CONCLUSIONS

This study involved an empirical analysis that examined the effects of corruption and tax burden on total factor productivity (TFP). It made use of panel data from 90 countries worldwide over the 1996–2014 time span, and employed the Corruption Perception Index (CPI) provided by Transparency International (TI) as a proxy variable.

The estimation results unambiguously suggest that corruption, like tax burden, has a negative effect on TFP. When productivity is only controlled for its lagged variable and corruption, the finding suggests that a one-unit increase in the corruption standard deviation leads to a decrease in productivity of 0.041%. Then, when the influence of tax burden and its interaction effect with corruption alongside the lagged dependent variable is taken into account, one can notice that the initially negative effect of corruption on productivity is drastically reversed. The overall effect of corruption on TFP turns positive, indicating that tax rate increases alleviate the negative effects of corruption on productivity. The same conclusion emerges in the alternative regressions when TFP is additionally controlled for other determinant variables. On the one hand, corruption and tax burden each have an overall effect that clearly lowers productivity in the first place. On the other, the presence of high tax burden at the same time mitigates the consequences of corruption on productivity.

All in all, the paper maintains that TFP represents a narrow channel through which corruption highly undermines the economic prosperity of countries. To respond to the threat posed by corruption for economies, decision-makers must pay due attention to fiscal policy in its design and implementation. The latter is a 'double-edged sword' for countries with regard to its intertwinement with corruption through the shadow economy and other illegal practices derived therefrom. Optimal taxation and the efficient use of tax revenues both constitute instruments for monitoring corruption efficiently; as such, they encourage economic progress. Conversely, their mishandling is likely to exacerbate corruption and significantly affect their contribution to the service of the community.

For future studies, a long-term comparison of the influence of corruption on the twin factors (human-physical capital) and TFP would be revealing as well. Doing so would help determine whether corruption affects the dynamic of economic changes over time – If so, then to what extent and according to which determinants? Answers to this and other related questions can help better direct anti-corruption efforts towards those factors displaying significant sensitivity to corruption, in turn ensuring their effectiveness.

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APPENDIX

Table A1. Unit-root test, Augmented Dickey-Fuller (AD-F) and Phillips-Perron (P-P) methods

Variable	Augmented Dickey-Fuller		Phillips-Perron	
	DF statistics	*p*-value	DF statistics	*p*-value
TFP	-9.846	< 0.01	-31.332	0.01
Corruption	-10.778	< 0.01	-32.583	0.01
Openness	-10.035	< 0.01	-31.959	0.01
Property rights	-9.953	< 0.01	-31.645	0.01
Inflation	-10.821	< 0.01	-31.664	0.01
Tax burden	-10.104	< 0.01	-30.934	0.01
Government spending	-9.720	< 0.01	-29.000	0.01
Health expenditure	-10.977	< 0.01	-32.182	0.01
Improved sanitation	-10.886	< 0.01	-31.853	0.01
Electricity	-9.306	< 0.01	-30.809	0.01
Transport service	-10.045	< 0.01	-32.198	0.01
Energy use	-9.249	< 0.01	-30.904	0.01

Notes. For both methods, the null hypothesis (H_0) is that the series contain a unit root, against an alternative hypothesis (H_1) that at least one panel is stationary. H_0 is rejected under the condition that the *p*-value associated with DF statistics is smaller than the critical value 0.05. Here, in both cases, all series are rigorously stationary.

Table A2. List of countries/territories in the sample

Argentina, Australia, Austria, Bahrain, Barbados, Belgium, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burundi, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Cyprus, Denmark, Dominican Republic, Egypt, Finland, France, Gabon, Germany, Greece, Guatemala, Honduras, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Laos, Lesotho, Luxembourg, Malaysia, Malta, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Netherlands, New Zealand, Niger, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Romania, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Swaziland, Sweden, Switzerland, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela.

Table A3. First-stage regressions, $Corruption_{i,t}$ is the dependent variable

	OLS 1	OLS 2	OLS 3	OLS 4	Fixed effects 1	Fixed effects 2
Constant	3.054*** (0.047)	4.162*** (0.021)	2.742*** (0.053)	2.732*** (0.014)		
$Corruption_{1996}$	-0.141*** (0.036)			-0.049*** (0.028)		
Government $spending_t$		0.218*** (0.091)		0.205*** (0.133)	0.073*** (0.025)	0.061*** (0.032)
Military expenditure			0.002*** (0.073)	0.001** (0.033)	0.003** (0.042)	0.001** (0.040)
$Corruption_{t-1}$					0.012** (0.037)	0.0014** (0.021)
$Corruption_{t-2}$					-0.004* (0.001)	-0.0034* (0.001)
$Inflation_t$						0.013*** (0.035)
Property $right_t$						0.044** (0.018)
Health expenditure						0.014* (0.364)
Improved $sanitation_t$						-0.053 (0.016)
Adjusted-R^2	0.0381	0.1271	0.023	0.1506	0.1073	0.2454
Number of obs.	1088	1088	1088	1088	1088	1088
Fisher test (p-value)	8.44e-08***	<2.2e-16***	<2.2e-16***	<2.2e-16***		

Notes. Regressions are based on OLS and Fixed effects estimators. ***, **, * symbolise the statistical significance at 0.1, 1 and 5% levels, respectively.

Table A4. Exogenous test regressions, $TFP_{i,t}$ is the dependent variable

	OLS 5	OLS 6	OLS 7	OLS 8	Fixed effects 3
Constant	2.547*** (0.028)	2.830*** (0.037)	3.135*** (0.015)	2.652*** (0.027)	
Corruption	-0.392*** (0.026)	-0.149*** (0.046)	-0.272*** (0.183)	-0.248*** (0.082)	-0.149*** (0.053)
TaxBurden	-0.164*** (0.015)	-0.103*** (0.014)	-0.117*** (0.011)	-0.209*** (0.013)	-0.018*** (0.035)
Residual(OLS 1)	0.043*** (0.061)				
Residual(OLS 2)		0.162*** (0.038)			
Residual(OLS 3)			0.217*** (0.051)		
Residual(OLS 4)				0.251*** (0.028)	
Residual(Fixed effects 1)					0.169** (0.009)
Adjusted-R^2	0.3312	0.4607	0.5028	0.6376	0.3401
Number of obs.	1088	1088	1088	1088	1088
Wu-Hausman(p-value)	2.16e-16***	2.e-12***	<2.2e-16***	<2.2e-16***	<2.2e-16***
Conclusion	IV	IV	IV	IV	IV

Notes. Regressions are based on OLS and Fixed effects estimators. ***, **, * symbolise the statistical significance at 0.1, 1 and 5% levels, respectively.

Figure 1.1. TFP vs Corruption: Emerging Developing Asia (EDA

Figure 1.2. TFP vs Corruption: Sub-Saharan Africa (SSA)

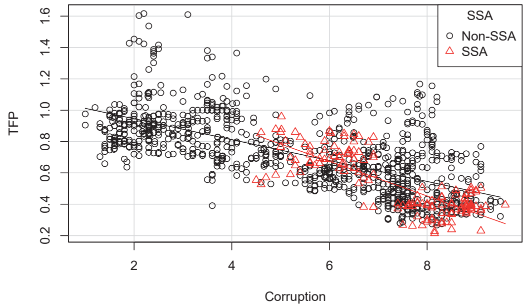

Figure 1.3. TFP vs Corruption: Advanced economies (AE)

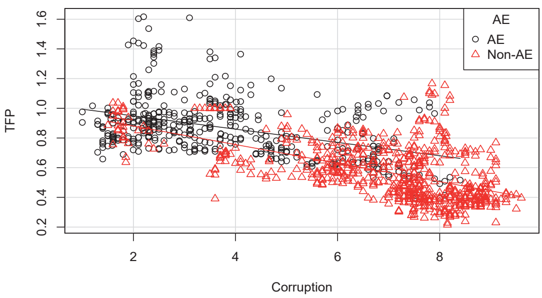

Figure 1.4. TFP vs Corruption: Latin America - Caribbean (LAC)

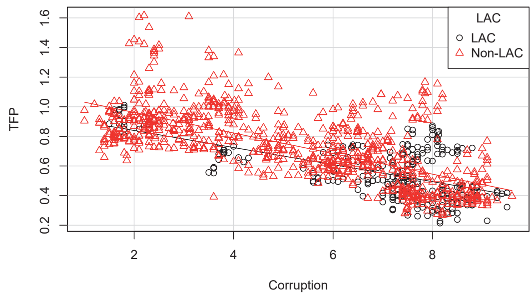

Figure 1.5. TFP vs Corruption: Middle-East - North Africa (MENA)

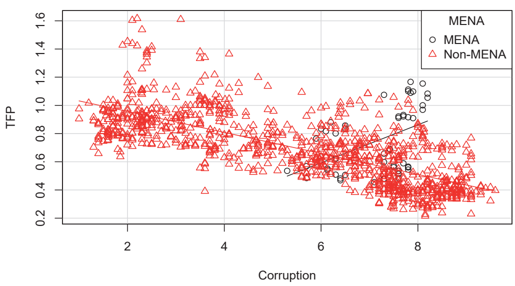

Figure 1.6. TFP vs Corruption: Euro area (EA)

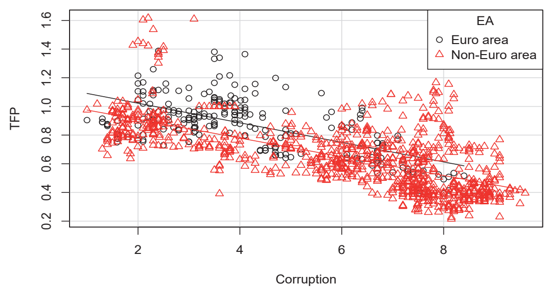

Figure 1.7. TFP vs Corruption: Emerg. market and developing economies

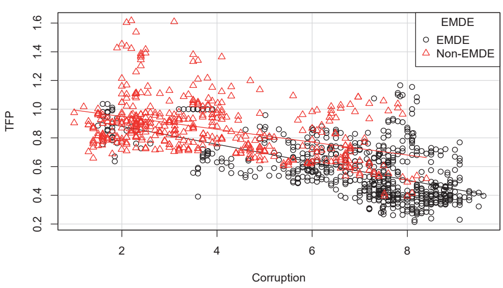

Figure 1.8. TFP vs Corruption: OECD