ESSAYS ON THE ECONOMICS OF CORRUPTION, INSTITUTIONS,

AND MANAGEMENT PRACTICES

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DECLARATION

I confirm that the work presented in this thesis is my own (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it). Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Daphne Athanasouli

STATEMENT OF CONJOINT WORK

One out of my five chapters that form part of this thesis involve conjoint work, as specified below:

Chapter III "Corruption and management practices: Firm level evidence" is conjoint work with Antoine Goujard. Part of this work has been published at the Journal for Comparative Economics.

ACKNOWLEDGMENTS

ABSTRACT

My thesis focuses on the economics of corruption, institutions, and management practices. The impact of corruption on economic performance is a key issue in development economics, central to the evaluation and design of public policies.

Chapter one introduces the theoretical framework of this thesis. It highlights the embeddedness of corruption at every institutional level and its interdependence with other institutions. The framework identifies petty and grand corruption and corruption at different levels, at the industry, region and country level, to examine the interrelation between corruption, other institutions, and management decisions on the resource allocation of firms, and the impact of public sector reforms in reducing corruption.

Chapter two and three examine the two channels through which corruption affects private sector development, the external environment under which firms operate, and their internal environment. Chapter two analyses the relationship between corruption measured at different levels and firm performance. I find that at the individual firm level, corruption could be, in some cases, profit-maximizing. However, at the regional and country level, I find that the aggregate costs of corruption remain negative and significant for all firms. Chapter three examines the impact of corruption on the firm's management practices. I investigate the impact of regional corruption on the management quality of firms within the manufacturing sector in Central and Eastern Europe. I find that firms in more contract-dependent industries located in more corrupt regions tend to have lower management quality.

Chapter four by contrast looks at factors that help eliminate corruption at the macro-level, and specifically e-government. I find that the development of online services by the state tends to decrease corruption, and that progress in e-government can facilitate several business processes.

Chapter five, concludes. I review the main contributions of the thesis and discuss future research.

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CHAPTER 1

1. Theoretical Framework

1.1   Introduction

This study examines the determinants and effects of the informal institution of corruption with a focus on transition countries. The motivation behind studying the informal institution of corruption is its systemic character and embeddedness in society, which affects individual behavior as well as resource allocation within firms that can in turn affect firm performance. The inherent difficulties in measuring corruption have resulted in mixed findings in the literature on its determinants and effects. Furthermore, the institutional framework underlying the links between the informal institution of corruption, formal institutions, transactions, and firm decisions has been under-researched in the existing literature, and the present work aims to address this gap by extending the institutional theory to explore the relationship between formal and informal institutions, and firms' resource allocation decisions.

Respectively, the understanding of corruption, formal institutions, and governance, and how they can affect the choices of firms will be examined in this thesis as well as the reverse mechanism of how the decisions of firms can affect the quality of governance and formal institutions, and consequently have a feedback effect on norms of corrupt behaviors. The understanding of corruption is of particular importance in transition economies, which have been facing economic, political, and social challenges after the fall of communism, for the success of any reform agenda in those countries. For this purpose, the thesis will also examine how changes in corrupt practices can be initiated through public policy at the level of formal institutions, rule of law, and governance, which can affect the level of bribing practices of firms and bring slow changes in societal norms on corrupt behavior.

The impact of corruption on economic performance is a key issue in development economics, central to the evaluation and design of public policies. Chapters 2 and 3 examine the two channels through which corruption affects private sector development, the external environment under which firms operate (competition and entry), and their internal environment (firm governance and

management practices). The impact of corruption on firms in transition countries is tested in the empirical chapters, 2 and 3. In particular, the research highlights that corruption may affect private sector development through three main channels, notably through (a) weakening the rule of law and judicial quality (b) deterring competition at the level of governance, obscuring the entry of new firms, and favoring incumbent firms that engage in bribery, and (c) hampering the internal decisions of the firm and distorting resources, negatively affecting management quality. Indeed, in corrupt environments, as firms can remain and expand their business based on criteria other than efficiency, the development of firm productivity and output maximizing management practices may not be the primary objective (Chapters 2 and 3). For example, managers may choose to devote more time to relationships with public officials rather than to set out quality-control procedures or prospect potential markets (Dal Bó and Rossi, 2007, Chapter 3). At the same time, firms can also initiate corrupt practices to influence the content of government regulations, and the degree to which firms are affected by these activities varies. This phenomenon challenges a causal interpretation of the correlations between measures of firm outcomes, such as sales or sales growth (Chapter 2), and the level of corruption. These different mechanisms also emphasize that the nature of relationships between individual firms, public officials, and political parties may deter corruption or create the possibility of extracting rents from all sides. Further, the thesis concludes with Chapter 4 which looks at factors that help eliminate corruption at the macro-level, specifically through e-government. I find that the development of online services by the state tends to decrease corruption, and I examine one possible firm-level mechanism of e-government that can facilitate several business processes. Therefore, Chapter 4 analyzes the extent through which setting out more transparent modes of collaboration between the public and private sector and less-discretionary procedures for senior public servants through the development of e-government services can reduce the extent of corruption.

This chapter will introduce the conceptual framework of the thesis and its theoretical underpinnings. I will review formal and informal institutions with a specific focus on the informal institution of corruption. Finally, I will present a summary of the empirical chapters, linking them to the conceptual framework of the thesis, and will conclude by outlining the contribution of this work to the literature.

1.2 Conceptual framework

The level of corruption and formal or informal practices of firms will differ based on the institutional context. The institutional character is related to country-specific characteristics but it can also be determined at regional level, when local municipalities have significant differences within the same national border. Formal and informal institutions will formulate the incentives that will determine whether firms remain in the formal sector or use informal practices, such as bribing. The literature to date has mainly discussed corruption as the outcome of formal institutions, without seeing corruption embedded in the institutional environment. There is scarce evidence on the institutional channels through which corruption may affect resource allocation and firm performance. There is also little discussion on how public policy reforms can reduce corruption through different levels of institutions and affect resource allocation decisions of firms, reducing their bribing practices.

According to Kaufmann et al. (2006) corruption is defined as the "extent to which public power is exercised for private gain as well as capture of the state by elites and private interests". The nature of corruption itself and its imperfect measurement are partly the reasons for the variety of different findings in the literature. There is no single type of corruption. Focusing on the links between different types of corruption and various dimensions of the institutional environment would enrich our understanding of corruption as a multifaceted phenomenon.

Apart from the very different types of corruption, a variety of different measures have been used (experience and perception), capturing often very different aspects of corruption. The problem in measuring corruption is related to the difficulties in measuring institutions overall. North (1990) noted that institutions cannot be seen, touched, or measured, whereas Solow (1995) observed that the measurement of institutions needs significant improvement. One of the main difficulties in capturing institutions is that often subjective measures, based on the perceptions of experts, are used. However, over the last two decades a variety of measures of institutions have been developed, focusing more on the experience of the respondents and addressed to citizens or firm owners and managers, that could provide more reliability.

Nevertheless, no attempts have been made to explore the linkages between different types of corruption and other formal institutions. In order to address this gap in the literature, building on

the institutional theory, I further develop a framework specific to corruption, to analyze how the institutional context impacts firms' decisions to resort to corruption, such as bribing in exchange for benefits that are either related to bypassing administrative barriers or influencing legislation related to their operation. The thesis offers a conceptual framework to consider the differing impact of institutions on the resource allocation decisions of firms, and the links between these institutions, as well as exploring how individual firm and household decisions can slowly feed back to the higher level of the institutional hierarchy and either reinforce a weak institutional environment or improve the functioning of institutions by limiting bribing practices.

The theoretical framework of this thesis is based on Williamson (2000) to identify institutions of particular significance for the bribing practices of firms. The thesis enhances Williamson's "hierarchy of institutions" to identify the fundamental institutions likely to influence bribing practices of firms. The thesis investigates the impact of different types of corruption on resource allocation decisions of firms and firm performance, the specific impact of the norm of corruption on contract institutions as a channel through which it can affect resource allocation decisions of firms and management practices, and the effect of public policies on e-government in reducing corruption through different institutional channels.

The theoretical framework of this thesis supports that corruption will affect resource allocation decisions of firms through two institutional channels: rule of law and governance. However, I also investigate the impact of two types of corruption, petty corruption and grand corruption, when firms engage in different types of corrupt practices with public officials, and how this can feed back to the institutions by either strengthening or undermining them.

I assess corruption through different surveys; firm-level data and household data are used for the evaluation of corruption as well as country indices based on a variety of corruption measures. I also use a variety of different levels in which I assess the impact of corruption at firm level, as well as industry, regional, and country level. The second chapter of the thesis looks at the correlation between corruption and firm performance at industry, regional, and country level. I find that the relationship between corruption and institutions is complex; individual practices of firms can affect the rule of law, through grand corruption, and governance, through petty corruption. I find that individual choices of firms to bribe do not hamper firm performance as much as when they become more embedded in society, looking at the context of the industry, the region, and the

country. I find that at individual firm level corruption could be, in some cases, profit-maximizing. However, at regional and country level I find that the aggregate costs of corruption remain negative and significant for all firms. The chapter highlights the systemic nature of corruption. It is when corruption becomes more embedded in society that corruption undermines the rule of law and governance, thereby affecting resource allocation and firm performance.

In the third chapter I investigate an institutional channel, contract institutions, through which corruption can affect resource allocation and management practices of firms. Corruption can hamper the enforcement of contracts between firms and weaken their resource allocation decisions and management practices. Chapter 3 examines the impact of corruption on firm management practices. I investigate the impact of regional corruption on the management quality of firms within the manufacturing sector in Central and Eastern Europe. I find that firms in more contract-dependent industries located in more corrupt regions tend to have a lower quality of management. In Chapter 4 I investigate a specific public policy, e-government, and its effect in the reduction of bribing practices through strengthening two institutional levels: rule of law and governance.

1.3 Corruption, institutions, and resource allocation decisions within firms

There is no single agreed global definition of corruption exists. Specifically, there is no unanimous view on what constitutes a corrupt act, while norms and accepted behaviours may differ greatly from country to country. Corruption would then become conditional to ethics. Universal definitions on practices, rights and obligations have inherent difficulties as they are to a large extent determined by culture. Sen (1999) discusses the complexities of applying a universal definition on human rights that by definition have a universal aspect, as different cultures may regard different rights as valuable. A wide definition of corruption is "the extent to which public power is exercised for private gain as well as capture of the state by elites and private interests" (Kaufmann et al., 2006). In practice, international organizations and instruments, such as the OECD, the Council of Europe and the UN conventions do not define "corruption", but establish different ranges of corrupt offences (OECD, 2007). In this thesis, I use measures for "petty" and "grand corruption" and proxies for corruption as an informal institution.

"Petty corruption" refers to the abuse of power by low and mid-level public officials in their everyday transactions with citizens and firms. "Grand corruption" occurs at a larger scale then petty corruption and relates to wrongful policy formulation that is based in exchange of benefits or misuse of public resources. Grand corruption refers to practices of politicians and high-level public officials who distort policies and manipulate legislation and formal institutions in the public sector functions for their own benefit and to the detriment of the public. These practices may involve illegal financing activities of and collusion with firms, and, as Transparency International states, these practices can occur so that politicians and high-level officials can sustain their power, status and wealth (Transparency International, 2017).

If corruption is prevalent as an informal institution and it is embedded in the belief system of people, then it will materialize in all other levels. At the level of formal institutions it will take the form of grand corruption, at the level of governance it will be petty corruption, and at the resource allocation level it will be manifested as the individual decisions of firms and households to bribe. Therefore, corrupt practices are influenced by societal beliefs, and at the level of formal institutions grand corruption is more likely to involve criminalized behaviours and have higher social costs; for example, when government funds are used for private gain, whereas at the level of governance petty corruption involves smaller costs as it takes place on a smaller scale. Even though petty corruption still has important social consequences. It is often determined by societal norms and culture, for example the custom of giving gifts to public officials, and the potential costs to society may not be understood by the parties involved. However, in the case of grand corruption it is expected that the parties involved are more aware of the costs of their action to others.

Corruption as an informal institution drives behaviour for grand and petty corruption and – depending on the tolerance for and culture of corrupt practices that characterize a society – it can impose constraints or create opportunities for corrupt behavior. Corruption as informal institution encompasses a broad spectrum of beliefs and attitudes, some of which include attitudes towards relying on formal routes; using small networks to promote personal interests; exchanging favours, offering gifts and bribes to get things done; getting ahead of others in areas of everyday life, such as health, education, and employment by unlawful means; creating more wealth, status, and power; having trust in the state as a welfare provider; beliefs about promoting social good; and

other informal practices. Many of these informal practices would constitute corruption based on Kaufmann et al.'s definition of corruption (Kaufmann et al., 2006). However, these practices may be determined by societal norms and belief systems and are not always viewed as illegal or unethical activity in their respective context.

The informality and embeddedness of these practices, and the influences from history and culture, render it complex to understand and encompass all aspects that can affect attitudes towards and beliefs about corruption. In addition, there may be differences between the different type of corrupt practices and their origin in terms of social norms and attitudes, for example differences in the norms influencing petty compared to grand corruption. Even different practices within the same broad category of corruption could involve different sets of embedded values: for example, in terms of petty corruption, a gift being offered may be less offensive and demanding compared to a bribe (Lambsdorff and Frank, 2010) that also has an expectation of exchange, and therefore one practice could involve different beliefs and patterns of behaviour.

According to some studies, corruption is attributed to dysfunctional formal institutions, rule of law, and governance. However, some studies highlight the complexity of corruption, in that it can be deeply embedded in society and cannot be attributed only to formal institutions. Corruption can then become an informal institution itself when it is so widespread and expected in individual and business transactions that it turns into a norm, with associated unwritten rules of conduct (Jepperson, 1991; Hyden, 2005; Darden, 2008). This thesis views corruption as an informal institution when it becomes embedded in the environment, whether this is a region, an industry, or a country to capture the embeddedness of the phenomenon and how it can determine and also be affected by resource allocation decisions made by firms. Therefore, I examine grand corruption at the level of formal institutions, when firms can affect law and regulations and impede the rule of law; petty administrative corruption at the level of governance, when firms pay bribes to public officials in exchange for services and licenses and this results in poor governance and poor contract enforcement; and corruption at firm level, when firms make resource allocation decisions in a corrupt environment.

In order to understand how corruption can be examined at different levels of the institutional hierarchy it is important to discuss the existing institutional theory and the conceptual framework of the thesis. According to North (1990), institutions should be divided into formal and informal

institutions and the individual decisions of firms and their behavior will be dependent on the overall institutional quality associated with different type of incentives. Informal institutions include norms and social behaviors and determine the quality of formal institutions, such as laws and rules. Indeed, based on the framework from North (1990), corruption as an informal institution could affect the quality of formal institutions, in particular whether laws and rules are enforced. The overall institutional environment would therefore determine the different incentives for firms and the decisions they make based on the opportunities and barriers of the environment in which they operate. When corruption is prevalent, incentives can be distorted and resources can be spent in overcoming the barriers of a corrupt business environment, such as dealing with public officials. Williamson (2000) provides a more in-depth institutional framework based on a four-level hierarchy.

This section will present and discuss the conceptual framework of corruption as an informal institution that forms the basis of the thesis. It will display the framework based on the order of institutions and their interconnectedness that will be consequently highlighted in the following chapters of this thesis. The factors presented in this conceptual framework on corruption are not exhaustive; the purpose is not to investigate all the possible effects and determinants of corruption. Its purpose is to connect all the variables presented in the thesis, see how they are linked and can influence one another, and determine their order in the institutional setting. I develop Williamson's framework, specifically in the context of corruption, to propose specific ways in which corruption influences the bribing practices of firms, and their resource allocation decisions, for example their management practices through the formal institutional channels.

The conceptual framework used is based on Williamson (2000), who presents four levels of social analysis that represent the Economics of Institutions. According to Williamson, the first level, embeddedness and informal institutions, imposes constraints on the second level, that of the rule of law, which in turn imposes constraints on the third level, the level of governance, which imposes constraints on the fourth level, that of resource allocation. However, there is another mechanism observed between the different levels, namely, feedback effects from lower levels to higher levels. Williamson states that because of the feedback mechanisms over the long term this system is fully interconnected; however, as he states in his analysis, these effects are mainly ignored (Williamson, 2000).

Williamson has tried to incorporate in his work and his analysis of the Economics of Institutions neoclassical theory transaction cost economics, and recent developments in the New Institutional Economics (NIE). However, he recognizes that work on institutions requires further research and that there are some areas that are not yet fully understood, especially informal institutions. Williamson (2000) states that until a consolidated institutional theory is developed, academics need to accept pluralism in this area. He claims that there are many informative theoretical endeavours to analyse institutions, and the way to overcome the complexities of this analysis is to acknowledge the contribution of each work at the same time as accepting its limitations. For this purpose, I will first address differences between my conceptual framework and Williamson's four levels of social analysis, and then discuss some other work on institutions and other dimensions of institutions that contribute to the development of a coherent institutional theory.

My thesis supports the idea that informal institutions cut through all the levels of the institutional analysis. The work of Williamson has been interpreted in the literature as a hierarchy of institutions, based on the fact that the higher levels, characterized by higher durability, determine to an extent the lower levels by imposing constraints on them (Joskow, 2004; Boettke and Coyne, 2009). However, the reference to a hierarchy may hinder the understanding of the effect of corruption as informal institution on all other levels, emphasize the links with the level below, and imply a rather static institutional order, where each level is only directly linked and constrained by the level above. Williamson, even though presenting the four levels of social analysis in a hierarchical order, does not refer to a "hierarchy". He recognizes the difficulties of understanding the complexities presented in the analysis of informal institutions and their far-reaching consequences on societies and economies in the long term. Williamson also supports the idea that informal institutions may address practical needs or develop symbolic value, and that some are extensively linked with other formal and informal institutions, which fact can partly explain their durability.

In Figure 1.1, the institutional framework for the "Economics of Corruption" illustrates the pervasive role of corruption as an informal institution in society, with the associated norms, beliefs and culture of corrupt practices cutting through all other levels. Specifically, it addresses the links between grand corruption and governance, and between petty corruption and informal institutions. It also presents the effect of corruption as informal institution on all other levels,

highlighting the forms in which corruption can materialize if it is prevalent as an informal practice. Finally, the framework takes into account other factors that can affect institutional change, and increase or decrease the effects of the opportunities for corruption and constraints for corrupt behaviour.

The thesis therefore substantiates the argument that corruption as an informal institution, comprising the norms and practices of corrupt behaviour inextricably linked with beliefs and culture around corrupt practices, cuts through all other levels of social analysis. The proposed economics of corruption framework recognizes the effect of higher levels to lower levels, but extends the discussion to constraints as well as opportunities for corruption. In the first level, corruption as informal institution can create constraints on or opportunities for corrupt practices in all other levels. The first level of corruption as informal institution – depending on the belief system and norms surrounding corrupt practices – either creates constraints or opportunities for grand corruption at the second level of formal institutions, petty corruption at the third level of governance, and individual decisions of firms and citizens to bribe at the fourth level of resource allocation.

Therefore, corruption as informal institution can materialize in different forms in all other levels. In level two, at the level of formal institutions, it will affect the level of grand corruption; in level three, that of governance, it will affect the level of petty corruption; and in level four, resource allocation, it will influence the decision of firms and households to bribe. If corrupt practices come up against the norms and beliefs of a society, then this will be evident in social or institutional constraints imposed in the levels below, whereas, if corrupt practices are the norm, then social or institutional opportunities for corruption will materialize in the other levels. The institutional constraints or opportunities imposed may sometimes be contradictory to the social constraints or opportunities. This could happen, for example, if corruption as an informal institution is prevalent but the government adopts rules and legislation to criminalize corrupt practices at the second level, and adapts governance structures at the third level. Although the government adapts formal institutions to render corrupt practices illegal, social opportunities for corruption will more likely exist, and grand corruption may still be prevalent at the second level, petty corruption at the third level, and individuals or firms may still choose to bribe at the fourth level, since corrupt practices are embedded in society.

Apart from the constraints and opportunities imposed from corruption as an informal institution at the first level, there are also feedback effects from lower levels to the level above. For example, changes in the lower institutional levels can provoke supporting changes in the higher levels. For instance,, increased levels of petty corruption observed in transactions with public officials in the construction sector could generate the need to adapt the institutions of bureaucracy and the legislation related to construction licenses and permits. Another indirect example would be that if the government signs anti-corruption conventions to combat bribery of foreign public officials in business transactions, in the absence of mechanisms to control this type of petty corruption, which is embedded in society, then signing up to such conventions may exert influences on the government to enact legislation and on the judiciary to apply it.

Some factors can advance changes whereas others delay or block changes in formal and informal institutions. The institutional framework of corruption does not encompass some of these factors that can be crucial in any attempts at reform. A discussion will follow to draw some linkages between these factors and the economics of corruption. The conceptual framework for corruption incorporates elements from Williamson (2000) but also from the work of others in the field of NIE, such as Douglas North (1990, 2005) and Masahiko Aoki (2001, 2007) as well as Rodrik (2000) among others. North (1990) discussed the role of institutions as defining the rules of the game, and this classification of formal institutions is presented on the second level in my institutional framework. Williamson (2000) presents the different social levels of analysis as a hierarchy and assumes that legal rules and informal institutions such as social norms and embedded beliefs are exogenous. However, Aoki (2001) emphasizes the importance of societal norms and beliefs, and gives institutions a definition different to the rules of the game; they are the behavioural beliefs and rules of common knowledge. His conceptual framework of economic institutions uses a game theory approach and supports the idea that institutions are endogenously shaped. Building on Aoki's analytical framework, if for example petty corruption is a common practice at the level of governance, then petty corruption is the institution- as opposed to the institution being defined as rules criminalizing these practices. Aoki provides examples of the difficulties of enforcing legal rules that are not based on shared beliefs, asking who will enforce the rules on the enforcer – a sort of modern *quis custodiet ipsos custodes* – and implying that deeply embedded beliefs cannot change because of legislation or enforcement because agents will lack incentives to abide by them. Institutions are therefore endogenously determined; they are

created based on observed behaviour and beliefs (Aoki, 2001). The societal practices followed become the institution, not the regulations imposed exogenously.

The conceptual differences between Williamson and Aoki appear major, as, according to Aoki, institutional change does not occur because of constraints on economic transactions imposed by legal rules, as Williamson maintained, but because of shifts in shared beliefs about the choices and intentions of other players (Aoki, 2007). Another perspective on institutions is presented by Rodrik (2000), who proposes a categorization of institutions into property rights and contract institutions, and argues that institutions can be effective either because they are enforced or if people believe in them. Accordingly, Rodrik (2000) recognizes the importance of embedded beliefs but argues that institutions can also exist and be effective through enforcement. Rodrik (2000) also emphasizes the relationship between economic growth and institutions. More growth can lead to more socially desirable outcomes and it can promote changes in observed behaviour. If there is economic growth, then people are more likely to accept social changes, and people will be characterized by higher levels of trust. Olson (2000) claims that the presence of good formal institutions and economic policies, the pressure to adhere to the law is higher as incentives are better aligned and private self-interest can restrict practices of corruption. Hodgson (2007) emphasizes the power of habit in creating long-term changes. Finally, revelation of corruption scandals as well as economic or political crises have also been found to drive institutional reforms (Ackerman and Palifka, 2016).
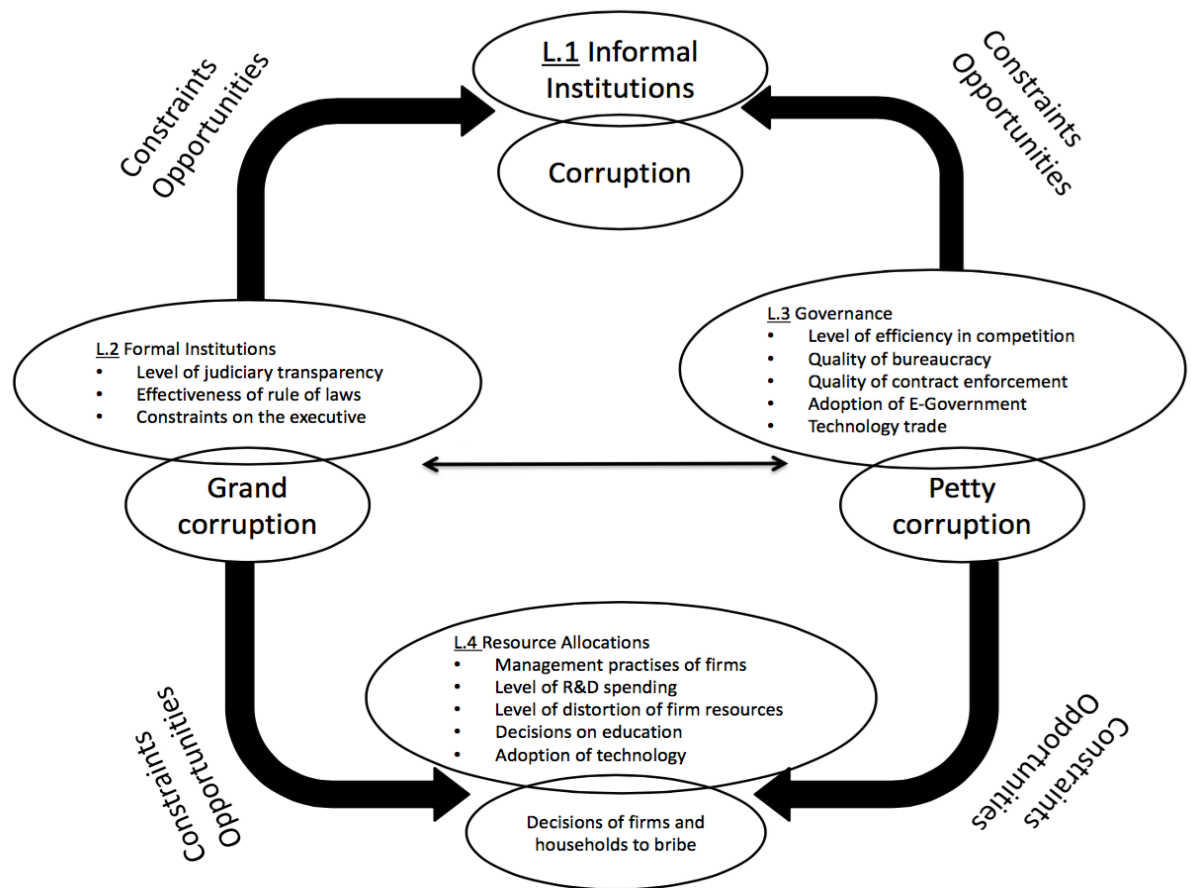
Figure 1.1 Conceptual Framework "Economics of Corruption"

1.4 Formal and informal institutions

Any successful economic policy-making relies on institutions. The role of institutions has been emphasized in the early literature (Samuels, 1987), and there is a growing empirical literature emphasizing their importance (Knack and Keefer 1995; Rodrik and Subramanian 2003; Kaufmann et al., 2007). The literature on the relationship between institutions and economic growth is also evident in several studies. Several empirical findings show that good institutions can significantly contribute to economic development (Olson 1971; North 1990; Knack and Keefer 1995; Mauro 1995; Barro 1996; Acemoglu et al. 2000; Rodrik et al. 2004). Acemoglu et al. (2005) find that the variation in cross-country per capita income is largely explained by institutions. The standard

neoclassical theory did not pay enough attention to the importance of the rule of law, property, and contract-enforcing institutions. However, a "perfect" market can only exist in a "perfect" institutional environment, since the market economy coexists with non-market institutions (Rodrik, 2000). The primary aim of New Institutional Economics is to extend the neoclassical theory in order to account for institutions. The role of institutions in the real world, where "perfect" markets do not exist, is very important as they can partly account for market failures, information asymmetry, limited rationality, and high transaction costs; institutions can then decrease risk and uncertainty. Institutions can also create a framework of sanctions and rewards to protect property rights and ease transactions (Acemoglu and Johnson, 2005). According to Rodrik (2000) it is therefore evident that institutions matter and the question that should be investigated is which institutions matter the most when evaluating public policies.

In this thesis I will adopt the definition from Douglas North (1990) that describes institutions as "the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction". Based on this definition, institutions can be understood as constraints set by society that could be subject to change. However, informal institutions rely on societal norms and beliefs and are very slow to change, whereas formal institutions are codified and could be altered through political procedures (Ahrens 2002; Roland, 2004). Informal and formal institutions are not operating separately; the interplay between them should be examined in public policy-making as they interact with each other. In particular, informal institutions, the oldest of institutions, can either strengthen or weaken formal institutions, as formal institutions rely on a codified code of conduct that can never be complete (North, 1990). Informal institutions can support formal institutional voids, creating a framework of beliefs and norms that drive social behavior. Any successful public policy reform needs to consider informal institutions as they are the basis of formal institutions, they are the highest level of institutions that are integrated in society, and any changes are very slow (Williamson, 2000). Changes in formal institutions can happen very fast, however, if they are contradictory to the informal institutions, and deeply embedded beliefs can result in failures if policymakers do not attempt to consider and address these tensions and recognize the interdependence of institutions when designing any public policy (Winiecki, 2004).

Informal institutions can be defined as societal norms, customs, traditions, or patterns of conduct (North 1990; Baumol 1996; Helmke and Levitsky 2004; Jütting and de Soysa 2007).

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Helmke and Levitsky (2004) note that informal institutions can denote several phenomena that arise from this set of shared beliefs and unwritten codes of conduct: corruption, traditions, and mafia (Helmke and Levitsky 2004). Informal institutions could develop in the absence of formal institutions; for example, at the onset of transition there was a legislative gap in private sector activity but the private sector emerged very dynamically before a formal framework was in place (Helmke and Levitsky 2004). Similarly, when institutions are not effective and do not respond to societal needs people can rely on informal institutions such as corruption to get things done. How informal institutions will be shaped is influenced by the shared beliefs that exist in a certain society, influenced by the past and the accumulated behavioral patterns. Informal institutions are socially inherited patterns of prevailing behavior that are not enforced through formal mechanisms but are enforced by the society that holds certain expectations on patterns of behavior that are expected and acceptable (Pejovich, 1999).

Formal institutions according to North include economic rules, and political and judicial rules, as well as contracts in a hierarchical structure. The rules comprise of constitutions at the highest level, of laws in the middle and of contracts at the end (North 1990). According to Pejovich (1999), formal institutions include economic and political rules and the institutions in place to enforce these rules, such as the police and the judiciary. Property rights and contract institutions have been emphasized in the literature as important measures of formal institutions. Property rights refer to the rights in place for using and making profit from property whereas contract rights refer to the provisions in place for an agreement or exchange (North, 1990).

Institutions are particularly important as they can affect growth and macroeconomic performance (Rodrik, 2000). Possible channels through which institutions can affect growth include the private sector, which has been found to be strongly affected by the rule of law (McMillan and Woodruff, 2002; Djankov and Qian, 2006). Institutions such as property rights can affect firm performance productivity and investment levels as well as entrepreneurship (Dawson 1998; Aidis et al., 2010). This thesis will look at judicial quality and public administration as well as contract institutions, competition in the business environment, and reduction of discretionary power of public officials to examine how corruption can affect resource allocation decisions of firms and firm performance. It will look at contract institutions and specifically contract dependence in order to evaluate the effect of corruption on management practices and firm

performance. It will also investigate how public policies, and specifically e-government, can reduce corruption through the formal institutional channels.

1.5   Transition economies

The second, third, and fourth chapter of the thesis focus on transition countries. The choice of these countries is motivated by the historic economic, political and social changes in post-Soviet states, and by the remaining institutional contradictions that still exist in terms of economic and political processes, formality and informality, twenty-five years after the dissolution of the Soviet Union. Many policy experts and academics discuss transition to a market economy as a completed process that is primarily driven by formal institutions. However, in practice, the institutional environment is quite different to what was expected; despite extensive reforms, corruption and informal practices remain prevalent in transition countries. There is evidence on how the formal and informal economy complement each other, with corruption being rampant in all aspects of everyday life, and at every level; for example, in the case of corruption in education, it starts with corruption and informal payments to get a place in a nursery, which continues to school and university, and then it is transferred to the labour market with the use of connections and favour-for-favours (Williams et al., 2013). This complex reality, and inconsistencies between reform goals and outcomes, is in line with the underpinnings of the conceptual framework. Informal institutions are embedded at every other level of social analysis and influence the success or failure of reforms depending on their level of alignment with the shared practices and behavioural rules. This contradiction between intended and actual outcomes in transition, and the continuing presence of corruption in every area of social interaction, makes transition countries a unique setting to study corruption, analyse its conceptual underpinnings and the mechanisms through which it operates, and take a step forward on the drivers for institutional change.

The different levels of progress and economic reforms across transition countries raise attention to the role of the institutional environment as a determinant for economic success. Indeed, effective institutional reform is crucial to enable the processes required for sustainable growth. Institutions can support effective changes in the real economy and contribute to economic growth, notably by affecting the level of economic efficiency with which resources are

allocated in the economy. Acemoglu et al. (2005) survey a voluminous literature that supports the hypothesis that institutions explain significant portions of the observed differences in per capita incomes.

Countries of Central and Eastern Europe (CEE) and the Commonwealth of Independent States (CIS) have been characterized by a J-curve pattern of economic growth (Campos and Coricelli 2002; Firdmuc 2003; Mickiewicz 2005; Falcetti et al 2006). The term "transition" refers to the organisational change moving from command to a market system (Young et al, 2002). The focus in the transition from central planning to market economies has been primarily geared toward macroeconomic stabilization and development of market institutions. The aim was to achieve fast rates of economic growth and to compete with more advanced market economies; however, the institutional framework that needed to be in place to ensure sustainability of growth was missing.

Not enough attention was given to the importance of governance mechanisms and informal institutions, such as corruption, in the implementation of reforms. Further, contract-enforcing institutions were particularly important in transition economics. Williamson (1985) stressed the importance of contract-enforcement institutions and associated the efficiency of a society with the type of contracts that can be enforced. The importance of contract enforcement was even more critical for countries undergoing transition, in which the policymakers focused on market reforms and did not put the necessary emphasis on institutions as the necessary condition for the success of reforms and the functioning of the institutional environment (Olson, 2000). According to the EBRD (2007), transition reforms include three stages of reforms: market enabling, market deepening, and market sustaining. The first stage reforms refer to liberalization, and privatization, trade, and foreign exchange; the second stage refers to large-scale privatization and financial sector reform. The market-sustaining reforms refer to the governance and enterprise restructuring, competition policy reforms. Market-enabling reforms are often referred to in other studies as Type I reforms, whereas market-deepening and market-sustaining reforms are referred to as Type II reforms (Svejnar, 2002; Mickiewicz, 2010).

However, in transition countries there was significant variation in the implementation of reforms, their success, and their depth. The determinants of reform success have been examined in the literature pointing to the fact that variation existed mainly in implementing market-deepening and market-sustaining reforms. The majority of transition countries implemented

successfully market-enabling reforms; however, the variation observed refers mainly to market-deepening and market-sustaining reforms (Svejnar, 2002). Studies have argued that the outcome of transition is determined mainly by informal institutions, and that if there are large inconsistencies between formal and informal institutions the success of transition will be more challenging (Raiser, 2001). Pre-existing informal institutions and deeply embedded beliefs, societal norms, and codes of conduct can have a decisive impact on the success and enforcement of market institutions (Winiecki, 2004).

In transition countries corruption has been persistent at a comparatively high level according to many available measures (EBRD, 2013). The reform policies that were implemented in these countries and the various privatization methods followed were in some cases associated with corrupt practices, giving power to insiders and specific interest groups. In some transition countries complete reform packages were implemented that resulted in more restructuring of the economy and created more opportunities for long-term growth. In other countries, partial reforms gave rise to specific interest groups that extracted benefits from the volatile environment and blocked the implementation of complete reform packages that would give access to information and resources to everybody. Corruption may still hold back necessary reforms and hinder economic and political developments in transition countries (World Bank, 2000). Corruption hampers growth through a variety of channels and it can have a devastating effect on the development of the private sector. The creation of a sound business environment, based on competitive structures and equal access to opportunities, remains a challenge for many transition countries.

The role of private sector development has also been emphasized in the literature on transition as catalytic for success of reform programs. However, the development of the private sector was determined by formal institutions and the functioning of enforcement mechanisms, largely shaped by informal institutions. Aslund (1999) supports that transition will only be over when corruption, specifically when the government extract monetary benefits, has been addressed. Therefore, transition economies provide fertile ground to examine the effects of corruption, as a high-level informal institution that played an important role in transition on the quality of other institutions, and on the functioning of formal institutions, governance, and resource allocation decision of firms, such as management practices, as well as firm development

in transition through the channels of contract enforcement and other governance mechanisms.

1.6 The evolution of corruption in transition countries

This section presents the different measures of corruption used and then shows the magnitude and evolution of corruption in transition countries. It also compares the measured extent of corruption in transition countries to Western European countries and EU countries. The chapter compares the different operational definitions and measurements of corruption used in this thesis. It outlines the main differences in construction and interpretation of perception-based measures and experience-based measures based on a survey of firms (Chapters 2 and 3) and households (Chapter 3). It also presents the advantages and limitations of widely used cross-country indicators of corruption that allow the assessment of trends over time and the comparison of transition countries with developed countries. This data is used later in Chapter 4 to investigate the impact of the development of e-government on the extent of corruption.

The different geographical groups– Central Europe and the Baltic states (CEB), South-eastern Europe (SEE) and the Commonwealth of Independent States and Mongolia (CIS), Russia, and Turkey – have also differed substantially in the degree to which they have been able to reduce the extent of corruption. The SEE median countries and Russia have displayed steady improvement in the control of corruption, while the measured progress in the control of corruption in CEB states and CIS countries has been limited between 1996 and 2014 (Figure 1.1). Indeed, these countries had very different starting points in transition in terms of income, education, and infrastructure, as well as level of dependency on natural resources. Moreover, they have been differently integrated into the European Union (EU) and have developed heterogeneous market institutions.
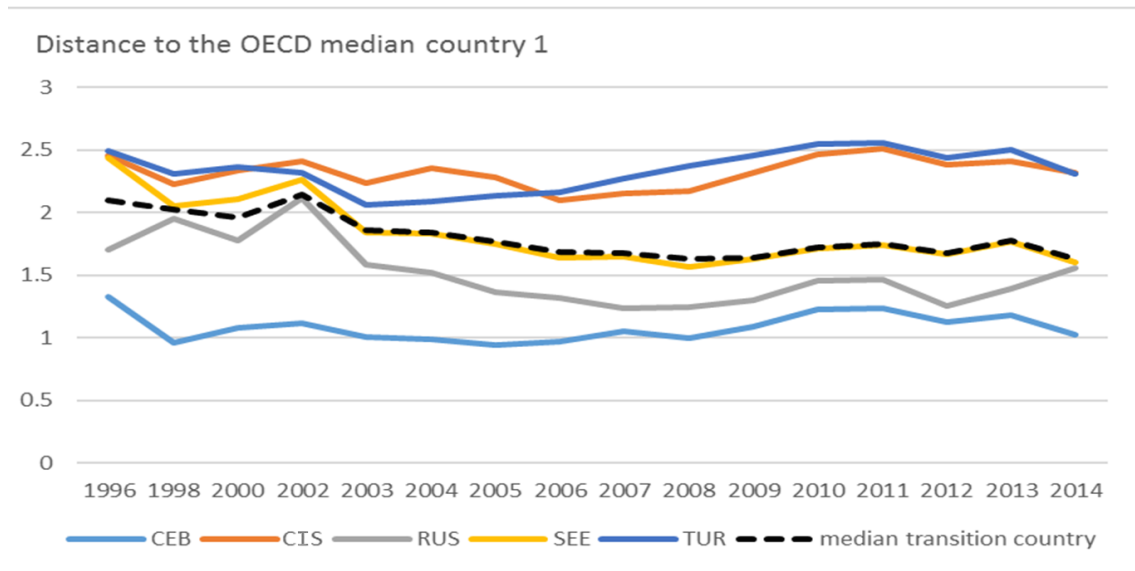
Figure 2.2 Control of corruption in transition countries compared to OECD countries

Note: The distance to the median OECD country (m) in terms of control of corruption is calculated as the absolute value of the transition country's control of corruption minus m. A value of 1 indicates that the difference between transition countries and the median OECD country is equal to the overall standard deviation in the measure of corruption across all countries analysed by the World Bank. There are 35 OECD countries in 2015, and 28 transition countries as defined by the EBRD. Source: The World Bank, The Worldwide Governance Indicators, 2015 Update

All 28 transition countries considered in this thesis still had a relatively high level of corruption in 2014. According to the World Bank's index of control of corruption, the perceived level of corruption in these countries was systematically higher than in the OECD median country (Figure 1.2). However, transition countries are highly heterogeneous. The Kyrgyz Republic, Tajikistan, Turkmenistan, and Ukraine had particularly low levels of control of corruption, while Estonia displayed a level of control of corruption close to the OECD median country. Progress in the control of corruption is also unequal among CEB and SEE countries. The strongest performers are Germany in Western Europe, and Spain in Southern Europe, with both countries being in the European Union and the Eurozone. Poland in Central Europe has also maintained above-average levels in control of corruption and shows a gradual progress toward transparency since 2005. However, another country of Southern Europe, Greece, also a member of the EU and the Eurozone, shows severe deterioration in the control of corruption, which from 2010 onwards has fallen below average levels (World Bank, 2015).

Transition countries that were perceived as highly corrupt in 1996 have seen the most important progress between 1996 and 2014 (Figure 1.2). From 1996 to 2014, the level of control of corruption in the median transition country has steadily and slowly converged toward the level observed in the median OECD country. Between 1996 and 2014 the median transition country closed the gap with the median OECD country by around half a cross-sectional standard deviation (Figure 1.3), though convergence appears to have stalled since 2006.
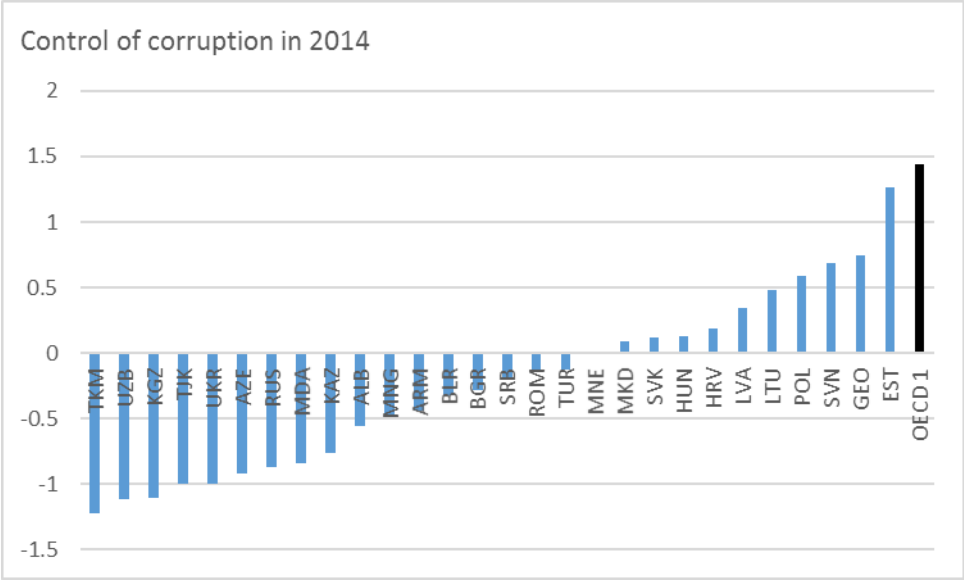
Figure 1.3 Control of corruption in transition countries in 2014

1. Median OECD country.

Source: The World Bank, The Worldwide Governance Indicators, 2015 Update.
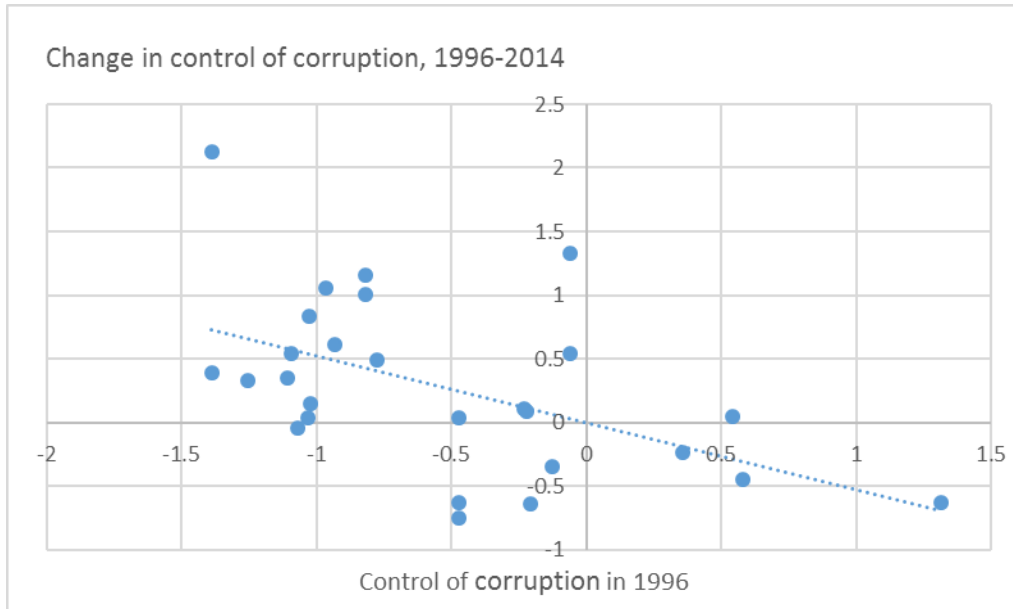
Figure 1.4 Change in control of corruption in transition countries, 1996-2014

Source: The World Bank, The Worldwide Governance Indicators, 2015 Update.

Corruption in transition countries is generally associated with weaker institutions. Indeed, in cross-section (Figure 1.4), control of corruption is positively associated with regulatory quality and higher levels of economic development as measured by the level of GDP per capita in purchasing power parity (PPP) terms in 2014. It is also associated with better governance of enterprises and competition policies as measured by the EBRD indicators of "Governance and enterprise restructuring" and "Competition policies" which reflect the judgment of the EBRD's Office of the Chief Economist about country-specific progress in transition. This shows that improvements in corruption can be associated with stronger rule of law and better governance. Appendix A1 gives a more precise description of all the country-level variables used in Figure 1.4. All correlations are highly statistically significant at the 1% level. Their economic significance is also important. For example, an improvement in the level of control of corruption observed in Turkmenistan to the one observed in Estonia is associated with an increase in GDP per capita of 13,000 US dollars in PPP terms. However, the numerous high correlations also question a possible causal interpretation of such estimates, as they may be due to reverse causality or omitted variables. I investigate further the causal interpretations of these correlations between corruption

and firm performance and economic development in Chapter 2 and firm governance in Chapter 3 using firm-level data.
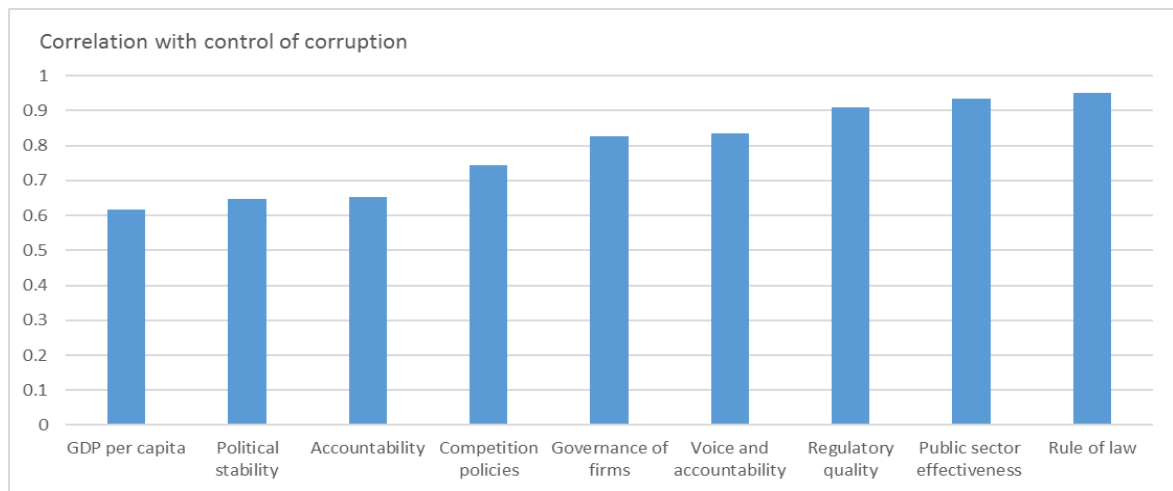
Figure 1.4 Correlations between indicators of governance quality in 2014

The sample consists of the 28 transition countries in Figure 1.1. The figure displays Spearman (rank) correlations.

Source: The World Bank, The Worldwide Governance Indicators, 2015 Update and World Development Indicator 2016.

1.7 Measures of corruption

The close relation of corruption to economic growth and the empirical findings that show it constitutes a serious impediment on growth have generated much interest in the subject (Pradhan, 2000). As corruption is generally considered to burden the economy with extensive costs and distort markets, the need to determine the institutional channels through which corruption can affect firm performance and what causes corruption is crucial. The large number of studies that have addressed this issue have investigated empirically the relationship between corruption and various economic and non-economic determinants. One issue that arises from the analysis of the causes and effects of corruption is the theoretical framework on which it is based. Corruption is a phenomenon with many different angles, not only economic, political, or sociological, and that makes it very difficult to specify a proper model for its causes and effects. At the same time there is limited consensus in the literature on the robustness of the results on the determinants of corruption to date. Often explanatory variables are found significant in some

specifications, but when other variables are introduced they lose their significance. Consequently, the determinants and effects of corruption still remain unclear.

The existing literature on corruption, its causes and effects has based its empirical foundations on measurements of corruption either by perceptions-based surveys, or surveys based on the experiences of respondents. The former are mostly based on subjective answers of how corruption is perceived, formed on evaluations and opinions of citizens and business people or international experts. They aim to measure the perceptions of how widespread or costly corruption is in certain countries. They often ask how the magnitude of corruption is perceived, i.e. what is the "spread" of corruption in a country, and to what extent it constitutes a barrier to business. The latter are based on a measure of corruption experiences and are conducted through surveys of business people and citizens in various countries. They often try to measure the direct experience of the respondents in paying bribes when dealing with public officials, i.e. the frequency of unofficial payments (Olken, 2006; Treisman, 2007).

The main perceptions surveys are conducted by the international civil society organization, Transparency International (TI), which was founded in 1993 and in its anticorruption fight conducts surveys and provides annual corruption perceptions indices (CPI). Another rating that is often used is the control of corruption index in the Worldwide Governance Indicators (WGI) published for the World Bank (WB) by Daniel Kauffman and his team. Both ratings aggregate results from various sources: country risk ratings by business consultancies, surveys of international or domestic business people, and polls of country inhabitants. The WB team generated the indices biannually from 1996 to 2002 but now generates annual indices, covering 212 countries. Both measures attempt to decrease the measurement error by using averages from different sources. A cross-country rating of corruption is also produced by the Political Risk Services (PRS). It is based on assessments by its group of experts and published in its International Country Risk Guide (ICRG). The ICRG ratings have been available since the beginning of the 1980s. All these measures are subjective to evaluations of experts and survey respondents on how widespread or costly corruption is in certain countries (Treisman, 2007).

The surveys based on the direct experience of corruption of respondents, either relating to their family or their firm, have also been widely used in recent years in the measurement and understanding of corruption. The TI "Global Corruption Barometer" (GCB), which has been

conducted annually since 2003, has interviewed more than 114,000 people in 107 countries in 2013. It entails public perceptions of corruption and experiences of bribery. The United Nations Interregional Crime and Justice Research Institute (UNICRI) conducted a survey on crime victims. The WB World's Business Environment Survey (WBES) is based on interviews with managers in more than 10,000 firms in 80 countries during late 1999 and early 2000. Another survey that has been widely used in the research on corruption initiated from 1999 by the World Bank and the European Bank for Reconstruction and Development (EBRD) is the Business Environment and Enterprise Performance Survey (BEEPS), a joint initiative of the European Bank for Reconstruction and Development and the World Bank, based on firm-level data in transition economies, to investigate issues like corruption in the business environment. The survey was conducted on the countries of Eastern Europe and Central Asia (including Turkey), in 1999, 2002, 2005, 2009, and 2012-2014, and on a set of comparator countries of Western Europe and East Asia in 2004.

The thesis uses various measures of corruption, based both on perception and experience of the respondents, at the firm, household, and country level to examine the effects and determinants of corruption. Corruption should not only be examined as the interaction of the state with firms, but also as the exertion of influence from firms to public officials (Kaufmann, 2005). The thesis will examine corruption from two perspectives: administrative corruption and grand corruption. Petty-administrative corruption is identified through three different measures of corruption examining the bribing practices of firms to public officials, and one measure of corruption at the household level when citizens give bribes to public officials. Grand corruption is identified when firms initiate corrupt practices and bribery to government officials to alter and influence the content of government decrees and regulations related to their business (Hellman and Kaufmann, 2001).

The first measure of petty-administrative corruption, is "average corruption" from BEEPS, which reports the percentage of total annual sales that a firm like the one represented by firm owners and managers would typically pay in unofficial payments and gifts to public officials.[1]

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[1] For all measures of corruption I consider refusals and "don't know" answers as missing values.

Interviewers asked firm managers and firm owners about the amount of corruption, based on what is happening to firms like theirs: "On average, what percent of total annual sales do firms like yours typically pay in unofficial payments or gifts to public officials?" The percentage of total annual sales that similar firms give as bribes is based on actual financial results. However, because of the sensitivity of this question and possibility of underreporting (Synovate, 2005), I include another measure of administrative corruption.

The second measure of petty corruption is "frequency of corruption" from The Business Environment and Enterprise Performance Survey (BEEPS), which measures the frequency of bribes that similar firms "have to pay to get things done with regards to customs, taxes, licenses, regulations, services". It depicts the frequency at which firms offer bribes to surpass delays and cases of institutionalized corruption, when firms bribe to have access to rightful processes. It can be argued that this measure of petty corruption could better capture prevailing patterns of behavior, societal and cultural norms toward bribery, and embeddedness of corruption in society. Average corruption and corruption frequency based on firms' and households' evaluation, together with a measure of grand corruption, will be used in chapters 2 and 3, at industry, regional, and country level, to capture prevailing patterns of behavior and proxy for corruption as an informal institution. These measures capture different dimensions of the magnitude of corruption.

The third measure of petty corruption measures the household assessment of "frequency of corruption" using the Life In Transition Survey (LITS) 2006, at regional level. Frequency of corruption is computed as the average of eight questions that measure access to public services. This measure of corruption examines the frequency of unofficial payments or gifts when interacting with public officials for services that should normally be delivered free of charge. The eight questions have the same wording: "In your opinion, how often do people like you have to make unofficial payments or gifts in these situations?" The eight situations are: interacting with the road police, requesting official documents (e.g. passport, visa, birth or marriage certificate, land register, etc.), going to court for a civil matter, receiving public education (primary or secondary), receiving public education (vocational), receiving medical treatment in the public health system, requesting unemployment benefits, and requesting other social security benefits.

For each question, the respondent can answer: never, seldom, sometimes, usually, or always. These qualitative answers are given cardinal values from 1, never, to 5, always.

The fourth measure of petty corruption from BEEPS is "corruption barrier," which captures the severity of corruption and identifies the extent to which corruption is an operational and growth barrier for doing business. Managers are asked if corruption constitutes an obstacle to the current operations of their business. It is expected that managers and firm owners respond to this question based on their experience of corruption and how costly it is for their business; however, the severity of costs could be subject to the perception of the respondents. Their answers range from 1 if managers do not consider corruption as an obstacle to the operations of their establishments, to 4 if managers assess corruption as a severe barrier for the operation and growth of their business. This question underlines the effect of corruption on the performance of firms but it could also reflect the perceptions of the firm managers and owners that are being interviewed. If managers rank corruption as an important barrier to doing business, it is hard to determine whether this answer stems from high corruption levels or their perception of the negative impact of corruption in doing business in general. Similarly, if managers do not consider corruption as an obstacle to doing business, it may be because corruption is low or because they consider corruption as a way to "speed up" some administrative processes.

Grand corruption is present in a weak institutional environment in which the rule of law is undermined and regulations are unevenly or partially enforced, as some firms make unofficial payments to public officials to gain advantages in the drafting of laws, decrees, regulations, and other binding government decisions. Grand corruption is a form of regulatory capture, where firms and government officials are involved in corrupt practices and bribery to alter and influence government decrees and regulations in favor of their business, which results in a reduced state capacity and corrupt, ineffective institutional environment. (Hellman and Kaufmann, 2001). The rent-seeking behavior of firms is investigated; it is present when firms attempt to influence the content of laws and regulations affecting their business. The measure is based on the experience of managers to whom the questionnaire is addressed. The question in BEEPS asks firms to rank the impact of the grand corruption practices of some firms with government officials in their business activity. It asks to what extent the unofficial payments or gifts by some firms to public officials to gain advantages in the drafting of laws, decrees, or regulations had a direct impact on their

business. The values range from 0, no impact, to 4, decisive impact (Synovate, 2005). Since this question measures the decision of some firms to bribe, it is related to the potential gains anticipated from bribery. It is assumed that firms that actively initiate these practices expect a positive return on their business. Therefore, these firms could be extracting regulatory exemptions from the government and divert government resources in their favor in exchange for payments and other gifts.

Assessing the level of, and changes in, corruption based on the BEEPS surveys is challenging; this introductory chapter and Chapter 4 use the Worldwide Governance Indicators (WGI) from 1998 to 2012. First, the BEEPS survey including the BEEPS questions on grand corruption have only been included in 2005. By contrast, the Worldwide Governance Indicators (WGI) are available from 1998 to 2012. More precisely, for the evaluation of the magnitude of corruption and the overall corruption progress the indicator of "Control of Corruption" from Worldwide Governance Indicators is used. This indicator assesses a comprehensive set of factors related to corruption. It evaluates the prevalence of grand corruption and petty corruption at all government levels, and also includes other aspects of progress in corruption ranging from the effectiveness of a country's anti-corruption framework and its enforcement to government accountability and public trust in politicians. It allows for cross-country, and over-time comparisons; however, small changes should be interpreted with caution as the indicators are standardized on an annual basis (Kaufmann et al., 2010). This indicator is based on a composite index, aggregating results from other sources, and aims to measure the extent to which public power is exercised for private gain, covering both petty and grand corruption. Its values range from approximately -2.5 (weak) to 2.5 (strong) governance performance (Kaufmann et al., 2010). These ratings aggregate results from various sources: from surveys on business people to polls of country inhabitants and expert evaluations. They are based on individual data sources from survey institutes, think tanks, non-governmental organizations, international organizations, and private enterprises. The indicators attempt to decrease the measurement error by using averages from these different sources along with correcting for the associated uncertainties. For the measurement of corruption at country level in Chapter 4 I also use the International Country Risk Guide (ICRG). The corruption measure by the ICRG is based on the perceptions of a panel of country experts. Some researchers recognize limitations in the use of this corruption measure

(Estrin et al., 2013), as small changes should be interpreted with caution since the measure is standardized each year and dynamics may be distorted.

Firms may be asked for bribes to obtain rightful licenses, or may initiate the bribery to increase profits or speed bureaucratic processes in an institutional environment that allows these practices. Through the three measures of petty administrative corruption at firm level, I try to capture firms that engage in bribery and unofficial payments or gifts to government officials regarding their business that depict different aspects of petty corruption. The three measures of average corruption and corruption frequency, at firm and household level, are based on the experience of the respondents and reveal the magnitude of corruption at the level of governance. The fourth measure of petty corruption, corruption as a barrier to doing business, is also based on the experience of the respondents, and shows the severity of corruption at the level of governance. The measure of grand corruption is based on the experience of managers and firm owners and reveals the severity of corruption at the higher level of formal institutions, as it undermines the rule of law. The measures of magnitude of corruption look at the "spread" of corruption in a country, and the measures of severity look at to what extent it constitutes a barrier to business or its impact on other firms. Even though the measures of petty and grand corruption are directly linked to the experience of the respondents, it could be argued that corruption barrier and grand corruption are also influenced by the perception of the firm owners and managers on how costly corruption is. Finally, the measures of corruption from WGI and ICRG are based on the perceptions of the respondents and capture petty and grand corruption, which have an effect at both governance and rule of law. The measures of corruption may include some noise as generally questions on corruption will. The measurement of corruption can include a risk of under-reporting and some of the questions may be biased toward zero; however, the combination of the questions used are the best available ways to measure corruption in the business environment at this moment. The thesis adds to the literature on corruption by using several different measures of corruption in the analysis of petty and grand corruption. It offers an extensive understanding of the phenomenon of corruption and its embeddedness in society and can overcome several perception biases.

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1.8   Chapter summaries depicting the different measures of corruption

This chapter, above, provided the theoretical underpinnings for the conceptual framework of the thesis. It demonstrated the embeddedness of corruption in society, which is therefore located at the highest level of the institutional hierarchy, but also showed how corruption can be prevalent at every institutional level. Second, it showed the interaction between corruption, institutions, and resource allocation decisions within firms. Finally, the chapter discussed corruption in transition countries that are also the focus of Chapters 2 and 3. In addition, it covered the various measures of corruption used.

Following discussion of the different measures of petty and grand corruption in the previous section, depicting both the magnitude and severity of corruption, this section proceeds to an overview of the empirical chapters that will follow. Table 1.1 shows which measures of corruption are used in each chapter, whereas Table 1.2 provides comparisons of these measures at country level. Summaries for the empirical chapters will discuss the different institutional channels that are examined and how different measures of corruption are used.

Table 1.1 presents the different measures of corruption used in this thesis. Appendix A1 reviews the surveys associated with the different corruption measures and Table A1 presents the countries covered by each survey. The different measures of corruption used in this thesis cover petty and grand corruption and enable the construction of industry level and regional indicators (Chapters 3 and 4) or long time-series (Chapter 4). The differences in the magnitude of corruption are based on the frequencies calculated from LITS and BEEPS, and averages of unofficial payments, whereas the difference in the severity of corruption is based on the measure of corruption as a barrier and on grand corruption. In Chapter 2, two rounds of the BEEPS survey[2] from 2005 are used, one round including the transition countries and one round conducted in the group of comparator countries. Chapter 3 also uses the frequency of corruption, based on the household assessment of corruption from LITS, as well as the BEEPS 1999, 2005, and 2009 surveys, in the setting of pooled cross-sections. The number of countries in Chapter 3 is constrained by the

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[2]The description of the data is largely based on the report that was prepared for EBRD and the World Bank by Synovate (Synovate, 2004a; Synovate, 2004b; Synovate, 2005), the firm responsible for the implementation of the BEEPS and the provision of data.

measures of management practices that is only available for ten transition countries. In Chapter 4, the WGI index is used for measuring corruption at country level.

Table 1.2 shows the different measures of corruption at country level, showing that some similar patterns are observed in corruption levels across the different measures. Specifically, least corrupt and most corrupt countries often tend to coincide, even if different measures are used. This initial assessment is confirmed by the different measures of corruption used in Chapters 2 and 3 (Table 1.1). CIS countries and Albania in Eastern Europe appear to have the highest corruption levels, whereas firms in Slovenia and Estonia appear to systematically bribe less frequently. More specifically, the measures of petty and grand corruption appear to be correlated at country level (Appendix Table A2).

Table 1.1 Measures of corruption

Dataset	Variable	Interviewees	Chapters	Years	Countries
LITS	Frequency of corruption (Petty Corruption)	Households	3	2010	Transition countries
BEEPS	Frequency of corruption (Petty Corruption)	Firm managers and owners	1, 2, 3	1999-2009	Transition and comparator countries (Southern Europe , Western Europe) in 2005
BEEPS	Average corruption, unofficial payments as % of sales (Petty Corruption)	Firm managers and owners	1, 2, 3	1999-2009	
BEEPS	Corruption as a business barrier (Petty Corruption)	Firm managers and owners	1		
BEEPS	Grand Corruption	Firm managers and owners	1, 2 ,3	2005	

WGI	Corruption (Petty and Grand Corruption)	Composite Index	1, 4	1996-2014	215 countries	

Table 1.2 Comparison of the different measures of corruption at country level

Variable	Year	Number of countries[1]	Average	Standard deviation	Least corrupt	Most corrupt
Frequency of corruption (Petty Corruption), BEEPS	2009	27	2.07	0.48	Slovenia	Uzbekistan
	2005	26	2.38	0.56	Slovenia	Kyrgyz Republic
Frequency of corruption, (Petty Corruption), LITS	2006	27	0.00	0.34	Estonia	Albania
Average corruption, unofficial payments as % of sales (Petty Corruption) BEEPS	2009	27	5.20	2.48	Poland	Croatia
	2005	26	1.05	0.60	Slovenia	Azerbaijan
Corruption as a business barrier, (Petty Corruption), BEEPS	2009	27	1.63	0.48	Montenegro	Ukraine
	2005	26	2.14	0.36	Slovenia	Albania
Grand Corruption, BEEPS	2005	26	0.38	0.22	Belarus	Albania
Corruption, (Petty and Grand	2010	28	-0.38	0.64	Estonia	Turkmenistan

Corruption), WGI						

Chapter 2. Corruption and firm performance: Bribing practices of firms and firm sales at industry, regional, and country level

The institutional framework of corruption provides a basis for the analysis of the "Economics of Corruption", and the subsequent chapters of the thesis. However, the institutional levels presented in the framework do not always find an absolute match in the empirical chapters, and proxies are used. The associated limitations in the quality of the proxies used may result in measurements that do not always fully capture and reflect the concepts. However, the institutional framework of corruption is important for the conceptual understanding of the empirical chapters and the hypotheses tested.

Even though corruption has been examined in the literature and its effects on firm performance have drawn the attention of several studies, the channels through which corrupt practices of firms and their resource allocation decisions can affect the rule of law and governance has not been examined. This chapter proposes that when corruption becomes embedded in a society it may be associated with lower firm performance because of distortion in resource allocation decisions. The chapter shows the interconnectedness of institutions, by examining how widespread corruption can influence resource allocation decisions of firms and weaken firm performance; this is because of the negative effect of corruption on the rule of law and the quality of governance.

This chapter also examines how corruption can become embedded in the environment; how the individual practices of firms can affect both the rule of law through grand corruption and governance through petty corruption. For the purpose of this analysis and the evaluation of

widespread corruption at the highest institutional level, I use measures of corruption at the industry, regional, and country level. I find that individual choices of firms to bribe do not hamper firm performance as much (weak direct effect) as when they become embedded in society (strong indirect effect). The chapter highlights the systemic nature of corruption. It is when corruption becomes more embedded in society that corruption undermines the rule of law and governance, thereby affecting resource allocation and firm performance.

With respect to the conceptual framework presented earlier, what this chapter investigates is presented at Figure 2. The factors of interest relate to widespread corruption seen as an informal institution at the highest level, representing embeddedness at industry, regional, and country level. At the level of formal institutions, I examine grand corruption that undermines the rule of law. At the level of governance, I examine petty corruption that hampers the efficiency of bureaucracy and distorts competition. Finally, at the level of resource allocation of firms, I examine the bribing practices of firms and the distortion of firm resources in a corrupt environment that are linked to a lower firm performance.

This chapter adds to the corruption literature, firstly by offering an integrated framework of analyzing corruption at different levels of institutions and highlighting the interconnectedness between them. Secondly, I specifically show how decisions of firms can affect not only governance but also the rule of law by using a dataset that offers an in-depth analysis of both petty and grand corruption. Thirdly, I show how widespread corruption is negatively associated with firm performance, highlighting the negative effect of corruption as it becomes institutionalized. At the resource allocation level, corruption is not found to be linked to lower firm performance; however, at the highest institutional level, when it becomes embedded in the industry, region, or country, it is associated with lower firm performance.

Chapter 2 does not directly test the channels through which corruption affects firm performance, but assumes some links based on the existing literature that are included in the institutional framework of corruption, such as distortion of a firm's resources, as more time may be spent in overcoming the inefficiencies of a corrupt environment and increased costs incurred from the requirement for bribery. It is also important to mention that to measure corruption as informal institution, a proxy based on the averages of corrupt practices of firms in terms of petty and grand corruption is used at the regional, sectoral and country level. This proxy captures

prevalent practices, but it may not fully capture corruption as informal institution. If corruption as informal institution is prevalent in a society, materializing in different forms at the levels below, namely grand corruption, petty corruption, and individual decisions to bribe, then firms will adapt the allocation of resources to deal with the corrupt environment. Specifically, the resources of firms' resources may be distorted and firm performance may deteriorate. The chapter, however, also discusses the different corrupt practices of firms in terms of petty and grand corruption and the associated implications for firms' resource allocation.

Chapter 3. Corruption and management practices: Firm-level evidence

Many studies have investigated the effect of corruption on firm performance but the channels through which corruption can affect firm performance have not been examined in the literature. In the third chapter I investigate an institutional channel, contract institutions, through which corruption can affect resource allocation and management practices of firms. Corruption can hamper the enforcement of contracts between firms and weaken their management practices and their resource allocation decisions. In particular, I examine how firms located in very corrupt regions and dependent on contracts will have weaker management practices, including resource allocation decisions with respect to management operations, targets, monitoring, and incentives. For example, firms may not put a system of monitoring performance indicators in place.

With respect to the conceptual framework presented earlier, this chapter investigates the effects of corruption on firm management practices and other resource allocation decisions (see Figure 3). The variables of interest relate to regional corruption representing informal institutions. At the level of formal institutions and the rule of law I look at a corrupt judicial system, and at the level of governance I look at contract enforcement. Finally comes the level of resource allocation management practices of firms and other resource allocation decisions, such as spending on research and development.

The premise of this chapter and the construction of the regional corruption measure take into account the effect of bribing practices of firms on governance through petty corruption and on the rule of law through grand corruption. The measure of regional corruption is based on corrupt practices of firms as well as households; therefore, compared to the framework of chapter 2, I incorporate bribing practices, petty and grand corruption, that can feed back to corruption at the

highest level of the institutional hierarchy. This chapter adds to the literature by examining one possible mechanism, contract institutions, through which corruption can affect resource allocation decisions, management practices, and firm performance.

It is important to mention that for measuring corruption as informal institution, regional corruption is used. The chapter investigates the effect of high regional corruption on resource allocation decisions of firms, which reflects norms and prevailing behavioural patterns, but it may not fully capture corruption as an informal institution. Corruption as informal institution, embedded in society and materialized in all other levels, will affect firms' resource allocation decisions and will specifically lower the quality of the firms' management practices. It will result in disincentives for R&D expenditure, and in the centralization of decision-making. The chapter examines corruption in the judicial sphere is a form of grand corruption, looking at the level of formal institutions, whereas it assumes a weak contract enforcement, as an effect of petty corruption, at the level of governance. In a similar vein to Chapter 2, the chapter asserts the importance of firm characteristics in the analysis of the impact of corruption on firms' resource allocation decisions. Specifically, the chapter investigates the embeddedness of corruption at the regional level and the technological characteristics of the firm, as its share of inputs openly traded and not requiring contracts. The different level of contract dependence may expose (if it is high) or protect the firm (if it is low) from institutional inefficiencies and namely from a weak contract enforcement and a corrupt judiciary unable to protect and enforce these contracts.

Chapter 4. E-government and corruption

In Chapter 4 I investigate a specific public policy, e-government, and its effect in the reduction of bribing practices, through strengthening two institutional levels: rule of law and governance. E-government can affect the rule of law since it affects the constraints of power with respect to the executive part of the government and creates another public administration model through the use of ICT for transactions with citizens and businesses. E-government can also affect governance since it can reduce the discretionary power of public officials by making information and transactions available online.

With respect to the conceptual framework presented earlier, this chapter investigates a possible determinant of corruption, by examining the effects of e-government. The variables of interest are

at the level of informal institutions: country-level corruption. At the level of the rule of law I look at e-government as affecting the constraints on executive power. At the level of governance I investigate how e-government affects the rules of the game, whereas at the level of resource allocation I look at individual decisions of firms to bribe. Specifically, I examine one channel through which e-government can reduce country-level corruption, reducing bribing practices of firms, which can in turn reduce both petty corruption at the level of governance and grand corruption at the level of rule of law, resulting in a slow change of country-level corruption.

This chapter provides an understanding of the institutional interconnectedness at the different levels of the hierarchy to show how this public sector reform can affect resource allocation decisions of firms and slowly change norms of corrupt behavior at the highest institutional level. Shedding light on the effect of public sector reforms from a wide institutional perspective and specifically in the context of corruption can be very useful in changing corrupt behaviors and understanding how these changes are generated.

The chapter argues that e-government development will reduce the informal institution of corruption, which is deeply embedded in society, through the feedback effects of reducing the manifestation of corruption at the other three levels. However, for measuring informal institutions a proxy of corruption is used at the country level, which is an absolute match to the concept of informal institution discussed in the framework. This chapter examines how the development of e-government can reduce corruption and affect institutional quality, first, at the level of formal institutions by strengthening the constraints on the executive and reducing grand corruption, second, at the level of governance, by improving efficiency in the bureaucracy and reducing petty corruption, and, third, at the level of resource allocation by limiting individual decisions of firms and households to bribe. The effect of e-government development on these three levels is expected to have a feedback effect on the norms, beliefs and practices of corruption entrenched in society.

1.9   Conclusion

The first chapter provides an analysis of the theoretical framework of this thesis, based on Williamson's Hierarchy of Institutions (2000). It provides a multi-level institutional framework for the examination of corruption and associated institutions, based on their characteristics,

durability, and characteristics of the evolutionary processes. Williamson distinguishes four levels of institutions, where each level is an outcome of the previous levels. The first level in the hierarchy includes informal characteristics, social norms, and culture. The second level, the higher order formal institutional environment, described as "the rules of the game," includes constitutional characteristics and the degree of government arbitrariness (e.g. constraints on executives). The third level, described as the "play of the game," includes the institutions of governance, the governance arrangements that are derived from the basic institutional environment, and country-specific characteristics. The fourth level, the short-term resource allocation, includes daily economic activities, the set of prices, costs, wages, and quantities, purchased and sold in the economy. The short-term resource allocation is the outcome of the three previous levels of institutions. The study of corruption and its application to the multi-level framework proposed by Williamson produces a new categorization of corruption, its effects and determinants, as well as the dynamic links between them.

While many studies have contributed effectively to the existing knowledge and understanding of the phenomenon of corruption, its effects and its determinants, the links between the effects, determinants, their interdependence, and origin remain largely unexamined. The chapter produces a theoretical framework in which corruption is embedded in the institutional environment; different categories of corruption and institutions are placed on different levels of the institutional hierarchy, showing the dynamic links between them. Different categories of corruption are separated in four, associated and interdependent, categories of institutions, based on Williamson's Hierarchy of Institutions (2000). Corruption is in some cases viewed in the literature as an informal institution and social norm, entrenched in a society, while another part of the literature views corruption as a short-term arrangement between firms, citizens, and civil servants. My view in this discussion is that there are different types of corruption, hence there is ambiguity. These different types of corruption can be determined differently, based on the specific components of corruption that are examined. I distinguish between corruption at industry, regional, and country level, based on perceptions of firms and households to capture corruption as an informal institution, grand corruption at the level of the rule of law, petty administrative corruption at the level of governance, and bribing practices of firms and households at the level of resource allocation, which involves a transaction and a short-term allocation of resources, based on supply and demand.

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High corruption at industry, regional, and country level can be associated with informal characteristics and related to the cultural and social norms embedded in a society. It discloses the acceptance of a pattern of behavior, and is linked to ethics and culture; however, it does not denote the act of bribing or receiving bribes. High corruption can be persistent and take a long period to change, and can be viewed as a partly exogenous component in the institutional process. Corruption can in this case be considered an informal institution, a widely shared pattern of behavior that becomes a norm (Estrin et al., 2013). The prevailing norms and tolerance of corruption can affect the actual prevalence of corruption and bribery at resource allocation level. A high level of corruption at industry, regional, and country level also reflects tolerance toward bribing practices.

I argue, on the framework of Williamson, that the act of bribing cannot be categorized only at the first level of the hierarchy of institutions. This level is characterized by strong durability, and includes informal characteristics, cultures, and social norms. According to Williamson, the informal institutions at the top of the hierarchy largely have a spontaneous nature, and do not suggest a deliberative, calculated choice. There is an interest in engaging in corruption and an expectation of a return. Therefore, the preferred measure to capture corruption as an informal institution is frequency of corruption. Frequency of corruption could better capture the social values, norms, and informal characteristics of this level, as well as tolerance of corruption. However, although other measures of petty corruption, as well as grand corruption, could be seen as a calculated choice in exchange for a service, they could also capture corruption as an informal institution when they form the prevailing patterns of behavior in the context of an industry, region, or country.

I focus on two types of corruption: grand corruption, when firms can bribe in exchange for regulations, and petty administrative corruption, specifically when public officials are seeking bribes in return for services. Grand corruption is a level two institution, as if firms can bribe in exchange for laws and regulation in their favor the rule of law is undermined. Petty administrative corruption is a level three institution that affects governance and results in a distortion of competition and other business barriers, such as barriers of entry. In the context of a corrupt institutional environment the managerial decision to bribe can lead to a distortion of firms' resources and a misallocation of managerial effort. Time and resources can be spent liaising with

public officials and offering bribes instead of investing in internal operations that can promote firm performance. The bribing practices of firms and households is a level four institution, a short-term resource allocation, as it involves a transaction and an allocation of resources. In conclusion, it is key to understand that corruption encompasses more than one aspect of the social and political system of human action, and the contribution of this thesis is in disentangling these aspects and considering them separately.

CHAPTER 2

2. Corruption and firm performance: Bribing practices of firms and firm sales at industry, regional, and country level

2.1   Introduction

The second chapter examines the relationship between corruption and firm performance using firm-level data in Eastern Europe and Central Asia, as well as some comparator countries in Southern Europe and Western Europe. It demonstrates how corruption is ingrained in every aspect of the institutional hierarchy, from informal institutions at the top level to formal institutions, governance, and firms' resource allocation decisions, located in the subsequent levels of Williamson's institutional hierarchy. To achieve this goal, the chapter makes use of all the firm-level measures of corruption described in Chapter 1, capturing both the magnitude and the severity of corruption, based on the experience and perception of the managers who responded at the BEEPS questionnaire. Specifically, it investigates the links between different measures of

"petty corruption" and "grand corruption", on the one hand, and firm performance – on the other hand. The study uncovers the links between widespread corruption in different contexts, at industry, regional, and country level, and firm performance. It shows that as corruption becomes more embedded in society, as a proxy for informal institutions at the highest level of the institutional hierarchy, it can impose additional burdens on firm performance and undermine their operations. The institutional channels through which corruption can influence management decisions on a firm's resource allocation and its performance are the weakening of the rule of law at the level of a high order of formal institutions, and the distortion of competition and inefficiency of state bureaucracy at the level of governance. This work places particular attention on the different types of corruption and the interdependence of institutions in order to explain firm decisions in a corrupt environment, and the links between widespread corruption and firm performance.

This chapter makes two specific contributions. First, unlike earlier studies, it distinguishes between different types of corruption and utilizes several different corruption measures to demonstrate how corruption is present at each level of the institutional hierarchy. Most of the existing literature on corruption to date has focused on the relationship between growth and corruption at a country level. Firm-level studies examining the linkages between petty corruption and grand corruption ,and firm performance are limited. This chapter analyzes different types of corruption, petty administrative corruption, and grand corruption, and their relationship with firm performance and growth. Petty administrative corruption hampers governance as it creates inefficiencies in state bureaucracy and reduces competition; grand corruption weakens the rule of law as it occurs when bribing firms manage to affect legislation and regulations in their favor. The incentives of firms that engage in petty corruption, offering bribes to avoid bureaucratic delays and obtain licenses, and the incentives of firms that give unofficial payments to influence the content of government regulations that affect their operations are quite different. The study therefore investigates how the engagement of firms in these two types of corruption can be differently associated to their performance.

Second, this chapter distinguishes the links between firms' practices of petty and grand corruption and the corresponding contextual setting in which firms' operate. The relationship between corruption and firm performance is investigated at different levels, notably at industry,

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region, and country levels, to examine the association between firm performance and corruption when it becomes embedded in different levels of the environment. At firm level, in the absence of enforcement, firms would be expected to decide on an optimal amount of corruption that allows them to maximize their profits. Indeed, firms may engage in corruption to increase their market share. For example, in the presence of grand corruption, firms may delay the implementation of laws and regulations through bribery and and not on merit, or in other cases successfully manage to outbid competitors in public procurement (Yakovlev and Zhuravskaya, 2012). This may have important spillover effects on the other firms in the industry and region in which the bribing firms operate. These other firms may be unfairly disadvantaged, and this may result in efficiency costs for the whole economy at country level, in addition to the value of bribes paid to public officials, as capital and workers are not allocated to their most productive use. At the same time, corruption could also be used to circumvent bureaucratic procedures or restrictive regulations. Therefore, at the aggregate level, the impact of corruption on firm performance would depend on whether the negative spillovers of corrupt practices at industry, regional, or country levels dominate the possible positive effects on sales and growth that certain bribing firms can achieve.

Distinguishing the link between corrupt practices and performance of bribing firms on the one hand, and the link between corruption and performance at industry, regional, and country level on the firm's peers on the other hand, can shed light on the mixed findings in the literature on the effects of corruptions on firm performance and economic growth. Studies investigating the effect of corruption on firm performance including the performance of the bribing firms can result in biased, positive findings. The performance of bribing firms could in some cases be better than that of non-bribing firms if they can circumvent bureaucracy and affect regulations to facilitate their business operations. Firms could decide an "optimal" level of bribes in a given legal and institutional environment to maximize their profit. If these bribing firms are included in the sample, the effect of corruption on firm performance could be close to zero or even positive, depending on whether the potential gains in performance from the bribing firms are larger or smaller than the negative spillover effects in their peers at industry, regional, and country level.

The chapter is organized as follows. The next section discusses the literature corruption and firm performance. Section 2.3 provides the features of the sample and the measures of corruption that are relevant for the analysis. Section 2.4 describes the data construction and some

summary statistics. Section 2.5 describes the main empirical findings on corruption and firm performance. Section 2.6 concludes.

2.2 Corruption and firm performance

Corruption constitutes a serious impediment on economic growth at country level and from a cross-border perspective (Hellman et al., 2000; Svensson, 2003; Bertrand et al., 2007; Fisman and Svensson, 2007; Banerjee et al., 2012; Olken and Pande, 2012). The World Bank reports that corruption is one of the major impediments on economic growth, and that more than 1 trillion USD is spent on bribes every year (Kwok and Tadesse, 2006). Corruption may deter entrepreneurial activity and private investment, but also obstruct the collection of taxes, result in the misallocation of resources, and obstruct the implementation of necessary regulations and reforms.[3] It has been suggested that the discretionary power of public officials leads to a tactical selection of projects based on the ability to extract rents. Consequently, corruption becomes an integral part of economic governance and more difficult to tackle (Ngo, 2008). Corruption may deteriorate a country's economy by deterring entrepreneurship, wasting resources, hindering private investment, impeding the collection of taxes, and obstructing the implementation of necessary regulations. Several attempts have been made to measure the economic cost of corruption due to illegal practices (Hellman and Kaufmann, 2001; Boswell and Richardson, 2003; OECD, 2011). At country level, the evidence that supports the argument that corruption could actually be beneficial for growth, by facilitating transactions and the bureaucratic process, even for countries with high bureaucratic regulations, remains weak (Mauro, 1995). However, the literature on the relationship between corruption and firm performance is more contradictory.

Firm-level studies examining the links between different aspects of corruption and firm performance are still rare, and there are some controversies surrounding it. More specifically, the earlier literature on corruption sees it as a "grease in the wheels of commerce" (Kaufmann and Wei, 1999), whereas the more recent literature views corruption as constituting a major constraint on firm performance (Kwok and Tadesse, 2006). In line with the first argument, some

empirical evidence suggests that corruption may benefit firms in the institutional environment where the regulations are weak. Corruption can speed up the wheels of commerce and have a positive impact on the development of firms, by allowing them to overcome bureaucratic barriers and bypass time-consuming processes (Wei, 1998). The acceptance of bribes by government employees could also work as an incentive and increase their efficiency (Huntington, 1968; Leff, 1964), and corruption has sometimes been described as the price people are forced to pay as a result of market failures (Acemoglu and Verdier, 2000). Firms may thus engage in corrupt practices in an attempt to obtain short-term growth gains, disregarding possible long-term costs (Kochan and Goodyear, 2011; Persson et al., 2013). For example, some evidence suggests that the tendency for firms to pay bribes is positively associated with the time that is wasted in bureaucratic procedures (Kaufmann and Wei, 1999).

Some of the reasons that drive firms to engage in corrupt practices are, among others, market expansion and profit maximization ambitions. Firms often engage in illegal practices and bribes to set up their operation at first (e.g. to obtain the operation licenses) and then to ease their expansion in a country. However, in some studies the attention is driven away from the interaction of the state with firms, and the focus is on the relationships that firms have with the state and their possible influence on government officials. Kaufmann (2005) explains that some firms in transition countries managed to exert power and use illegal, corrupt practices for their benefit, to ensure their power and dominance, with important social implications. In this 'capture economy', which characterises the transition, the legal and policy conditions are formed based on the captor's huge benefit, and at the expense of the rest of the enterprises. There is occasional evidence that some firms gain from using corrupt practices but this usually refers to a few large firms with very good political connections (Kaufmann, 2005).

The second strand of the literature identifies corruption as a barrier to firm performance. A vast amount of literature has argued that there may be a negative relationship between corruption and private sector development. Indeed, corruption affects both firms' external environment and internal structure. On the external environment, corruption creates inefficiencies in the state bureaucracy, with additional costs for businesses, and it can decrease competition. The number of competitors decreases in industries where some firms are actively seeking to influence laws and regulations affecting their business through bribery and other gifts

to public officials. Firms at individual level may enjoy benefits and special favors from public officials on the implementation of regulations and may block specific measures of regulatory packages and increase entry barriers for other firms in their sector. These practices and the unlawful favor-for-favor relationship between the state and some firms deters competition, alleviates incentives for restructuring, and creates inefficiencies that prevent development of the private sector and of the competitive environment. The firms that bribe and provide gifts and other favors to public officials can expand their business on the basis of selective treatment. Inefficient firms with poor practices may remain in business and obstruct the entry, survival, or expansion of new firms, if the "connections" of the former companies are the right ones.

Corruption is also expected to deteriorate private sector development through its impact on the internal structure of the firm. Firms may adapt their structures to fit the institutions and corruption in particular, which can lead to inefficiencies. Corruption may urge managers to engage in activities that are not directly productive, such as alluring public officials through unofficial payments or gifts in exchange for various services. These additional operational costs of corruption can cause a distortion in use of the firm's resources and drive activities away from efficiency. Corruption and the expectation of unofficial payments and gifts create an environment of favor-for-favors that influences the internal structure, corporate governance, and management practices. Second, some firms may pay bribes to outbid competing parties in public procurement and influence government decrees to increase their market share. The resulting regulations would not impose sufficient pressure on the adoption of more competitive use of firm resources. This can obstruct the development of effective firm strategies, incentives for firm restructuring, and employee empowerment, resulting in lower management quality.

Yakovlev and Zhuravskaya (2012) show that the most corrupt regions in Russia delay or circumvent the implementation of liberalization policies. This generates considerable inefficiency, as incumbents may be favored over new entrants or innovative start-up firms. This environment of favor-for-favor results in similar economic inefficiencies and institutional drawbacks, as in the pre-transition period with the soft budget constraint. Kuznetsova and Kuznetsov (2003) discuss how several firms were late to implement any restructuring reforms in the aftermath of transition while the state's decreased economic and administrative authority during reforms aggravated the institutional environment.

2.3   Data and preliminary evidence

2.3.1   Sample and measures of firm performance and corruption

This chapter uses two rounds of the Business Environment and Enterprise Performance Survey (BEEPS) 2004-5.[4] The round surveying transition countries and the round conducted in the group of comparator countries, Southern and Western Europe. The choice of this specific dataset is based on the multiple measures of corruption that were included in the BEEPS survey in 2005, which have not been repeated since. The large number of countries also allow to have large variations in their levels of corruption. The measures of grand corruption that the study uses have not been included in any other BEEPS survey. The BEEPS survey is conducted at establishment level, with a total number of 12,508 firm observations. The establishments are plants that may be part of larger companies. Establishments with 10,000 employees or more, and firms that started to operate in the years 2002, 2003, and 2004, were not included in the sample. The sample covers a vast range of firms: mining and quarrying, manufacturing, construction, transport, storage and communication, wholesale and retail, real estate, renting and business services, hotels and restaurants, and other services (Synovate, 2004a; Synovate, 2004b; Synovate, 2005).

To investigate the bribing practices of firms at industry, regional, and country level, and the economic performance of firms, as measured by firm sales, I use a rich cross-sectional firm-level data set over 30 transition countries, and comparator countries of Southern and Western Europe in 2005, before the global financial crisis. As these countries have very different institutions and are confronted with different forms of corruption, this provides an ideal set-up for this investigation. The total of 30 countries investigated in this chapter is separated in regional groups based on their geographical locations: South-Eastern Europe is Romania, FYROM, Albania, Bulgaria, and Serbia and Montenegro; Central Europe and the Baltics is Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia; Eastern Europe and the Caucasus is Armenia, Azerbaijan, Belarus, Georgia, Moldova, and Ukraine. Central Asia includes Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan and I also include separately Russia and

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[4]The description of the data is largely based on the report that was prepared for EBRD and the World Bank by Synovate (Synovate, 2004a; Synovate, 2004b; Synovate, 2005), the firm responsible for the implementation of the BEEPS and the provision of data.

Turkey. Greece, Portugal, and Spain in Southern Europe, and Germany in Western Europe are included as comparator countries.

To assess firm performance, this chapter uses logs of firms' sales revenue and sales growth as the main measures. Sales revenue is estimated by the managers in US dollars at the exchange rate of the date of the interview. This is an appropriate measure of sales across countries as many manufacturing firms compete on a global market. However, one should keep in mind that it may be affected by short-term changes in exchange rates that create some measurement error. The same measures have been used by Gorodnichekno et al. (2014). Sales revenue gives a measure of a firm's revenue efficiency, i.e. how efficiently firms generate sales revenue at different levels of corruption. By using sales revenue as the dependent variable, the regressions in this chapter capture firm productivity as well as improvements in pricing, marketing and other aspects of revenue generation that are crucial for corporate performance. The extent to which firms are affected by corruption also depends on the institutional environment, an issue that I explore later.

This chapter examines corruption from two perspectives: petty administrative corruption and grand corruption. Petty corruption is measured through the three measures discussed in Chapter 1: average corruption, corruption frequency, and corruption barrier. Grand corruption is present when firms make unofficial payments or gifts to public officials to alter and influence the content of government decrees and regulations related to their business (for a detailed discussion of the measures see pages 30-36 of Chapter 1). Grand corruption would be expected to positively affect the sales of the bribing firms. However, overall the impact of grand corruption on the firms that are not involved could be negative, which could be evident at sectoral, regional, or country level. Indeed, a small number of large firms may shape regulations and legislations to their advantage through unlawful corrupt practices and bribery of public officials. This small number of bribing firms may then benefit from government decisions resulting in a misallocation of resources where other firms are unfairly disadvantaged. In such an environment, other firms and new entrepreneurs have incentives to invest their talents in capturing the state rather than in developing innovative products, in order to compete successfully (Hellman and Kaufmann, 2001; Hellman et al., 2003). Moreover, household income may be reduced as economic institutions favour the elite and owners of the bribing firms (Acemoglu and Robinson, 2006).

2.3.2   Preliminary evidence

The empirical strategy relates different measures of corruption, firm sales, and growth. Although not all the omitted variable biases are addressed at firm level, I identify some stylized facts about the association between the two different forms of corruption and firm performance, measured by firm revenue sales and growth. The relationship between administrative corruption at firm level and firm sales appears negative. However, this is not the case for the measure of grand corruption that is either positively correlated or uncorrelated with firm sales. Moreover, I do not find a relationship between firm-level corruption and growth.

However, when I measure the extent of corruption at regional level, industry level, and country level, this pattern changes radically. I find that contextual petty and grand corruption among firm peers are always negatively associated with firm sales, and that these associations are more negative than the ones based on the firm's own measure of corruption. Thus estimates using firm-level measures of corruption are likely to be biased towards zero or positive values. Therefore there may also be important spillovers from firm corrupt behaviors, as firms do not internalize the costs of their own corruption for other firms. This is related to a part of the literature which sees corruption as a collective action problem (Persson et al., 2013). Some firms may use bribery and other corrupt practices, and exchange of favors to achieve certain benefits in their operations and performance, for example by outbidding competing parties in public procurement processes. The result could be that the performance of the bribing firm increases, whereas the performance of the other firms that compete in the same industry, region, or country decreases.

2.4   Descriptive analysis

2.4.1   A negative association between state-level corruption and firm sales

Figure 2.1 presents the relationship between petty average corruption at country level (bribes expressed as a percentage of total annual sales; see pages 15-17 for a discussion of measures of corruption) and the log of total annual sales, where annual sales are expressed in current US dollars. I observe a negative relation between corruption and firm sales revenue: when the extent of corruption is lower the firm is characterized by higher sales.

Figure 2.2 shows the geographical groups and my preferred measure of administrative corruption: the share of sales paid as bribes. The geographical groups that altogether appear to be the most corrupt are Central Asia and Eastern Europe and the Caucasus. These transition countries have a recent history as market economies and their institutional environment and governance lacks the maturity of established democracies. Corruption has been apparent in the various privatization processes that were followed in the transition of these countries to market economies (Moran, 2001). The process to democratization and economic reforms, often rapidly implemented, generated possibilities for corrupt practices and privatization plans were criticized for their impact on corruption.

Firms in Russia, Turkey, and South-East Europe also appear to bribe frequently, whereas firms in Southern Europe followed by Germany and Central Europe and the Baltics appear the least corrupt.[5] Countries of Southern Europe – Greece, Spain, and Portugal, members of the European Union and Eurozone – are also recently established democracies and went through dictatorships. However, they have achieved significant development and have received substantial funds from the European Union.

Overall the geographical pattern of administrative corruption seems to confirm that long exposure to democratic regimes decreases corruption levels (Treisman, 2000). This pattern is qualitatively similar for grand corruption (Figure 2.3). European countries of Southern Europe and Germany seem the least affected by grand corruption, while recent transition countries are the most affected. However, the ranking within transition countries is very different for petty corruption and grand corruption.

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[5] The two other measures of petty corruption displayed similar geographical patterns.
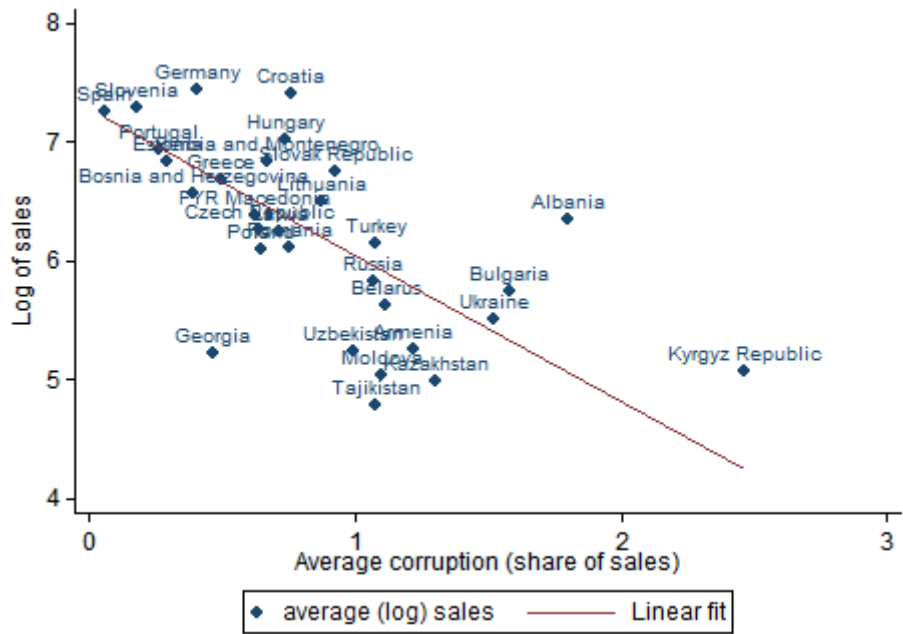
Figure 2.1 Average corruption (bribes as % of total annual sales) and firm sales at country level

Source: EBRD-WB BEEPS (2005) and author's computations.
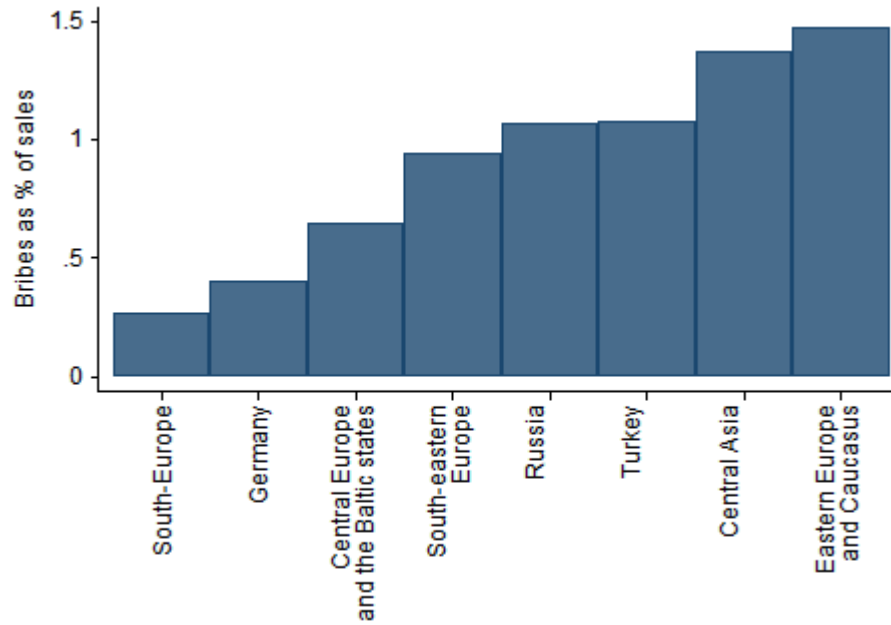
Figure 2.2 Average corruption (bribes as % of total annual sales) by geographical group

Source: EBRD-WB BEEPS (2005) and author's computations.
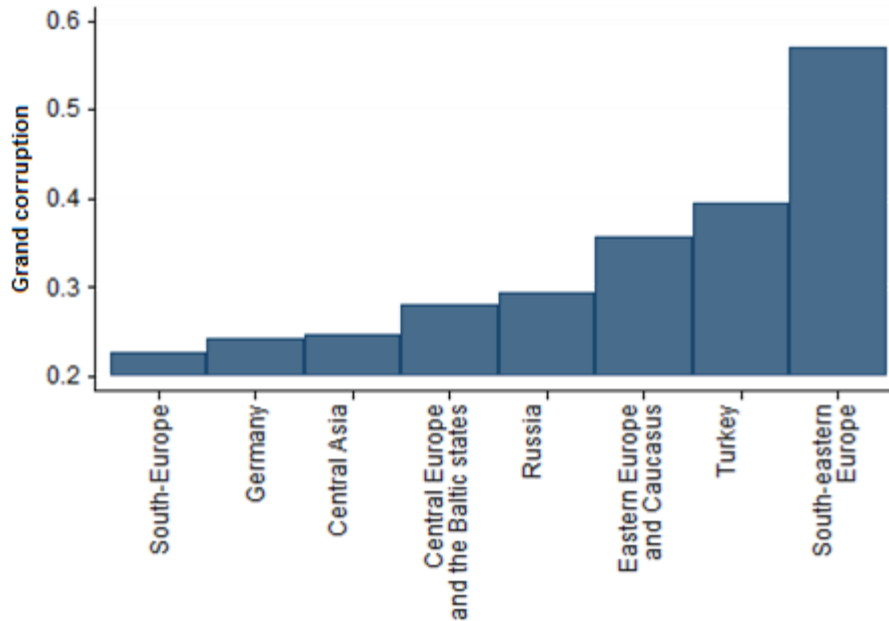
Figure 2.3 Grand corruption by geographical group

Figure 2.4 depicts a positive cross-sectional association between average corruption and the growth of sales at country level. However, there is an issue regarding the analysis of the relation between growth and corruption, based on the time I am using for the measure of corruption. Corruption in the survey is measured in 2005, whereas firm growth is based on the percentage change in sales in the three years from 2002 to 2005. It has not been possible to use corruption figures from 2002, based on the previous BEEPS, as the measures of corruption that the study aims to investigate were not included. Therefore, by using the measure of corruption in 2005, the interpretation of the relation between corruption and growth of sales could be less clear, even though one could expect that the corruption levels would be similar across these years.
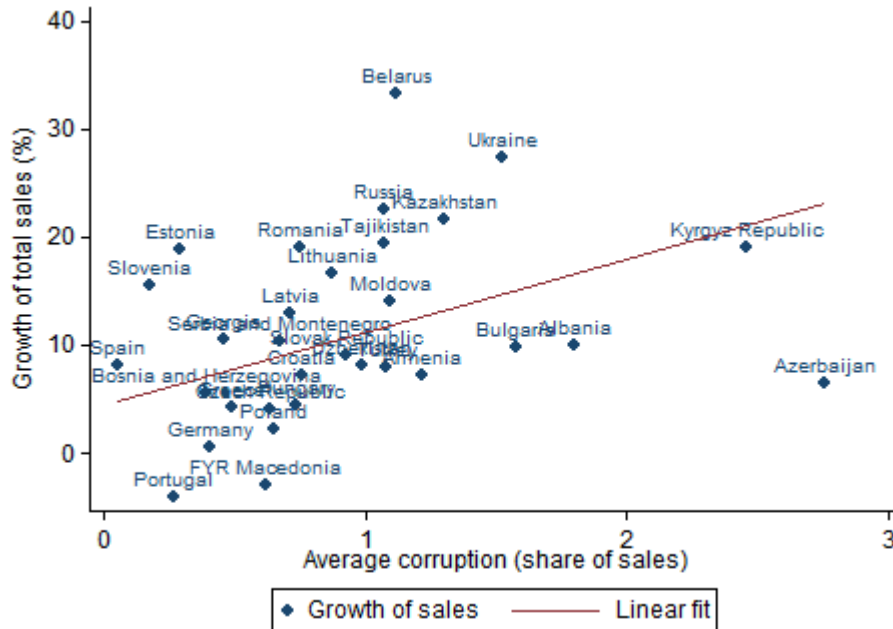
Figure 2.4 Average corruption and firm sales growth at country level

Source: EBRD-WB BEEPS (2005) and author's computations.

Figure 2.5 and Figure 2.6 display the relationship between petty average corruption and the log of sales, and average corruption and the growth of sales at regional level. The negative relationship between average corruption and log of sales, and the positive relationship with growth of sales, hold at regional level as at country level. On average, individual firms located in the most corrupt regions of the countries tend to have significantly lower sales revenues than firms located in less corrupt regions.
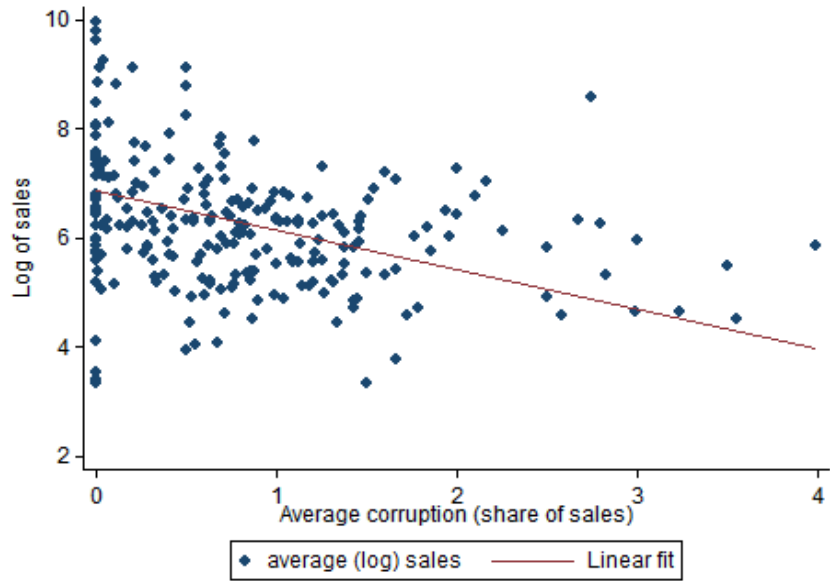
Figure 2.5 Average corruption and firm sales revenues at regional level

Source: EBRD-WB BEEPS (2005) and author's computations.
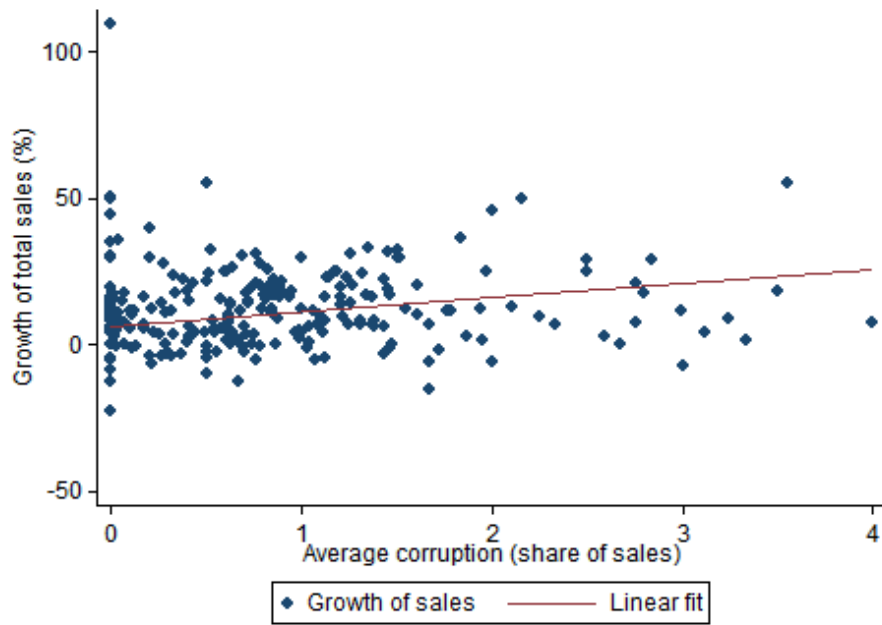
Figure 2.6 Average corruption and firm sales growth at regional level

Source: EBRD-WB BEEPS (2005) and author's computations.

2.4.2   Non-linear relation of corruption and firm size

I then examine the different relationships between corruption and firm sales revenues based on the size of the firms. Companies are divided into three main categories: small from 2 to 49 employees, medium from 50 to 249, and large from 250 employees and more.[6] I further divide the small and medium categories into two subcategories, and large firms into three groups. I applied this classification at establishment level.[7] Very small firms with 2 to 10 employees represent 43.74 % of my sample. Firms with 11 to 49 employees represent 28.48%, firms with 50 to 99 employees 10.25%, firms with 100 to 249 employees 7.83%, firms with 250 to 499 employees 5.77%, firms with 500 to 999 employees 2.2%, and firms with more than 999 employees 1.73%. Figure 2.7, shows the aggregate level of corruption for the 2005 for the whole BEEPS sample described in section 2.3.1. Small and medium firms, specifically the highest end of small firms and the lowest end of medium firms, appear the most affected in terms of bribes per share of sales. Large firms seem to be the least affected and those with 1000 employees and more seem to pay very few bribes to public officials. Medium firms followed by small firms and specifically their two subgroups are also asked more often for payments. Corruption is much less frequent at the lower end of small firms, which can be attributed to the smaller rents the government officials could extract from very small firms. These results are based only on formal firms that were interviewed during the BEEPS survey; however, a large share of small firms may also include informal firms. If small informal firms pay a large share of sales as bribes to avoid the costs of formal operations, this may change the observed relationship between firm size and corruption.[8]

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[6] This corresponds to the European Union's current classification of firm size.

[7] Unfortunately, the survey does not contain the number of employees of any parent companies that the establishment is part of. However, foreign-owned firms constitute a small share of the sample (approximately 5.8%).

[8] The BEEPS survey does not provide information on the informal sector that could be important in order to draw definite conclusions about small firms.
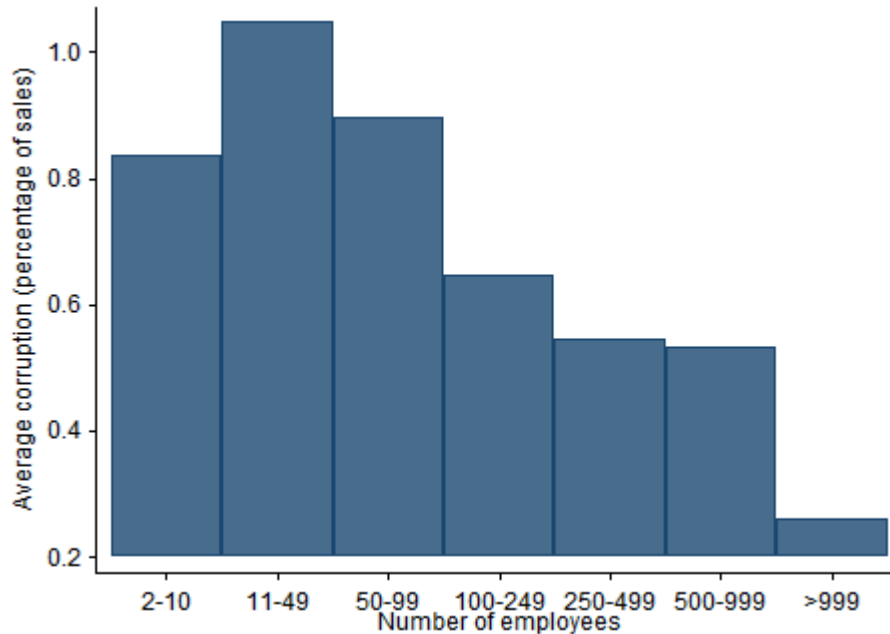
Figure 2.7 Average corruption (bribes as % of sales) across firms of different size

Source: EBRD-WB BEEPS (2005) and author's computations.

The same pattern between corruption and firm size appear for the other measure of petty corruption: the frequency of bribes. Figure 2.8 displays the aggregate level of petty corruption for the 2005 for the whole BEEPS sample described in section 2.3.1, according to firms' size. The relationship between the share of sales paid as bribes and the size of the respondent firms appears non-linear. Micro firms of fewer than 10 employees seem to be less affected by corruption. This could be justified by their small size. The micro firms may be less observable, have less access to public procurement markets, and the bribes they are able to pay may be too costly to extract for public officials. As small firms grow they possibly attract more attention from public officials and are more frequently approached for unofficial payments. The small firms of 11-49 employees and the medium firms of 50-99 employees represent the two subcategories where

corruption is more prevalent and constitutes a greater obstacle in the operation and growth of their business.[9]
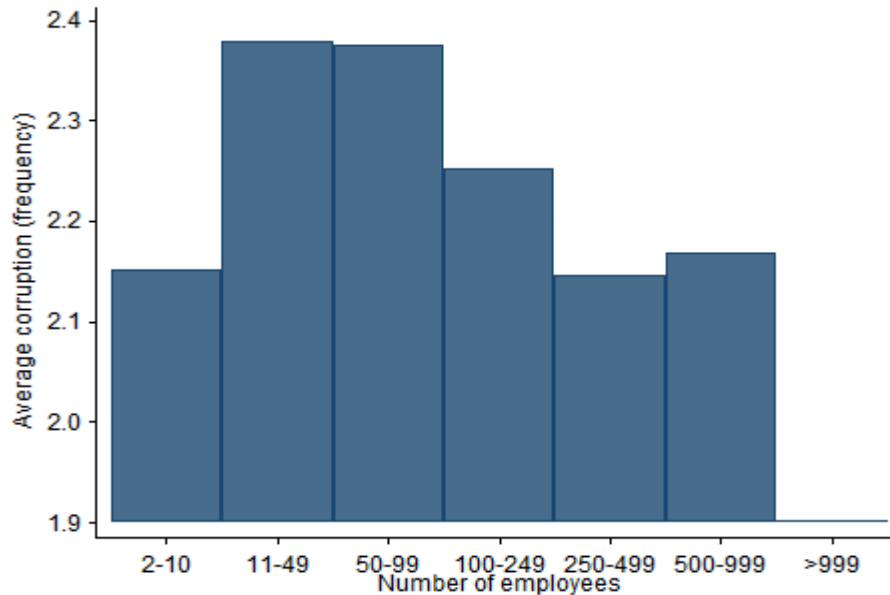
Figure 2.8 Frequency of corruption across firms of different size

Source: EBRD-WB BEEPS (2005) and author's computations.

Firms that exceed 100 employees appear to be less affected by corruption, less asked for bribes, and engage less in corrupt practices. The growth of their power in the market and the increase of their experience could allow them to overcome possible operational barriers for their business. As firms grow in size and market power, they may be able to set the rules of the game and be less exploited by public officials, while some of these powerful firms would be the ones attempting to capture the state (engage in grand corruption) and influence government decrees related to their business.

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[9] The other measures of corruption present a similar pattern. Firms that associate corruption as an important obstacle in doing business are mostly the two subgroups that are characterized by higher and more frequent corruption: the higher end of small firms with 11-49 employees and the lower end of medium, with 50- 99 employees. However, firms of all sizes appear to consider corruption as a barrier in the operation and the growth of their business, including very small or large firms.

Figure 2.9 displays the aggregate level of grand corruption for the 2005 for the whole BEEPS sample described in section 2.3.1. Grand corruption does not display the same non-linear pattern as petty corruption. In particular, the managers of micro firms respond that they are not affected by grand corruption. As mentioned earlier, micro firms may lack the ability to influence high-level public officials. On the contrary, the managers of firms that have between 250 and 499 employees declare the highest levels of grand corruption, and the impact of grand corruption also appears important among medium firms of 50 to 99 employees.
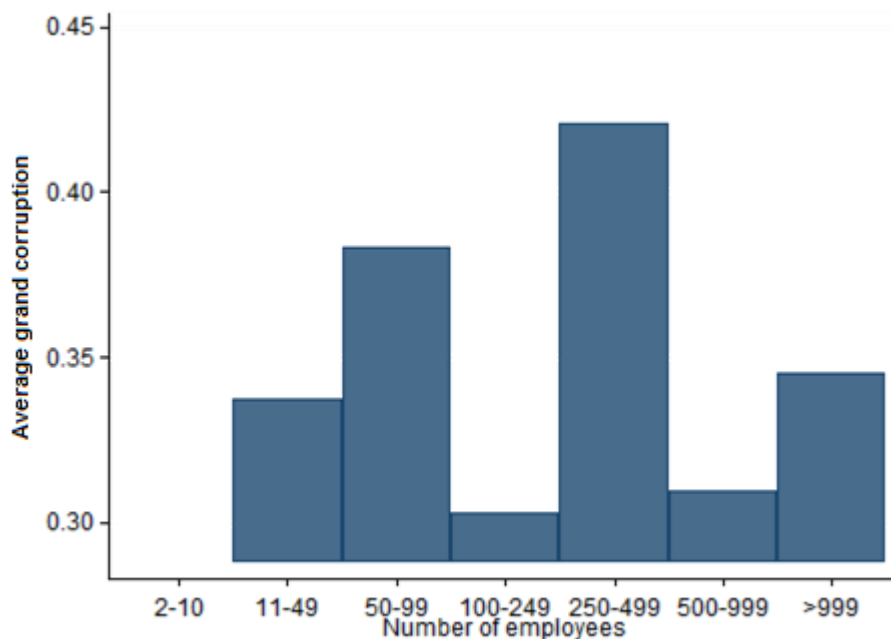
Figure 2.9 Grand corruption across firms of different size

Source: EBRD-WB BEEPS (2005) and author's computations.

2.4.3   Descriptive statistics

Table 2.1 presents descriptive statistics for the different measures of corruption. Panel A shows my measures of corruption at firm level, and panels B to D show the measures of corruption averaged at regional, industry, or country level respectively. The averages are leave-one-out averages. For example, for a given firm in the region of Moscow the average includes all the firms in the region of Moscow excluding the firm itself. These measures capture contextual corruption, that is the relation between other firms bribing behaviours and the firm's own sales. As firms may

have incentives to bribe to gain benefits, this strategy in principle, may avoid endogeneity concerns that arise as a firm may determine jointly its firm-level corruption and sales. For example, larger firms or firms evolving in highly concentrated sectors, such as telecommunication and network industries, may have higher benefits to engage in corruption and higher sales in order to prevent new entry. More generally,the observed relationship between firm-level corruption and firm-level sales could be driven by similar unobservable firm characteristics.

Panel A presents descriptive statistics of the three measures of petty corruption – average corruption, corruption frequency, and corruption barrier – and my measure of grand corruption. Panel A firms identify the impact of grand corruption as lower than the measure of petty corruption as a barrier in doing business (please see pages 30-36 in Chapter 1 for a discussion of these measures), which could be attributed to the fact that grand corruption would be expected to be a less frequently occurring practice, and that it would not be possible for a large number of firms to affect laws and regulations through unofficial payments. However, it is important to note that it is very difficult to compare the different measures of corruption I use, as the questions they use are different and capture different aspects of corruption. Therefore even if the results are lower, the impact on the firm size and performance could be higher. Furthermore, for panel A, the measures of corruption at firm level are all positively correlated. The linear correlations between the different corruption measures are stronger between corruption frequency and corruption as share of sales, which is expected because of the similarity between the two measures. They are less correlated with corruption as a barrier and grand corruption. The impact of grand corruption and the barrier of corruption are correlated, as managers may identify grand corruption as an important barrier to doing business.

Table 2.1 Descriptive statistics for the different measures of corruption

Panel A:	Measures of corruption at firm level						
	Mean	S.D.	Min	Max	Linear correlations		
Average corruption	0.86	2.20	0.00	50.00			
Corruption frequency	2.24	1.43	1.00	6.00	0.40		
Corruption barrier	2.02	1.13	1.00	4.00	0.23	0.38	
Grand corruption	0.32	0.76	0.00	4.00	0.15	0.29	0.30
Panel B:	**Measures of corruption at industry*country level[1]**						
Average corruption	0.85	0.87	0.00	15.00			
Corruption frequency	2.24	0.66	1.00	6.00	0.55		
Corruption barrier	2.02	0.52	1.00	4.00	0.37	0.51	
Grand corruption	0.32	0.31	0.00	3.00	0.22	0.33	0.44
Panel C:	**Measures of corruption at regional level[1]**						
Average corruption	0.86	0.67	0.00	5.00			
Corruption frequency	2.24	0.56	1.00	5.33	0.66		
Corruption barrier	2.02	0.48	1.00	4.00	0.42	0.53	
Grand corruption	0.32	0.27	0.00	3.00	0.24	0.34	0.54
Panel D	**Measures of corruption at country level[1]**						
Average corruption	0.86	0.57	0.05	2.76			
Corruption frequency	2.24	0.49	1.50	3.76	0.73		
Corruption barrier	2.02	0.39	1.40	2.84	0.51	0.61	
Grand corruption	0.32	0.18	0.03	0.88	0.37	0.43	0.68
Panel E:	Main explanatory variables at firm level						
Log total sales	6.31	2.02	0.00	14.51			
Growth of sales	10.24	35.39	-98.00	400.00	0.06		

Note: 1. The variables are averaged at region, industry times country, or country level (excluding the firm observation). Industry is a 2-digit ISIC classification. Source: EBRD-WB BEEPS (2005) and author's computations.

At industry level and at regional or country level, the aggregate measures of corruption present similar patterns (Table 2.1, panels B to D). The correlations between the different measures of corruption are higher than the ones observed at firm level. This underlines that multiple corrupt practices may be common among the group of peers of a firm, measured at

regional, industry, or country level. Industries, regions, and countries that are affected by petty corruption are also affected by grand corruption.

2.5 The relationship between sales, firm-level and contextual corruption

2.5.1 Firm-level corruption, firm size, and performance

Corruption at individual firm level does not always show a clear negative relationship with sales revenues. The four measures of corruption I use have different and not always negative relationships with firm sales. Specifically, grand corruption seems to be positively correlated with firm sales, even though the estimated coefficient does not appear statistically significant. The result could be explained by the incentives of firms to bribe. Grand corruption refers to firms choosing and actively initiating unofficial payments (including gifts or benefits) to public officials in order to influence the content of government decrees related to their business. I could therefore expect that firms choose these practices to gain advantages and maximize their profits, through the influence of decrees and access to resources, in a way that it would be advantageous for their business.

Table 2.2 presents the Ordinary Least Squares (OLS) estimates of the regression of firm-level log of sales on firm measures of corruption. When the measures of firm-level corruption are included in the regressions, the share of bribes paid, the frequency of corruption, and corruption as a barrier are significantly and negatively correlated with the level of sales. For example, the coefficient of the share of bribes, -0.113, shows that an increase of the share of bribes in total sales by one percentage point is associated with a decrease of total sales by 10% (significant at the 1% level). The first three measures of corruption appear to have similar relationships with total sales. A one standard-deviation increase of these measures (2.2 percentage points, 1.43, 1.13, and 0.76 unit respectively) is associated with a decrease in total sales by 3.8% to 24.9%. However, the measure of grand corruption has a positive correlation with firm sales, though it is close to zero and does not appear statistically significantly associated with total sales (at the 10% level).

Table 2.4 reports the results of the previous regressions controlling for 43 manufacturing sectors, by adding individual dummy variables. Indeed, the total demand for firm output is different by manufacturing sectors and this could cause some omitted variable bias. The R-squared of all regressions increases significantly. This indicates that manufacturing sectors are important drivers

of total sales revenues. However, tthe estimated correlations between corruption and firm sales remain similar to the previous estimates. The coefficient of -0.118 for the average share of bribes indicates that an increase of the share of bribes in total sales by one percentage point (at national level) would decrease total sales by 118% (significant at the 1% level). A one standard-deviation increase in the measures of corruption (2.2 percentage points, 1.43, 1.13, and 0.76 unit respectively) would imply a decrease in total sales by 2.4% to 25.9%.

Table 2.2 Firm measures of corruption and firm sales revenues[10]

Dependent variable:	(Log) Total sales			
	(1)	(2)	(3)	(4)
Average Corruption	-0.113*** (0.010)			
Frequency of Corruption		-0.095*** (0.015)		
Corruption as a Barrier			-0.114*** (0.018)	
Grand Corruption				0.050* (0.028)
Observations	8774	8578	9055	8272
R-squared	0.013	0.004	0.004	0.000

Note: Standard errors robust to heteroskedasticity in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales. Source: EBRD-WB BEEPS (2005) and author's computations.

Table 2.3 Firm measures of corruption and firm sales controlling for manufacturing sectors

Dependent variable:	(Log) Total sales			
	(1)	(2)	(3)	(4)
Average Corruption	-0.118*** (0.010)			
Frequency of Corruption		-0.109*** (0.014)		
Corruption as a Barrier			-0.132*** (0.018)	
Grand Corruption				0.031 (0.027)

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[10] The log of sales distribution is approximately normally distributed.

Manufacturing sectors controls	Yes	Yes	Yes	Yes
Observations	8774	8578	9055	8272
R-squared	0.130	0.116	0.116	0.115

Note: Standard errors robust to heteroskedasticity in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales. Source: EBRD-WB BEEPS (2005) and author's computations.

Then I conducted a regression of firm measures of corruption on the three-year growth of sales. Table 2.4 shows that the estimates on the impact of the share of bribes paid, the frequency of corruption, and corruption as a barrier to sales growth are all close to zero and not significant at conventional levels.

Table 2.4 Firm measures of corruption and three-year growth

Dependent variable:	Δ (Log) Total sales in 2005-2002			
	(1)	(2)	(3)	(4)
Average Corruption	-0.002 (0.002)			
Frequency of Corruption		0.003 (0.003)		
Corruption as a Barrier			-0.005 (0.003)	
Grand Corruption				0.002 (0.005)
Manufacturing sectors controls	Yes	Yes	Yes	Yes
Dummies by geographical group	Yes	Yes	Yes	Yes
Log total sales in 2002	Yes	Yes	Yes	Yes
Observations	8552	8351	8820	8059
R-squared	0.037	0.035	0.036	0.041

Note: standard errors robust to heteroskedasticity in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales in 2005 minus the natural logarithm of total sales in 2002. Regional dummies include Southern Europe, South-Eastern Europe, Central Europe and the Baltics, Eastern Europe and the Caucasus, Central Asia, Russia, Turkey, and Germany. Source: EBRD-WB BEEPS (2005) and author's computations.

2.5.2   The relationship between contextual corruption and firm size

In this section I investigate the relationship between firm sales and a corrupt environment. Widespread corruption may be negatively associated with business performance and growth. It can cause misallocation of resources, changes on the composition of public expenditure, and can impede the collection of revenues (Mauro, 1996). A corrupt environment deprives firms of equal market opportunities, reduces competition, and increases the cost of doing business. This raise can create obstacles in the market entry of firms. It should also be noted that in the incidence of corrupt judicial systems, the operational ability of firms is obstructed, as is their ability to enforce contracts, resulting in fewer business opportunities. Corruption decreases competition and efficiency and develops a "rent-seeking" environment. The demand of bribes by public officials, for approving licenses and permits, reduces the amount of firms that can enter the market (Sullivan, 2004). Thus, corruption may deteriorate the business environment worldwide, and some firms lacking sufficient resources to bribe government employees may have reduced access to services and increased costs.

Here, I focus on the impact of corruption manifestation at a regional and country levels.. The point estimates of the impact of contextual corruption at industry level displayed similar patterns and are omitted.[11] Following the prevailing arguments in the existing literature reviewed in section 2.2, I expect that the impact of corruption on firm size and growth will be negative at both the regional and country levels. Indeed, most of the existing empirical literature has focused at the country level and found a negative association between corruption and economic development (Campos et al, 2010; Ugur, 2014). Moreover, a few studies at the regional level have found a similar negative relationship between corruption and firm performance (Campos et al, 2010; Lisciandra and Millemaci, 2016). Shleifer and Vishny (1993) supported that local authorities can have high and very different corruption levels depending on the control that is exercised centrally by the government.

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[11] They are available from the author on request.

2.5.3   Regional corruption and firm sales

Table 2.5 shows the estimated correlations between regional corruption and the firm log of sales. As corruption is now defined at regional level, the standard errors are clustered at this level of aggregation. On average, at regional level, there is an observed negative relationship of average corruption as share of sales and firm sales. This relationship is in contrast with the estimates of the firm-level estimates, which were less significant, and of smaller magnitude.

Table 2.5 Regional measures of corruption and firm sales

Dependent variable:	(Log) Total sales			
	(1)	(2)	(3)	(4)
Average Corruption	-0.787*** (0.150)			
Frequency of Corruption		-0.734*** (0.181)		
Corruption as a Barrier			-0.675*** (0.233)	
Grand Corruption				-0.466* (0.250)
Observations	8768	8571	9046	8259
R-squared	0.051	0.039	0.027	0.004
Clusters	232	229	229	225

Note: standard errors clustered at regional level in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales. The explanatory variables are averaged at regional level (excluding the firm observation). Source: EBRD-WB BEEPS (2005) and author's computations.

Table 2.6 presents the estimates of a regression of the firm three-year growth of sales on regional measures of corruption.[12] When the measures of regional-level corruption are included in the regressions I observe that the two measures of corruption, corruption as a barrier and grand corruption, become strongly significant and negative, at the 1% and 5% significance level

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[12]The results for the industry*country measures of corruption and three-year growth are very close to the regional measures of corruption and not reported.

respectively. The other two measures, corruption as share of sales and corruption frequency, appear close to 0 and are insignificant.

Table 2.6 Regional measures of corruption and three-year growth

Dependent variable:	Δ (Log) Total sales in 2005-2002			
	(1)	(2)	(3)	(4)
Average Corruption	0.008 (0.013)			
Frequency of Corruption		0.002 (0.014)		
Corruption as a Barrier			-0.040*** (0.015)	
Grand Corruption				-0.051** (0.021)
Manufacturing sectors controls	Yes	Yes	Yes	Yes
Dummies by geographical group	Yes	Yes	Yes	Yes
Log total sales in 2002	Yes	Yes	Yes	Yes
Observations	8546	8344	8811	8046
R-squared	0.037	0.035	0.038	0.043
Clusters	232	229	229	225

Note: standard errors clustered at regional level in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales in 2005 minus the natural logarithm of total sales in 2002. The explanatory variables are averaged at country level (excluding the firm observation). Dummies include Southern Europe, South-Eastern Europe, Central Europe and the Baltics, Eastern Europe and the Caucasus, Central Asia, Russia, Turkey, and Germany. Source: EBRD-WB BEEPS (2005) and author's computations.

2.5.4   State corruption and firm sales

Table 2.7 includes in the regressions the country averages of the share of sales paid as bribes, the frequency of corruption, and the perception of corruption as a barrier to business. As corruption is now defined for each of the 30 countries in my sample, the standard errors are

clustered at country level. All the measures of corruption at county level are negatively and significantly correlated with the level of sales. Taken at face value, the average share of bribes indicates that an increase in the share of bribes in total sales is associated with a decrease of total sales.

Table 2.7 State corruption and firm sales

Dependent variable:	(Log) Total sales			
	(1)	(2)	(3)	(4)
Average Corruption	-1.281*** (0.238)			
Frequency of Corruption		-1.017*** (0.271)		
Corruption as a Barrier			-1.080*** (0.309)	
Grand Corruption				-1.100 (0.780)
Observations	8774	8578	9055	8272
R-squared	0.089	0.058	0.046	0.009
Clusters	30	30	30	30

Note: standard errors clustered at country level in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales. The explanatory variables are averaged at country level (excluding the firm observation). Source: EBRD-WB BEEPS (2005) and author's computations.

Table 2.8 shows the regression of the three-year firm growth of sales between 1992 and 1995 on my measures of petty and grand corruption at the country level. All the measures of contextual corruption at country level appear to have a negative relationship with growth. The share of bribes paid, the frequency of corruption, and the perception of corruption as a barrier to business are all negatively correlated with the level of sales, whereas corruption as business barrier and grand corruption are significant at the 5% and 1% significance level. The coefficient of -0.152 for the average grand corruption indicates that an increase of grand corruption by one

percentage point (at national level) would decrease growth of sales by 15.2% (significant at the 1% level). A one standard-deviation increase of these measures (0.39 and 0.18 unit respectively) would imply a decrease in growth of sales of around 3%.

Table 2.8 State corruption and three-year growth

Dependent variable:	Δ (Log) Total sales in 2005-2002			
	(1)	(2)	(3)	(4)
Average Corruption	-0.001 (0.027)			
Frequency of Corruption		-0.020 (0.025)		
Corruption as a Barrier			-0.079** (0.031)	
Grand Corruption				-0.152*** (0.045)
Manufacturing sectors controls	Yes	Yes	Yes	Yes
Dummies by Geographical Group	Yes	Yes	Yes	Yes
Log total sales in 2002	Yes	Yes	Yes	Yes
Observations	8552	8351	8820	8059
R-squared	0.037	0.035	0.040	0.047
Clusters	30	30	30	30

Note: standard errors clustered at country level in parentheses. ***, **, *indicate estimates significant at the 1%, 5%, and 10% significance level respectively. The dependent variable is the natural logarithm of total sales in 2005 minus the natural logarithm of total sales in 2002. The explanatory variables are averaged at country level (excluding the firm observation). Regional dummies include Southern Europe, South-Eastern Europe, Central Europe and the Baltics, Eastern Europe and the Caucasus, Central Asia, Russia, Turkey, and Germany. Source: EBRD-WB BEEPS (2005) and author's computations.

The estimated correlations between regional and state corruption and firm sales and growth are much larger than the estimated correlations between firm sales and growth and corruption based on the firm's own behaviours. This suggests that the estimated correlations using firm-level corruption may be biased towards zero (Table 2.2 to Table 2.4). Three alternative arguments could explain this pattern. First, the firm-level estimates could be biased towards zero as the firm-level measures of corruption are subject to measurement error. Managers may have an imprecise idea of the amount of bribes being paid or choose to declare an imprecise amount of bribes as share of sales. The attenuation bias associated with classical measurement error would cancel out when the measures of corruption are aggregated at regional, industry, or country level. However, this argument does not explain the fact that the point estimates for grand corruption were slightly positive when measured at firm level.

Second, firm-level corruption is an endogenous decision that could bring individual benefits to individual firms. Thus, firm-level estimates, using firm-level measures of corruption, could have been biased towards positive values. Finally, the firm's own corrupt behaviors could have important spillovers for their peers and competitors. Firms do not internalize the costs of their own corruption for other firms. Hence, contextual corruption would be more detrimental for firm sales and growth than firm-level corruption. This last argument is corroborated by experimental evidence. It has been found that individuals bribing public officials in India for driving licenses obtain their licenses more easily. However, they are later involved in more road accidents and they exert significant negative influences on other drivers (Bertrand et al., 2007).

2.6   Conclusion

In relation to the theoretical framework, the second chapter of the thesis investigated two different types of corruption, petty and grand corruption, and their association with firm performance in transition countries and in a set of comparator countries. The chapter examined the twofold relationship between corruption and firm sales revenue and growth. First, I identified a negative relationship between firm sales and petty corruption, when firms engage in unofficial payments and bribes to public officials, depicted by the measures of average corruption, corruption frequency, and corruption as a barrier to doing business. Second, I examined the relationship between grand corruption and firm sales, when firms bribe to achieve alterations in

the content of government decrees affecting their business. Firms appear to be affected to a different extent by these two forms of corruption.

Taken at face value, the preliminary findings in this chapter suggests that bribing practices of firms can feed back to the other levels of the institutional hierarchy, through petty and grand corruption. The effect of individual firm practices on rule of law and governance can influence patterns of behavior and norms regarding corrupt practices at the highest level of embeddedness in society. At the firm level, I find a negative associationbetween petty corruption and unofficial payments on firm performance. On the contrary, grand corruption, the influence exerted on government decrees from some firms, appears positively correlated with firm sales.

A second preliminary finding is that contextual corruption appears more negatively correlated with firm sales than with the firm's own experience of corruption. In order to evaluate the level of embeddedness of corruption in the environment, at the top of the institutional hierarchy, I examined corruption at regional and country level. The estimated correlations suggest that corruption can have more severe implications when it becomes embedded in the environment. The business environment may have a large effect on firm behaviors, and grand corruption exerted by some firms may generate important negative spillovers on their peers. My analysis also shows that the levels of the institutional hierarchy are interlinked in the context of corruption. Widespread corruption, at industry, regional, and country level can affect high-order formal institutions as it hampers the rule of law and weakens governance through imposing barriers to entry for firms and reducing competition.

A main limitation of my analysis is its descriptive nature, as it does not directly assess the causal effect of different corrupt practices on firm behaviors. My empirical application is based on a cross-sectional dataset as the variables capturing grand corruption are not available in the latest BEEPS surveys in 2009 or 2013. The 2004-5 round of the BEEPS survey is the only round including all the measures of both petty and grand corruption explored in this chapter. Moreover, many omitted firm-level characteristics may be correlated with corruption and could bias its estimated impact on firm sales and growth. Therefore, the preliminary findings of this chapter would benefit greatly from the use of alternative identification strategies and the future availability of panel data, as they could control for many unobserved firm characteristics. In particular, further research could use cross-country panel data to measure the effect of corruption on firm

productivity, controlling for both country and sector fixed effects. However, in a cross-sectional setting or with panel data, research will face significant challenges that have not been addressed in this chapter.

An important concern, about the identification of the impact of corruption on firm performance, is that institutional quality and corruption may be an outcome of firm behaviours. Firm performance may be affected by corruption, but firms may also affect the overall level of corruption. In addition, firm owners and managers may choose to operate in corrupt environments, and expect the opportunity to use discretionary power and authority for corrupt practices that may not suit the best interests of the firm and the firm's performance, but serve their individual benefit. Corruption and bribing practices may then evolve in response to firm behaviours. This endogeneity problem needs to be addressed in the identification strategy. An appropriate instrumental variable identification strategy could address this identification problem.

The identification strategy also has to address the possible correlation between corruption and other unobservable determinants of firm behaviours. For example, corruption may be more prevalent in less- developed economies, and development – as proxied by GDP per capita – could also drive firm sales. The strategy should try to identify quasi-random exposure of firms to corruption and to define appropriate control variables. In addition, many omitted firm-level characteristics may be correlated with corruption. Several controls for firm performance that have been identified in the literature could be used to extend this work further. Apart from control for industry and location, important controls include firm's ownership (de novo, privatized, or state-owned), degree of foreign ownership, size of firm, age of the firm, whether the firm sells to multinationals, whether it sells to the government, whether it exports or imports and the corresponding levels, the level of competition, the elasticity of demand, and, last, the level of innovation and R&D expenditure (Hellman et al., 2003; De Rosa et al., 2010; Gorodnichenko et al., 2014). However, additional controls may also lead to bias estimates as firm characteristics may be endogenous to corruption. For example, more corrupt countries may be subject to less competition, because of state capture (Dal Bó, 2006). In this case, different sets of controls should be used to assess the sensitivity of the results.

There are other inherent identification difficulties with respect to accurately measuring firm performance in transition countries. Specifically when measuring sales as firms may choose to

report a lower profit when corruption is prevalent. Managers may extract favours and monetary assets in their corrupt dealings with public officials that are hidden and not incorporated in the firm's performance (Hellman et al., 2003). In this scenario, firms could prefer being located in corrupt environments. Further work using panel data could control for this potential selection problem by first-differencing to control for unobserved heterogeneity and including fixed effects for country and industry in the specification. Moreover, corruption may be measured with errors which would likely bias the estimated relationships between firm sales and corruption. An ambitious strategy could try to find a suitable instrument for corruption to correct for measurement error and avoidance behaviour.

CHAPTER 3

3. Corruption and management practices: Firm-level evidence

3.1   Introduction

The third chapter of my thesis is based on the institutional framework discussed in Chapter 1 and on the underpinnings of Chapter 2 that support that bribing practices of firms and households can feed back to the highest level of embeddedness of corruption in society through widespread petty and grand corruption, and lead to widespread regional corruption. The chapter then examines the relationship between regional corruption and specific resource allocation decisions of firms, and outcomes at the firm level using a measure of the quality of management practices. Regional corruption can affect management decisions on the allocation of resources in firms, through two main channels. First, at the level of the rule of law, corruption can be affecting the judicial system, and second, at the level of governance, corruption can hamper contract institutions and impede contract enforcement. The chapter finds that management practices and other resource allocation decisions of firms deteriorate when they operate in regions with widespread corruption and when they are more dependent on contracts in their line of business,

rendering them more susceptible to the deficiencies of a corrupt judicial system and weak contract institutions.

This chapter argues that aggregate productivity can be diminished by corruption because of the latter's effect on firms' resource allocation, and specifically because it leads to a deterioration in firms' management practices. It investigates how the quality of management in firms in the Central and Eastern European manufacturing sector is impacted by regional corruption. It does so by creating a novel dataset that merges a survey of firm management practices with regional measures of corruption derived from household and firm surveys. The chapter adopts a difference-in-differences instrumental variable methodology to estimate manufacturing industries' sensitivity to corruption by analyzing their level of dependence on contract institutions. By controlling for region and type of manufacturing industry-country fixed effects—we show that enterprises in industries that are both more contract-dependent and are in more corrupt regions tend to have a lower quality of management, a more highly centralized decision-making process and administrative workers with lower levels of education. In regions with higher levels of corruption, other resource allocation decisions of firms are also influenced; lower R&D investments and smaller product markets are also a characteristic of contract-dependent firms. The falsification tests performed in the study show that contract-dependent firms do not seem to be affected by other business barriers; instead they systematically report corruption as a more severe barrier to doing business, and particularly corruption in the judicial system. This reinforces the theoretical underpinnings of this chapter that regional corruption affects the resource allocation decisions of firms and management practices through the channels of poor judicial quality and weak contract institutions in the presence of corruption.

In this chapter, we calculate how regional corruption affects firms' management quality within the manufacturing sector. To do this, we create a new dataset merging surveys of firm and households, enabling us to assess both regional corruption and management quality across manufacturing firms in transition countries. Making use of detailed geographical localisation and industry classifications, we merge firm-level measures of management practices in Central and Eastern Europe both with measures of regional corruption from household and firm surveys, and with measures of sensitivity to corruption estimated on the basis of different manufacturing industries' contract dependence. Identifying how corruption impacts on firm management quality

and performance is, understandably, not without difficulties; bribing practices may often partly be in response to a dysfunctional political or economic environment. We therefore turn to a difference-in-differences identification strategy, based on the different levels of exposure to corruption; the aim of this strategy is to neutralize the endogeneity issue and thus pinpoint the effects of corruption on management quality rather than the effects of other institutional inefficiencies. Through a comparison of firms operating within the same region but displaying different exposures to corruption, it is possible to determine precisely the channels through which corruption influences firm performance. We thus establish the firms' exposure to corruption and the institutional environment based on the degree of contract dependence within their industry. What emerges from our findings is a marked association between an industry's contract dependence and its managers' evaluation of corruption as a barrier to doing business. The logic is that firms that are in industries heavily dependent on contracts and their enforcement, for example with suppliers for complex and firm-specific inputs needed in their production process, would be more sensitive to corruption compared to firms that are in industries that can acquire their inputs in the open market and are not dependent on contracts for their production process. In a corrupt business environment courts may not be able to enforce contracts, and contracts offer only limited security between the firms and their suppliers. Taking this sensitivity to corruption as our basis, we estimate difference-in-differences instrumental-variables specifications, which show how sizable the effect of corruption on management practices, overall management quality, and firm development can be. Adopting this strategy has a twofold purpose. In the first place, it allows us to differentiate the effect on firms of corruption that is exogenous to firm behavior and is based on contract dependence from other endogenous forms of corruption, such as grand corruption. Second, our strategy identifies the mechanisms by means of which exposure to corruption is capable of imposing barriers to firms' performance, management practices, and overall management quality.

Four main results emerge from our identification strategy. First, without controlling for the endogeneity of corrupt practices, we establish that the correlation between management quality and corruption is robustly negative. To identify corruption, we use two corruption measures, on the one hand, based on how managers evaluate corruption as a barrier to doing business and on the frequency of corruption, and, on the other hand, based on household measures of the frequency of corruption when interacting with public authorities. Second, the negative

relationship between corruption and management quality is confirmed by the use of our preferred difference-in-differences specification within regions. According to our findings, in more highly corrupt regions, firms with higher contract dependence have substantially weaker management practices than firms with lower contract dependence. Our findings suggest that the impact on a typical establishment, with median contract dependence, of an increase in regional corruption from the level observed in West Ukraine to the level observed in East Ukraine, would be a decrease in management quality of roughly one standard-deviation. These large figures seem not to be driven by omitted variables or measurement error. Third, we also look at the specifics of firm organization. Contract-dependent establishments in regions where corruption levels are higher are marked not only by lower-quality management, but also by a substantially more centralized decision-making process and administrative employees with lower educational levels. In endemically corrupt regions, contract-dependent firms also enjoy lower development prospects. This is instantiated in the reduction of production targets, lower R&D investment, and reduced product markets. Taken together, these findings indicate that management practices are a possible conduit through which corruption impacts on firm performance.

This chapter investigates the effects of corruption on management practices as a possible transmission channel for the negative relationship between corruption and firm performance. To do this, we turn to three main strands in the extant literature. The first strand relates to management practices and firm growth. There is a strong link between management practices and firm performance (Bloom and Van Reenen, 2007). There is also a clear association between improvements in management and higher annual sales growth, profitability and survival rates (Bloom and Van Reenen, 2010). Moreover, recent empirical evidence from India has identified the causal impact of management quality on firm productivity (Bloom et al., 2011). This strand also suggests that the quality of management practices is influenced by a firm's ownership structure (multinational firms and private ownership), competition and human capital (Bloom, Propper et al. 2010; Bloom, Sadun and Reenen, 2010). Finally, in this vein, Bloom and Van Reenen (2007) also find that in developing countries firm productivity and general management quality are significantly lower than in developed countries.

A second literature strand links institutional characteristics and firm organization. The quality of institutions and the levels of corruption within them can affect firm organization. Firstly,

corruption potentially redirects firm inputs away from firms' principal economic activity. For example, Dal Bó and Rossi (2007) show that, in more highly corrupt countries, firms in the electricity distribution industry employ more labor to produce the same level of output as firms in less corrupt countries, because operating in a corrupt business environment may result in additional costs, waste of resources and increased time that staff have to spend dealing with public officials. Moreover, because corruption is illegal and therefore imposes a need for secrecy on firms, it could drive them to adopt specific corporate governance structures that obstruct change and innovation (Murphy et al., 1993). For example, managers might conceal financial information and details of the firm's operations, or severely restrict employee involvement in the decision-making process, in their efforts to reduce the risk of information leakages and to minimize rent seeking by public officials. In addition, the uncertainty created by a corrupt business environment, in which government officials are enabled to extort benefits from firms, may also discourage firm investment and expansion strategies (Ades and Di Tella, 1997).

Finally, a third and more recent literature strand investigates the determinants of firms' vertical integration and centralization across countries. Within multinational firms, trust is related to centralization (Bloom et al., 2009). Acemoglu et al. (2010) and Bloom et al. (2009) argue that countries with greater levels of inter-individual trust and higher levels of product market competition tend to favor multinational firms that are less centralized, while countries characterized by weak contracting institutions, severe contract enforcement problems, and insufficient financial development tend to favor more vertically integrated firms.

This chapter seeks to make three contributions to the existing literature that we believe to be important. First, we provide estimates of the effect of corruption on management practices, as a possible conduit through which corruption adversely affects firms' performance, bringing together three different strands of the literature. Our sample focused on transition countries because they provide the ideal environment in which to study the linkages between firm behavior and corruption, given that they are still characterized by various forms of corruption and ineffective institutions (Slinko et al., 2005).

Second, our measurement of corruption is on the regional level, in contradistinction to the bulk of the existing literature, which uses either country-level or firm-level measures of corruption. By using this regional variation, we are able not only to control for country-specific heterogeneity

but also to estimate the effects of corruption with far greater precision. Institutional arrangements differ greatly across the transition countries of the study. For example, Russia experienced major political and institutional decentralization in the 1990s, through which its administrative regions regained some legislative and regulatory autonomy (Shleifer and Treisman, 2005), while Uzbekistan maintained a (more) centralized legislation. As Shleifer and Vishny (1993) argue, very high and heterogeneous levels of corruption can manifest themselves when weak State governments fail to control their local administration authorities. Consequently, from a methodological point of view, we are able to draw conclusions from substantial heterogeneity in the differing corruption levels across countries and regions.

Finally, by focusing on our measure of regional corruption our difference-in-differences identification strategy effectively pinpoints the corrosive effects of corruption on management practices, the mediator that drives the relationship between corruption and firm performance. We manage to isolate the effect of corruption on firm management quality by analyzing manufacturing industries[13] that display different levels of contract dependence and exposure to the same regional institutional environment. Theoreticians would undoubtedly argue that the combination of corruption and deficient contract institutions inevitably increases the risks of moral hazard in contracts between firms and their suppliers, thus elevating the costs of contract-dependent inputs (Acemoglu et al., 2007). In accordance with this hypothesis, we expect that businesses that are typically dependent on contracts will be disproportionately hurt by corruption, given that such firms will be more exposed to the deficiencies of the institutional environment for their production processes.

The chapter is organized as follows. Section 3.2 discusses our assumptions about the relationship between corruption and management practices. Section 3.3 describes the measures of corruption and management practices and some summary statistics. Section 3.4 describes our difference-in-differences identification strategy. Section 3.5 describes our main empirical findings on the effects of corruption on management practices. Section 3.6 investigates the effect of cor-

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[13] We use manufactuting industries as the Management, Organisation, and Innovation Survey we use (MOI) is based on firms in the manufacturing industry.

ruption on specific management practices, the centralization of the firm decision process, and firm performance. Section 3.7 presents some conclusions.

3.2   Theoretical mechanisms

We expect corruption to lead to deterioration in management quality through two main conduits. First, corruption may encourage (or force) managers to engage in activities that are not directly productive, such as enticing public officials through unofficial payments or gifts in exchange for various services. The additional operational costs that can arise from these activities can cause a distortion of firm resources and activities away from efficiency. Firms may also choose given forms of governance in order to be able to successfully navigate the circumstances of a corrupt business environment and maintain the secrecy of any illegal interactions with the State. Consequently, we expect that firms operating in more corrupt regions will have lower management quality.

Turning to specific aspects of management practices[14], we expect corruption's impact to have repercussions both on management of the production process and on human resource management. The expectation is that managers would have to trade off aspects of operational efficiency in order to deal with public-sector corruption. First, exposure to corruption could negatively impact performance monitoring. For example, given the existence of widespread corruption, incentives for monitoring the production process may be reduced so as to simultaneously reduce the financial information on the basis of which officials can extract bribes. It is also to be anticipated that exposure to corruption would significantly discourage firms from setting a long-term growth strategy, due to the occurrence of additional unanticipated costs, from a dysfunctional institutional environment and increased uncertainty. Second, in more corrupt regions, firms are likely to be hampered by inefficient human capital allocation. For example, one consequence of corruption could be that firms are constrained to have a disproportionate ratio of administrative employees by manufacturing plant in order to manage corruption, bureaucracy, and the barriers to interacting with the public sector.

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[14] Process Management, Human Resource Management, Monitoring Management, Production Target Management

We also expect that the impacts of corruption on firms would affect firm organization and the internal decision-making process. It makes sense for top managers who play a role in bribing public officials to wish to facilitate these activities while at the same time concealing them; accordingly, the decision-making process at higher management levels will tend to be both more centralized and more concentrated Therefore, a corrupt public sector could be related to management teams with more executive powers in the private sector, whereas, as previously noted, high inter-individual trust and a strong rule of law have been associated with a decision-making process that is strongly decentralized (Bloom et al., 2009).

Our difference-in-differences identification strategy is related to the incomplete contract theory developed by Williamson (1975, 1987). Our comparison is of management practices in firms operating within the same region, based on their industry's general dependence on contract-dependent inputs. This can be seen as a test of the theoretical framework of Acemoglu et al. (2007). Acemoglu et al. (2007) extend the theoretical model of Grossman and Hart (1986) and Hart and Moore (1990). The model they create establishes that more advanced technologies require a larger number of contracts with suppliers. In more corrupt countries, it is likely that the judicial system will be less equitable and impartial and less capable of enforcing its decisions. Therefore, in a corrupt business environment, a smaller set of inputs is contractible. Suppliers encounter hold-up difficulties when they engage in relationship-specific investments for which they have to negotiate ex-post with downstream firms. The model of Acemoglu et al. (2007) reveals that the contracting institutions primarily affect industries with higher contract-dependence, restricting them to fewer investments in contractible and non-contractible activities as suppliers are limited, and to higher levels of vertical integration, and lower technological innovation. Furthermore, even if contractual institutions are partly fixed at the national level, Acemoglu et al.'s model finds that small regional changes in the number of contractible inputs can generate large changes in productivity and investment levels.

3.3   Data and preliminary evidence

3.3.1   Regional corruption in Central and Eastern Europe

Our investigation takes Central and Eastern Europe as its focus in its analysis of the effects of regional corruption on management practices. Corruption clearly reaches particularly severe

levels if one considers the ICRG (International Country Risk Guide) data: the measure of controlling corruption within the political system is 2/5 compared to a world average of 2.5/5 in 2009. There has been much discussion in the corruption literature about whether it is more appropriate to measure corruption at the national or the regional level (Olken and Pande, 2011). The effects of corruption on firms may be felt at each of these levels, and which matters the most has not been adequately established. In this study, we have taken the decision to focus on regional corruption for the pragmatic reason that we only observe management practices for ten transition countries: Belarus, Bulgaria, Kazakhstan, Lithuania, Poland, Romania, Russia, Serbia, Ukraine, and Uzbekistan. In our within-country estimates, all the effects on enterprises of national corruption are subsumed under country fixed effects. However, regional corruption is clearly a topic worthy of investigation, since the bulk of firm–State interactions take place with the regional public authorities. Furthermore, more than 60 percent of the variation in corruption is registered between regions of *the same countries*. Consequently, it is natural to expect that the regional level will account for a large proportion of the effect of corruption on firms.

We use two surveys to evaluate regional corruption. The Business Environment and En-terprise Performance Survey (BEEPS) provides an assessment of corruption in 2009 and the Life In Transition Survey (LITS) provides a household assessment of corruption in 2006. Both surveys define regions as large subnational entities, giving an average of five per country. For European countries, regions correspond to the third level of the Nomenclature of Units for Territorial Statistics (NUTS3). For non-European countries, the EBRD and the World Bank grouped existing national administrative divisions for sampling purposes where necessary (EBRD, 2008, 2010).

We follow two approaches to measure the firms' assessment of regional corruption using the BEEPS 2009 survey.[15] First, to measure corruption and bribery in regional business–State inter-actions, we compute the regional average of petty corruption the amount of bribes paid by firms.

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[15] We use median weights for all computations. Median weights include in the projection population the respondent establishments and the active establishments that could not be reached.

The amount of bribes paid by firms is summarized by the average regional ratio of bribes over annual sales (see pages 30-36 for a discussion of measures). This ratio builds on Svensson (2003) and Reinikka and Svensson (2006). Although this measure may reflect the ability of corrupt public officials to extract rents as well as the ability of firms to grease an inefficient administration, it is a direct measure of the managers' experience of corruption. Second, we use the regional average of managers' assessments of the frequency of corruption (see pages 30-36 for a discussion of measures). We then compute the standardized value of the answers and we calculate each region's average values.

Our source for measuring the household assessment of regional corruption is the Life In Transition Survey (LITS) 2006. Regional corruption is estimated from the average scores of eight questions measuring access to public services (see pages 30-36 for a discussion of measures). This measure of corruption examines how often unofficial payments or gifts have to be dispensed when people interact with public officials for services that ought normally to be provided free of charge. Having standardized these eight household survey answers, we then obtained an indicator of the frequency of bribes by computing their average that we then again standardized. Regional corruption is evaluated on the basis of the regional average (indicator) of household responses.

We first evaluate the credibility and limitations of these two regional corruption measures. Table 3.1 reports the different measures of regional corruption from the BEEPS 2009 and LITS 2006. All the measures of regional corruption appear to have substantial variation across regions. 60% to 80% of the overall variance of the measures occurs within countries, which strongly supports investigating corruption at the regional level. The different measures of regional corruption appear highly correlated. Table 3.2 Panel A displays the correlations between the three measures of corruption. The correlations drop slightly in magnitude when we consider within country measures of correlations (Panel B). The different measures of corruption within countries remain mostly correlated above 0.2. These lower correlations may be due to the lower heterogeneity of the different forms of corruption at the country level, or the larger sampling error of the regional estimates that are based on a small number of observations.

Table 3.1 Descriptive statistics and analysis of variance of regional corruption measures

	Descriptive statistics					Variance (Share of variance within country)
	Mean	S.d.	Min	Max	Obs.	
A. Firms' assessment of regional corruption						
Share of sales paid as bribes	0.83	0.93	0.00	5.31	56	0.53
Firms not answering the share of sales	0.22	0.10	0.03	0.47	56	0.62
Frequency of bribes	-0.09	0.36	-	0.69	56	0.45
Firms not answering the frequency of	0.09	0.10	0.00	0.50	56	0.70
B. Households' assessment of corruption						
Frequency of bribes	0.01	0.43	-	1.57	56	0.56
Households not answering the frequency	0.00	0.00	0.00	0.03	56	0.85
C. Sample size						
# firms by region (BEEPS2009)	93.16	78.22	7	544	56	0.59
# households by region (LITS2006)	165.36	77.36	40	420	56	0.79

Note: Observations cover 56 regions. The frequency of bribes according to firms is the standardized value of the question "Is it common for firms in my line of business to have to pay some irregular "additional payments or gifts" to get things done with regard to customs, taxes, licenses, regulations, services etc?" (BEEPS 2009, question ecaq39). The frequency of bribes according to households comes from eight questions related to the frequency of bribes when households interact with the road police, request official documents, have other forms of interactions with the police, go to courts, receive public health care or public education, and request unemployment or social security benefits (LITS 2006, questions q313 1 to 8). The answers to each question are standardized and averaged. The final indicator is standardized at the household level. The share of sales paid by firms as bribes is the percentage of total annual sales paid as informal payment (BEEPS 2009, questions j7a, j7b and d2). Missing values are considered as missing at random. For each corruption indicator, higher values indicate higher levels of corruption. Source: Authors' computations based on BEEPS 2009 and LITS 2006 (EBRD-WB).

Table 3.2 Correlations between different measures of corruption at the regional level

| | Frequency of bribes | | Share of sales paid as bribes |
| | (BEEPS 2009) | (LITS 2006) | (BEEPS 2009) |
	(1)	(2)	(3)
Panel A. Linear correlations between corruption indicators			
Frequency of bribes (BEEPS 2009)	1.00		
Frequency of bribes (LITS 2006)	0.51	1.00	
Share of sales paid as bribes (BEEPS 2009)	0.50	0.38	1.00
Panel B. Nonlinear correlations between corruption indicators			
Frequency of bribes (BEEPS 2009)	1.00		
Frequency of bribes (LITS 2006)	0.46	1.00	
Share of sales paid as bribes (BEEPS 2009)	0.61	0.41	1.00
Panel C. Within country linear correlations between corruption indicators			
Frequency of bribes (BEEPS 2009)	1.00		
Frequency of bribes (LITS 2006)	0.26	1.00	
Share of sales paid as bribes (BEEPS 2009)	0.21	0.09	1.00
# Regions	56	56	56

Note: Observations are for 56 regions. The frequency of bribes according to firms is the standardized value of the question "Is-it common for firms in my line of business to have to pay some irregular "additional payments or gifts" to get things done with regard to customs, taxes, licenses, regulations, services etc?" (BEEPS 2009, question ecaq39). The frequency of bribes according to households comes from 8 questions related to the frequency of bribes when households interact with the road police, request official documents, have other forms of interactions with the police, go to courts, receive public health care or public education, and request unemployment or social security benefits (LITS 2006, questions q313 1 to 8). The answers to each question are standardized and averaged. The final indicator is standardized at the household level. The share of sales paid by firms as bribes is the percentage of total annual sales paid as informal payment (BEEPS 2009, questions j7a, j7b and d2). Missing values are considered as missing at random. For each corruption indicator, higher values indicate higher levels of corruption. Panel A displays linear correlations. Panel B displays Spearman rank correlations. Panel C displays linear correlations controlling for country fixed-effects (within country correlations). Source: Authors' computations based on BEEPS 2009 and LITS 2006 (EBRD-WB).

In Figure 3.1 we show the regional variation in corruption for the 56 regions[16] in a map of the 10 transition countries of our sample. Panel A displays the regional average of the share of sales paid as bribes, while Panel B displays the household assessment of the frequency of corruption. Both measures of corruption appear spatially auto-correlated across state boundaries. However, national borders, indicated with the dark black lines in the map, still appear to play a key role in the 10 transition countries.

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[16] The regions are the following: Belarus: Brestskaya, Gomelskaya, Gorod Minsk, Grodnenskaya, Minskaya, Mogilevskaya, Vitebskaya, Bulgaria: Severen Tsentralen, Severoiztochen, Severozapaden, Yugoiztochen, Yugozapaden, Yuzhen, Tsentralen, Kazahkstan: Center, East, North, South, West, Lithuania: Coast and West, North-East, South-West, Vilniaus, Poland: Central, Eastern, Northern, North-western, Southern, South-western, Romania: Bucuresti Ilfov, Centru, Nord Est, Nord Vest, Sud Est, Sud Muntenia, Sud Vest Oltenia Russia: Central, North-West, Siberia, South, Ural, Volga, Serbia: Belgrade, Central, East, South East, Vojvodina, West, Ukraine: East, Kiev, North, South, West, Uzbekistan: Samarkandskaya oblast, Tashkent city, Tashkentskaya oblast
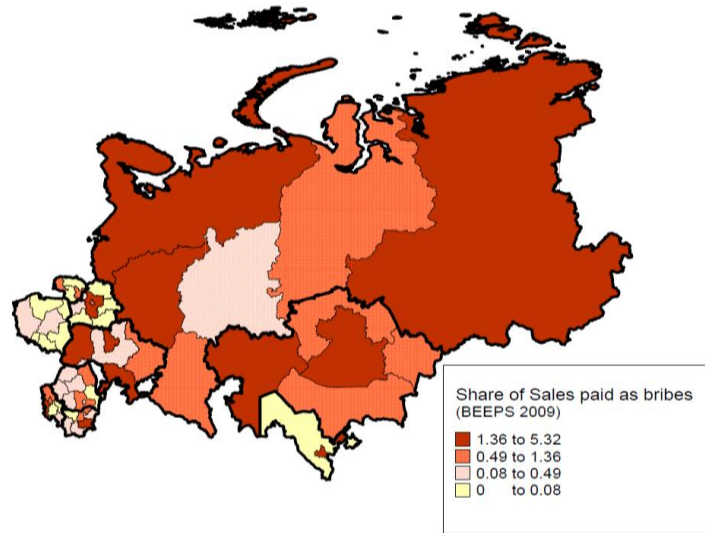
Figure 3.1.a Regional average corruption (Firm share of sales paid as bribes, BEEPS 2009)
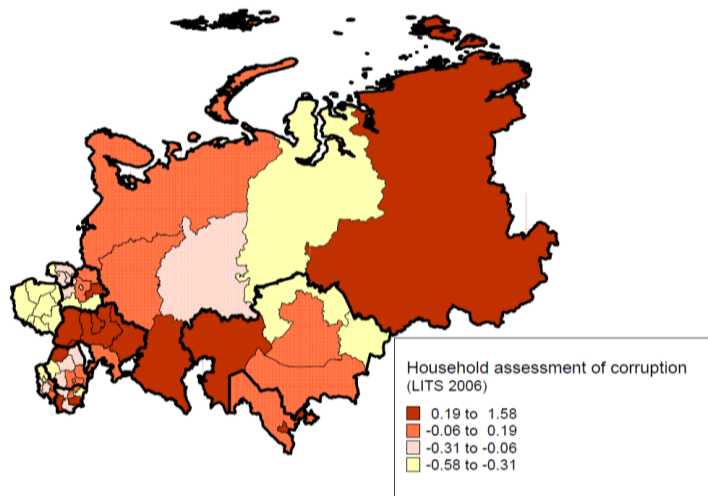
Figure 3.1.b. Regional household corruption (household assessment of the frequency of corruption, LITS 2006)

Figure 3.1 Map of regional corruption

Note: Share of firm sales paid as bribes according to the BEEPS 2009 and household assessment of the frequency of corruption according to the LITS 2006. Far-East Russia is not included in the MOI sample and not represented on the map. The 56 regions are divided by quartiles. Darker colors represent higher levels of corruption. Source: Authors' computations based on the BEEPS 2009 and LITS 2006 (EBRD-WB) and the Global Administrative Areas project.

We then test the informational content of our measures of regional corruption using two of the most widely used and established perception based measures of corruption at the country level. Figure 3.2 displays the average country score according to the International Country Risk Guide (ICRG) index, the Transparency International Corruption Perceptions Index (CPI), and two measures of corruption used in this chapter at the firm and the household level, the share of sales paid as bribes by firms, and the household assessment of the frequency of corruption. Both the ICRG and CPI indices are specifically designed to allow for cross-country comparability. The CPI captures the perception of business people, academics, and risk analysts, while the ICRG index focuses on the perceptions of a panel of country experts. Even though perception based surveys have been widely criticized (Olken and Pande, 2011), the country rankings based on CPI, ICRG and the two measures of corruption we use from the firm and household surveys appear similar. Germany, Poland and Romania display systematically the lowest levels of corruption, while Kazakhstan, Ukraine, Uzbekistan and Russia display the highest. The 10 transition countries cover a range of economic progress and corruption is a salient feature. According to all four measures of corruption, most countries score systematically below the world average, with corruption levels three times above the levels of Germany.

Figure 3.2.a Perception of corruption index (ICRG)
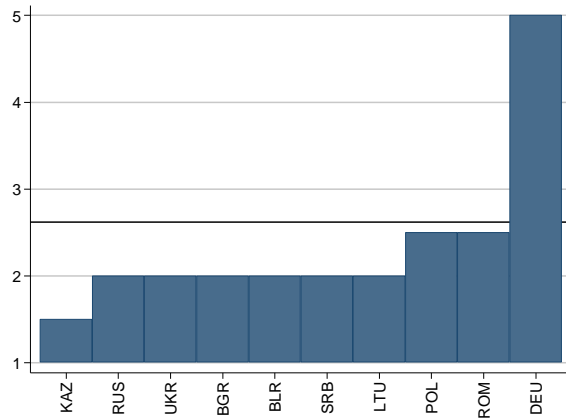
Figure 3.2.b Perception of corruption index (CPI)
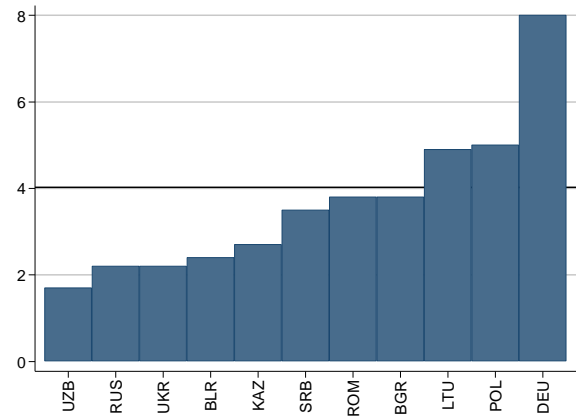
Figure 3.2.c. Share of firms' sales paid as bribes
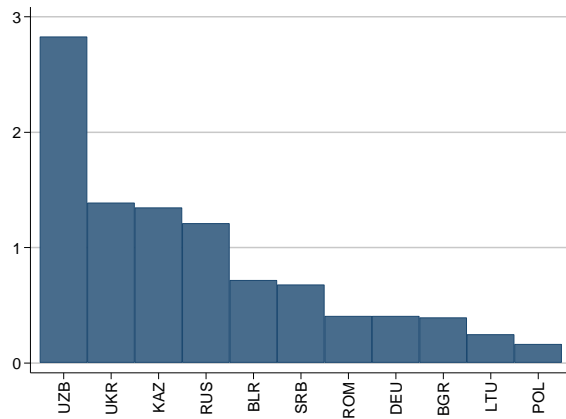
3.2.d. Households' frequency of bribes (2006)
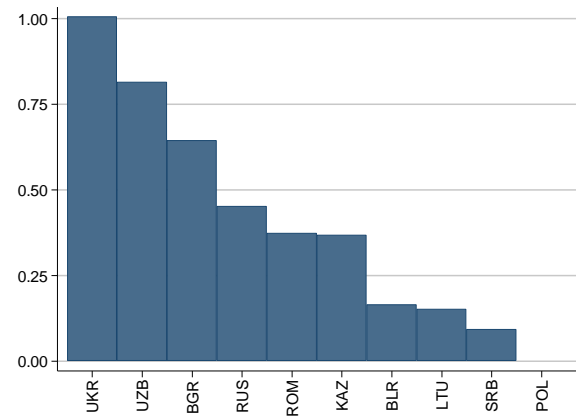
Figure 3.2 Corruption measures across transition countries in 2009

Note: Panel a displays the ICRG corruption perception index in 2009. Uzbekistan is not rated. Higher values indicate lower perceived corruption. Panel b displays the Transparency International CPI index in 2009. Higher values indicate lower perceived corruption. Panel c displays the share of sales paid as bribes by manufacturing and service firms in 2009, except for Germany where the measure is from the 2005 survey. Median sampling weights are used. Panel d displays the average frequency of corruption according to local households from the LITS in 2006. It is an unweighted average of eight questions related to the frequency of

bribes when households meet civil servants. The scores are rescaled so that Poland has a score of 0. Sampling weights are used.

The horizontal line represents the world average. BGR stands for Bulgaria, BLR for Belarus, DEU for Germany, KAZ for Kazakhstan, LTU for Lithuania, POL for Poland, ROM for Romania, RUS for Russia, SER for Serbia, UKR for Ukraine, and UZB for Uzbekistan.

Source: ICRG, Transparency International, BEEPS 2009 survey and LITS 2006 survey (EBRD-WB).

3.3.2 Management practices

In this section we discuss the main outcome variables of our analysis, namely, firm management practices. Firm-level data assessing management practices is derived from the Management, Organization and Innovation (MOI) Survey. The EBRD and the World Bank conducted the MOI Survey between October 2008 and November 2009, in conjunction with BEEPS 2009. It should be noted at this point that individual establishments rather than corporations are the units of observation. To define our terms, "establishments", which we also refer to as "plants", or "firms", have their own addresses, business names, and managers, but could quite possibly be partialy or wholly owned by other firms. Our survey covers 1,355 public or privately owned manufacturing establishments employing from 50 to 5,000 employees. No establishment that took part in the MOI survey participated in the BEEPS surveys. The sampling frame, from which we selected the manufacturing firms surveyed, is based on the Bureau Van Dijk's Orbis database (as available in August 2008) with the exception of Kazakhstan and Uzbekistan. For the sampling frame we used the official list of establishments, obtained from the Agency of Statistics of the Republic of Kazakhstan, and in Uzbekistan the Uniform State Register of Enterprises and Organizations, published by the State Department of Statistics of the Republic of Uzbekistan. Establishments belong to 11 manufacturing industries: food, textiles, garments, chemicals, plastics and rubber, metallic mineral products, basic metals, fabricated metal products, machinery and equipment, electronics, and other manufacturing plants[17]. All regions of a country had to be

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[17] These 11 manufacturing industries correspond to a grouping of International Standard Industrial Classification of All Economic Activities (ISIC3.1) codes.

covered, and the percentage of the sample in each region was required to be equal to at least half the sample frame population in each region.

The MOI survey chiefly targets factory, production or operation managers, namely, managers who are in close day-to-day contact with the firm's operations but are at the same time in a senior enough role to furnish an informed overview of management practices. Interviews were face to face, and conducted in the managers' mother tongue by interviewers employed by the market research companies responsible for the implementation of the MOI survey in 2008 and 2009 (Bloom et al., 2012). The MOI survey includes two kinds of management quality measure: measures on management practices and measures of managers' perception of the management quality in their establishment. As Bertrand and Mullainathan (2001) argue, it can be problematic to use measures of management quality based on individual perception as dependent variables, for the simple reason that they are subject to measurement error that may be correlated with unobserved characteristics either of the respondent or of the establishment itself. To limit the risk of perception bias, we focus strictly on those measures of management practices that are based on managers' responses to questions about different management practices that characterise resource allocation decisions made by the firm.

Specifically, our experience-based measure for management quality correspond to an aggregate indicator whose values are higher whenever the establishment in question has adopted more advanced management practices in the following four areas, as noted in Bloom et al. (2012): operations, monitoring, targets, and incentives. The operational indicator analyzes how establishments handle process problems, such as machinery breakdowns. The monitoring indicator looks at the collection, monitoring, revision and use of production performance indicators. The targets indicator covers the time-scale of production targets, while the last indicator, the incentives indicator, covers promotion criteria, practices for addressing poor employee performance, and rewarding the successful achievement of production targets. We compute our measure of management quality as a standardized average of the four components of management practices, so that it has zero mean and unitary variance across firms. We also experimented by doing a principal component analysis of the four management scores. The correlation between our measure and the first principal component is 0.96 (0.28 with the second principal component). The first principal component explains 41.5% of the total variance, and the

first two components 66.2%. Therefore, we only report the results using the Bloom et al. (2012) measure of management quality, which they find to be significantly correlated with several indicators of firm productivity. Figures 3.3a and 3.3b display the characteristics of this management measure. Figure 3.3a, the distribution of management practices appears negatively skewed, and poorly managed establishments appear to follow heterogeneous practices. Figure 3.3b presents figures for the average management quality for the 10 countries that appear highly correlated with the corruption measures of Figure 3.2. Countries are ranked in reverse order compared to their level of corruption. Management scores range from the lowest average score of -0.55 in Uzbekistan to a high of 0.35 in Lithuania. Such substantial differences suggest that a number of firms in transition countries may have failed to carry out reforms to their management practices, and continue to operate within an outmoded and obsolete organizational structure, derived from years of central planning combined with a non-existent business development strategy (Bloom et al., 2012).

Figure 3.3.a. Distribution of management quality across establishments
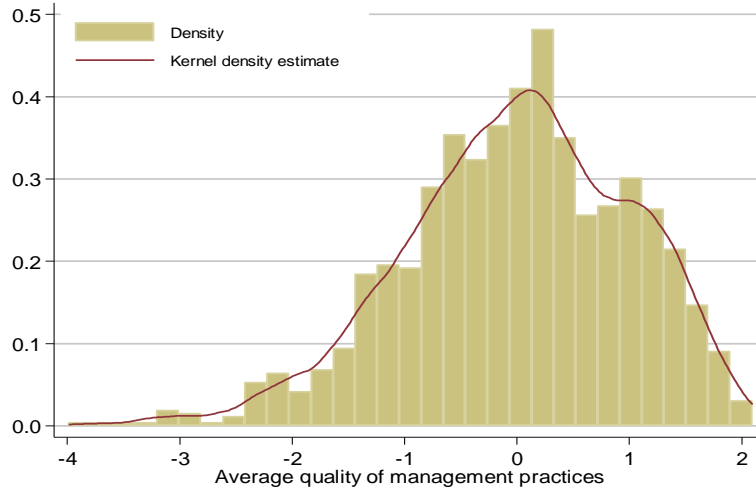
Figure 3.3.b. Average management quality at the country level
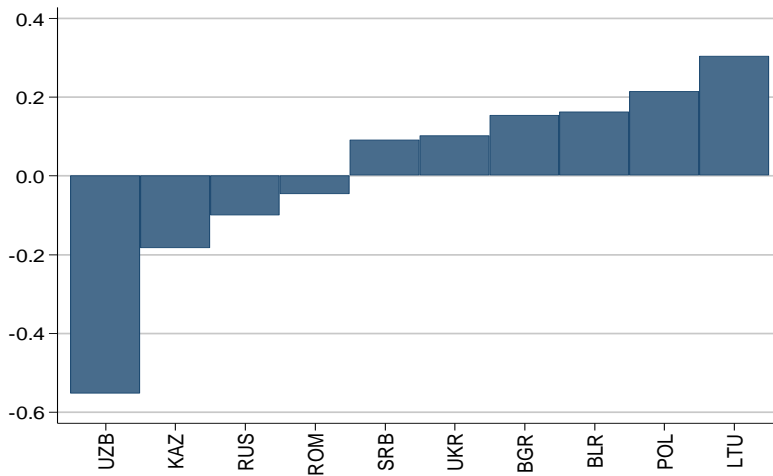
Figure 3.3 Distribution of management quality and country averages

Note: The figure reports descriptive statistics for 1,355 manufacturing establishments. All scores of management quality are in deviation from the sample mean and have a standard-deviation of 1. Figure 3.b displays the average management score in each country.

We also investigate disaggregating the management scores into their component questions. However, answers to individual questions on management practices tend to be positively correlated. In Table B6 of the Appendix we show that the correlations between the four components of management quality and the aggregate index range from 0.50 to 0.72. If a firm scores highly on one dimension of management, then it tends to perform well on all of them. In this respect, transition countries do not appear different from non-transition countries covered by Bloom and Van Reenen (2010). This creates difficulties in identifying whether corruption has a stronger impact on specific management practices. The only exception appears to be the monitoring practices of the firms, which do not appear significantly correlated with most other management practices.

Finally, we compute an index of other resource allocation decisions made by the managers of the plant. Specifically, we measure the centralization of the decision process. This was achieved by computing the average score of six questions on managers' decisions about the following issues: working hours, days of factory holidays, employing new workers, making investment decisions, introducing new products, and setting prices. For each of these six dimensions, managers are asked whether they involve the workers for their opinion. The production process is accordingly considered to be more centralized when decision making is concentrated in the hands of managers and workers are not asked for their opinion. The verbatim wording of the questions was: *Does this establishment's top and middle management ask workers for their opinion with regard to any of the following decisions?* Managers could answer yes (0) or no (1). Therefore, the higher values in our index point to no inclusion of workers in the decision making and therefore more centralized production plants.

Table 3.3 presents descriptive statistics for the 1,355 manufacturing establishments inlcluded in the MOI survey. Panel A presents the main aggregate measure of management quality and its subcomponents, namely, operation, monitoring, targets and incentives. Panel B reports our measure of the centralization of the decision process and alternative measures of firm

performance. Panel C displays the main characteristics of the establishments that we later use as control variables: the number of full-time employees, the ownership structure, and the number of inhabitants in the locality of the establishment. Panel D reports data on the two measures of firm exposure to a corrupt business environment, contract dependence and product complexity that we discuss in Section 3.3.4.

Table 3.3 Descriptive statistics, sample of establishments

	Mean (1)	Std. Dev. (2)	Min (3)	Max (4)	Obs. (5)
Panel A. Quality of management practices					
Average	0.00	1.00	-3.99	2.09	1355
Operation	0.00	1.00	-4.48	0.81	1351
Monitoring	0.00	1.00	-3.53	1.72	1354
Targets	0.00	1.00	-1.94	1.32	1345
Incentives	0.00	1.00	-3.58	2.08	1354
Panel B. Internal organization of the establishments and other outcomes					
Centralization of the decision process	0.76	0.26	0.00	1.00	1355
Share of administrative employees	0.26	0.17	0.01	1.00	1307
Share of college graduates among:					
Production employees	0.16	0.21	0.00	1.00	1201
Administrative employees	0.51	0.34	0.00	1.00	1227
Innovation (new product in last 3 years)	0.67	0.47	0.00	1.00	1348
R&D spending over last fiscal year	0.39	0.49	0.00	1.00	1320
3 year averaged growth of employment[1]	1.75	16.79	-111.89	116.89	1105
Main market: regional	0.22	0.41	0.00	1.00	1343
Main market: international	0.24	0.42	0.00	1.00	1343
Panel C. Basic controls for establishments' characteristics					
Establishment is part of a larger firm	0.18	0.38	0.00	1.00	1355
Size (full time employees)	267.17	445.93	13	5403	1355
Size unknown	0.01	0.09	0.00	1.00	1355
Ownership					
Multiple Owners	0.17	0.38	0.00	1.00	1355
Foreign	0.14	0.34	0.00	1.00	1355
Family	0.06	0.23	0.00	1.00	1355
Individual	0.44	0.50	0.00	1.00	1355
State	0.12	0.33	0.00	1.00	1355
City size (population)					
Population over 1 million or capital city	0.40	0.49	0.00	1.00	1355
Over 250,000 to 1 million inhabitants	0.24	0.43	0.00	1.00	1355
50,000 to 250,000 inhabitants	0.27	0.44	0.00	1.00	1355
Fewer than 50,000 inhabitants	0.09	0.29	0.00	1.00	1355
Panel D. Dependence to institutions					

Contract dependence	0.89	0.13	0.11	1.00	1355
Product complexity	-0.10	0.04	-0.24	-0.04	1355

<u>Note:</u> The table reports descriptive statistics for 1,355 manufacturing establishments.

1. The growth rate of employment takes only into account permanent full time employees .<u>Source:</u> Authors' computations based on MOI survey (EBRD-WB), and Nunn (2007).

3.3.3   Preliminary evidence

In this section, using data from the BEEPS and LITS surveys we report on conditional correlations between the management of the manufacturing establishments and the different measures of regional corruption. We relate the quality of management practices in a manufacturing establishment to levels of regional corruption, to various establishment characteristics, and country fixed effects:

$$y_{isrc} = \gamma \, C_{rc} + x_{isrc} \, \beta + \alpha_{sc} + \varepsilon_{isrc} \qquad (1)$$

In Specification 1, presented above, *i* is an index for manufacturing plants, *s* is an index for different manufacturing industries, *r* is an index for regions, and *c* is an index for countries. y_{isrc} is the quality of the firm's management practices as described in Section 3.2. C_{rc} are our measures of corruption, e.g., the proportion of annual sales paid as bribes by the average establishment in region *r*. α_{sc} is a full set of countries interacted with manufacturing industries fixed effects. which control for differences in production technologies across countries and manufacturing industries. These controls take into account country specific-characteristics, such as the rule of law and overall institutional quality. This is particularly important, since the rule of law may be correlated to corruption, facilitate contract enforcement and increase the likelihood of delegation. These fixed effects also control for the level of competition in a manufacturing industry at national level. Since product market competition may decrease rent-seeking opportunities and increase management quality (Bloom and Van Reenen, 2007), it could generate negative correlations between corruption and management practices. Finally, x_{isrc} is a row vector of control variables at the firm level. In all specifications, the standard errors are clustered at the regional level to take into account the level of variation in our corruption measures.

Table 3.4 reports the estimates of the descriptive specifications for different sets of control variables. We estimate two main specifications. We consider country and manufacturing

industry fixed effects (Columns 1-3), and the interaction of manufacturing industries and country dummies to capture country specific characteristics (Columns 4-6). Furthermore, we use three different classifications of manufacturing industries: from 11 industries in a coarse classification (Panel A), 22 industries in the 2-digit ISIC3.1 classification (Panel B), and 59 industries in the 3-digit ISIC3.1 classification (Panel C). The most stringent specifications also control for basic firms characteristics and a set of noise controls to correct for measurement error in management practices (Columns 4-5). The basic firm characteristics we make use of include a quadratic function for establishment size (the number of full-time permanent employees), a dummy variable for unknown size, a series of dummy variables for the kind of ownership, a series of dummy variables for the number of inhabitants in the locality, and a dummy variable which is assigned value 1 if the establishment is part of a larger firm. Noise controls include age, gender and education, the day of the week, the time of day the interview was conducted, its duration, and a quadratic function for the date of the interview. The partial correlations generally display the expected negative sign. Regional corruption, measured as the frequency of bribes from firm and household surveys, appears to significantly deter good management practices. The estimated coefficients are stable across specifications. The similarity in the estimates of the different specifications implies that the basic establishment characteristics are mostly orthogonal to regional corruption. In some alternative specification (unreported), we also included additional controls that are likely to be endogenous: the interviewers' perception of the truthfulness of the information, their assessment of the respondent's knowledge of the firm, as well as controls for gender, and the number of years the respondents have been working in their position. The point estimates for the estimate of the frequency of corruption on management quality were again stable.

By contrast, when we measure regional corruption using the proportion of sales paid as bribes, the estimates display an expected negative sign (Column 3) or are close to zero (Column 6), but they are all small in magnitude and insignificant at the 10% level. This underlines that measurement error on the amount of bribes paid may skew the effect of corruption on management practices towards zero. Taken at face value, the estimated effects suggest that a one standard-deviation increase in the frequency of corruption (0.43 points) is associated with a decrease of one-tenth standard deviation of management quality (0.11 points). This estimated association is substantial. It is the equivalent, in terms of management quality, of a move from the average Ukrainian establishment to the average Polish establishment.

Panel D of Table 3.4 confirms the robustness of the cross-sectional association between regional corruption, measured as the frequency of bribes, and the quality of management practices. We have added several controls at the regional level that have been emphasized by the literature as potential determinants of management practices and firm performance. We include the proportion of the population aged 15 to 65, that is out of the labor force or unemployed, education as a proxy for human capital (Glaeser et al., 2004), and inter-individual trust (Fukuyama, 1996; La Porta et al., 1997). We consider as population out of the labor force or unemployed that portion of the population aged 15 to 65 that did not work for income during the previous 12 months. We proxy education by the number of individuals between 15 and 65 years old who only completed primary education or do not hold a degree. Inter-individual trust corresponds to the answer to: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people". While regional education and individual trust appear to have the expected signs, none of them is significant and the point estimates for the effect of corruption on management practices are even slightly higher than in Panel C.

Table 3.4 Corruption and difference in management practices across regions

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 11 manufacturing sectors						
Frequency of bribes	-0.265**			-0.288***		
(BEEPS 2009)	(0.130)			(0.108)		
Frequency of bribes		-0.253*			-0.203	
(LITS 2006)		(0.130)			(0.127)	
Share of sales paid as bribes			-0.027			0.001
(BEEPS 2009)			(0.053)			(0.050)
R-squared	0.068	0.070	0.064	0.154	0.154	0.150
Panel B. Controlling for 22 manufacturing sectors						
Frequency of bribes	-0.274**			-0.269**		
(BEEPS 2009)	(0.133)			(0.133)		
Frequency of bribes		-0.260**			-0.205	
(LITS 2006)		(0.128)			(0.124)	
Share of sales paid as bribes			-0.024			0.026
(BEEPS 2009)			(0.054)			(0.051)
R-squared	0.086	0.088	0.082	0.230	0.204	0.200
Panel C. Controlling for 59 manufacturing sectors						
Frequency of bribes	-0.264*			-0.273**		
(BEEPS 2009)	(0.136)			(0.135_		
Frequency of bribes		-0.264**			-0.214*	
(LITS 2006)		(0.130)			(0.127)	
Share of sales paid as bribes			-0.023			0.020
(BEEPS 2009)			(0.057)			(0.059)
R-squared	0.113	0.116	0.109	0.298	0.299	0.295
Panel D. Controlling for 59 manufacturing sectors and regional characteristics						
Frequency of bribes	-0.346**			-0.339**		
(BEEPS 2009)	(0.136)			(0.161)		
Frequency of bribes		-0.264**			-0.247*	
(LITS 2006)		(0.126)			(0.136)	
Share of sales paid as bribes			0.054			0.041
(BEEPS 2009)			(0.062)			(0.066)
Out of labor force	-0.071	-0.200	0.241	0.385	0.344	0.758
(age 15-65)	(0.486)	(0.505)	(0.523)	(0.678)	(0.609)	(0.678)
Primary education or below	-0.180	-0.086	0.281	-0.571	-0.482	-0.172
(age 15-65)	(0.561)	(0.477)	(0.546)	(0.567)	(0.491)	(0.547)
Individual trust	0.038	0.055	0.070	0.031	0.050	0.059
	(0.150)	(0.139)	(0.155)	(0.165)	(0.152)	(0.170)
R-squared	0.322	0.323	0.319	0.300	0.300	0.296
Industry fixed effects	Yes	Yes	Yes			
Country fixed effects	Yes	Yes	Yes			

Industry x country fixed effects				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions)	56	56	56	56	56	56

Note: The table reports partial correlations and standard-errors for the difference in the quality of management practices. Additional control variables include a quadratic function of size (number of full-time employees), dummy variables by types of ownership, by age of the establishment, by size of municipality and a dummy variable if the establishment is part of a larger firm. Standard-errors are clustered at the regional level. * denote a significant estimate at the 10% level, ** at 5%, *** at 1%. Source: Authors' computations based on BEEPS 2009 and LITS 2006 (EBRD-WB).

The existence of this large set of control variables notwithstanding, Ordinary Least Squares (OLS) estimates of the impacts of corruption on firm behavior are unlikely to identify γ, the parameter of interest, because Crc could possibly be correlated to unobserved firm characteristics through εisrc. Three main reasons make this identification problem difficult to circumvent. First, simultaneity may result from the fact that industries that are more corrupt may display specific yet unobserved characteristics related to management practices. For example, firms that are unproductive or badly managed are more likely to rely heavily on bribes as a means to improve their competitiveness and as a way of gaining access to markets. In contrast, firms that are more productive or larger may be the target of corrupt public officials as they attempt to extort a higher amount of bribes. This may imply that there is a mutual interdependence between regional corruption and firm management practices. Second, the results of Specification 1 may be affected by omitted regional variable biases. While we control for country fixed effects and some regional characteristics, regions that are more corrupt may also be poorer, have higher rates of criminality and a less effective enforcement capacity. In their turn, poverty rates or enforcement capacity might be correlated with firm behaviors. For example, while the legal and regulatory framework may well deter corruption and ease any administrative burden, it could also directly affect firm management practices. Hence, it is important to compare the effects of corruption on different manufacturing industries operating under a similar regime of enforcement of anti-corruption laws. Finally, corruption measures may be subject to measurement error. Such error may in turn lead to attenuation bias in our fixed-effect specification 1. Combined, the three different forms of biases could drive OLS estimates to over- or underestimate γ, depending on which measure of management quality and corruption is used.

3.4 Empirical strategy

3.4.1 Main empirical specification

Industries and regions display variations in their exposure to corruption. As a result, regional corruption measures and different sensitivities of manufacturing industries to corruption are used to prevent biases caused by omitted regional characteristics. More precisely, the characteristics of manufacturing industry affecting firms' exposure to corruption were identified. The strategy to achieve this is to run regressions of the form:

$$y_{isrc} = \gamma \times exp_{is} \times C_{rc} + x_{isrc}\, \beta + \alpha_{sc} + \delta_{rc} + \varepsilon_{isrc} \qquad (2)$$

As in Specification 1, i is an index for manufacturing plants, s is an index for different manufacturing industries, r is an index for regions, and c is an index for countries. y_{isrc} is a firm outcome: management practices, centralization of the decision process, or firm performance. C_{rc} is a measure of corruption, e.g., the proportion of sales paid as bribes in region r. exp_{is} is the exogenous exposure to corruption of manufacturing industry s. The coefficient of interest is γ. It captures the differential effect of regional corruption on firm outcomes. The principal advantage of Specification 2 over Specification 1 is that it includes the industry's exposure to corruption and it allows us to control for δ_{rc}, i.e. a series of regional fixed effects that capture geographical unobservable characteristics. These fixed effects control for macroeconomic instability, the level of education of the labor force, the quality of regional infrastructure, and the overall legal and institutional environment. The final variable needed to calculate specification 2 is the manufacturing industry's exposure to regional corruption, exp_s.

Two measures of an industry's dependence on corruption and of institutional quality have been identified in the literature. These measures take the structure of a manufacturing industry's intermediate inputs to determine its dependence on contracting institutions. First, industries producing goods that require a more complex production process are more prone to be affected by corruption and disorganization (Blanchard and Kremer, 1997). Industries that purchase fewer intermediate inputs from other industries should have to rely less on courts, regulatory authorities, and regional governments (Rajan and Subramanian, 2007; Levchenko, 2007). Chor (2010) convincingly demonstrates that the twin measures of contract dependence and product complexity can capture different sources of vulnerability to institutions across countries. Second,

the nature of the intermediate inputs determines how heavily the industry is dependent on institutions (Nunn, 2007; Rauch, 1999). It has been established that certain industries depend crucially on relationship-specific investments for production of a particular good; corruption provides favorable conditions for firms in the private sector to deviate from the terms of a contract. For instance, industries manufacturing computer and electronic equipment rely heavily on inputs that are not openly traded on an exchange market. Consequently, they depend on specific contracts, and on the enforcement of those contracts by regional institutions. In contrast, manufacturing establishments that use inputs traded on markets are able to depend less heavily on regional institutions. This leaves little scope for kickbacks, moral hazard, and contract enforcement. Under this assumption, corruption at the regional level inevitably generates higher transaction costs in the more contract-dependent manufacturing industries, and larger losses in management quality, because managers are obliged to exert more effort and expend more resources in dealing with the demands imposed by a corrupt public sector.

In our analysis, contract dependence is computed as the proportion of industry inputs that are not traded on markets (Nunn, 2007). Additionally, product complexity is defined as minus the Herfindahl index of input concentration (Blanchard and Kremer, 1997). Data on the actual use of inputs are typically not available for the countries surveyed in the MOI. However, even if these data were available, they could not be used in our calculations, since the use of inputs depends on the overall institutional environment and regional corruption. Instead, in order to circumvent these endogeneity issues, data illustrating contract dependence derived from manufacturing industries in the United States are used instead (Nunn, 2007) and input-output data from the U.S. (Rajan and Zingales, 1998; di Giovanni and Levchenko, 2010). Under the reasonable assumption that U.S. institutions do not distort industry demand for inputs, U.S. data permits identification of the composition of input demand according to industry, driven by technological characteristics, from the demand-driven the institutional environment. For the construction of the measure of input concentration, we use the 1997 United States benchmark Input-Output (I-O) table at the 6-digit level, similar to the data used by Nunn (2007) to compute measures of contract dependence[18]. Finally, we match the I-O industry classification to the ISIC3.1 industries, used in the

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[18] Nunn (2007) and Rauch (1999) have a liberal and a conservative definition of goods, including goods sold on an exchange market, and goods with listed prices. Throughout the paper we use their liberal

MOI survey, by constructing a concordance. We use the I-O classification to NAICS 97 concordance from the U.S. Bureau of Economic Analysis (BEA) and concordance between the NAICS97, NAICS02 and ISIC3.1 from the U.S. Bureau of Labor Statistics (BLS). We use equal weights when we aggregate the I-O industries to the 4-digit ISIC3.1 classification (see data in Appendix B for detail). For each 4-digit industry of the MOI survey, we have 1997 benchmark U.S. data for inputs that are either sold on an organized exchange market, have listed prices, or inputs that do not belong in either of the previous categories.

Figure 3.4 reports the distribution of our two proxies for the dependence to regional corruption across firms. Both the measure of contract-dependence and the measure of product complexity exhibit significant variation across manufacturing industries. The MOI survey provides information only about the main product of each establishment. Although there may be some misclassification of industries, this bias should be limited in the estimation, as the main product represents on average 82% of the sales, and we aggregate manufacturing industries at the 2- or 3-digit level.

definition. However, none of the results in the paper are affected if we use the conservative definition.

Figure 3.4.a. Distribution of Nunn's measure of contract dependence (2007) by manufacturing sector
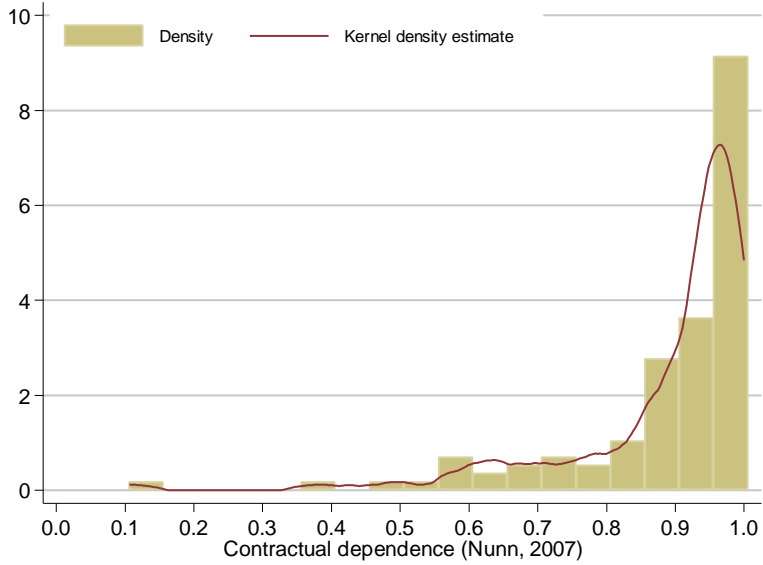
Figure 3.4.b. Distribution of the measure of product complexity by manufacturing sector
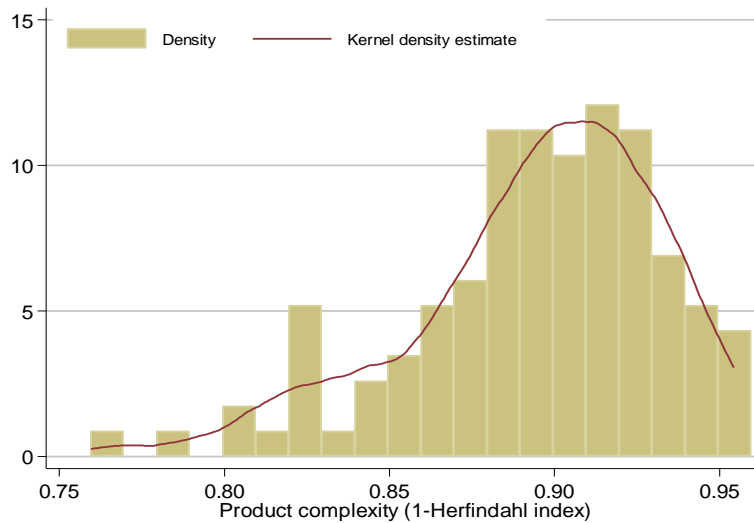
Figure 3.4 Dependence on institutions by manufacturing sector

<u>Note:</u> Contract dependence of manufacturing sectors at the ISIC3.1 4-digits level. The measure is the share of relationship-specific inputs used by each U.S. manufacturing sector in 1997. It is computed using Nunn (2007) share of inputs neither traded on open markets nor listed on leaflets at the 6-digit I-O classification level. It is converted to ISIC3.1 sectors using the BEA correspondence between the I-O classification and the NAICS 1997 and the BLS correspondence files between NAICS 1997 and 2002 and NAICS 2002 and ISIC3.1.

<u>Source:</u> Nunn (2007), Rauch (1999) and authors' computations based on BLS and BEA correspondence files.

3.4.2   Falsification tests and graphical evidence

It is widely acknowledged that research designs produce the cleanest estimates when the treatment and control groups are randomly assigned. Unfortunately, it is possible that levels of exposure to corruption, as measured by the two measures of industry dependence on corruption, namely, contract dependence and product complexity, are not randomly allocated across industries. As our Specification 2 controls for regional fixed effects and country-industry fixed effects, it allows for unobserved regional characteristics that are correlated with regional corruption, and unobserved manufacturing industry characteristics that are correlated with contract dependence or product complexity. It is crucial to rule out the interaction between these two forms of unobserved characteristics (Almeida and Carneiro, 2012; Mian and Sufi, 2012). In order to address this concern, we investigate whether highly contract-dependent firms are more liable compared to low contract-dependent firms to reporting that given regional characteristics and regional economic conditions act as significant business barriers. For example, we test

whether the quality of regional infrastructures affects highly contract-dependent firms more than it does low contract-dependent firms. Despite the difficulty of answering this question definitively, we investigate the relationship between institutional dependence and managers' assessments of business barriers, within regions, using the BEEPS 2009 for the 10 transition countries of the MOI sample.

We compare the managers' own assessment of business barriers to their establishments' dependence on contracts. Table 3.5 Panel A presents the partial correlations between our proposed measures of contract dependence and the likelihood of a manager responding that a particular factor constitutes a severe impediment to doing business, controlling for regional fixed effects. This specification points toward the industries that are most affected by some regional business barriers. Acemoglu and Johnson (2005) adopt a similar strategy to verify the validity of legal origin, as an instrument for the quality of the legal system.

As expected, within a given region, the managers of contract-dependent firms are more prone to state that corruption makes doing business problematic (Column 1). Managers of contract-dependent firms are also more likely to express the view that the courts are corrupt and not impartial, but they do not tend to report the judicial system as being slow (Columns 2 and 3). As a result, managers' assessment of the quality of courts as an obstacle to doing business is strongly predicted by our measure of dependence on contractual institutions (Column 4). Similarly, managers of contract-dependent firms report being more affected by political instability and crime (Columns 5 and 6). In contrast, our analysis shows that no significant relationship holds between our measure of contract dependence and managers' assessment of the following as barriers to doing business: corporate tax rates, tax administration, business licensing and permits, access to finance, and transport infrastructure (Panel C). It also emerges that managers of contract-dependent firms are slightly more likely to state that the educational level of the labor force creates a problem for their firm's operation, though this result is only significant at the 10% significance level (Panel C, Column 6).

Overall, our findings show that contract dependence is indeed correlated with the reporting of corruption as a business barrier, while it is mainly unrelated to other business barriers, that capture regional institutional quality and economic conditions. We interpret this pattern as evidence that our measure of contract dependence does capture a firm's sensitivity to

corruption, and corruption in the judicial system, which is largely unrelated to other possible business barriers. This strengthens the theoretical framework of this chapter, supporting that regional corruption affects management practices of firms because of weak judicial quality and inefficient contract institutions. Therefore, we interpret the estimates of our difference-in-differences Specification 2, based on contract dependence, as estimates that capture a causal effect of regional corruption on manufacturing industries.

In more corrupt regions, the court system may be less fair and impartial and able to enforce its decisions. Corruption in the judicial system undermines the rule of law and it imposes additional barriers in doing business, as it limits the penalties associated with non-compliance to contracts. Contracts may not be enforced and rights not properly protected at courts, agents may not abide by the rules, creating opportunities for private firms to deviate from the specified contractual terms. Firms in industries that depend heavily on specific contracts, and their enforcement by regional institutions, would be expected to be particularly hampered by regional corruption and corruption in the judicial system. The widespread regional corruption, corruption in the judicial system at the level of the rule of law, and weak contract enforcement mechanisms at the level of governance, would be expected to deteriorate the management decisions on the allocation of firm resources.

Panels B and E of Table 3.5 demonstrate that the complexity of the production process, as measured by (minus) the Herfindahl index of inputs, captures different industry vulnerabilities to business barriers when compared with our measure of contract dependence. Generally speaking, the estimates have the expected sign but are not statistically different from zero, at the 10% significance level. In unreported estimations, we obtain similar results, using a probit model, and alternative measures of input diversification, such as the Gini coefficient, the share of the 20 most important inputs, or a 3-digit input classification instead of a 6-digit classification. We therefore focus on the measure of contract dependence; our robustness checks in Appendix B, when we use (minus) the Herfindahl index to capture the complexity of the production process, report qualitatively similar results.

Table 3.5 Contract dependence, product complexity and barriers to doing business managers' assessment of

	Linear probability model for stating that the following factors are a severe obstacle to doing business:					
	Corruption	Quality of courts		Quality of Courts	Political instability	Crimes & disorders
		Corrupt	Slow			
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A.						
Contract dependence	0.123***	0.467***	0.128	0.091**	0.104*	0.110**
(Nunn 2007)	(0.043)	(0.125)	(0.170)	(0.042)	(0.061)	(0.045)
R-squared	0.070	0.114	0.128	0.049	0.093	0.070
Panel B.						
Input diversification	0.230	-0.733	0.025	0.062	0.134	-0.137
(1-Herfindahl in 1997)	(0.240)	(0.565)	(0.589)	(0.181)	(0.246)	(0.165)
R-squared	0.069	0.111	0.128	0.048	0.092	0.068

Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,252	2,131	2,178	2,186	2,328	2,353
Manufacturing sectors	114	114	114	114	114	114

	Licensing & permits	**Taxes**	**Tax admi-nistration**	**Access to finance**	**Transport network**	**Education labor force**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Panel C.						
Contract dependence	0.027	0.078	0.034	0.087	-0.097	0.123*
(Nunn 2007)	(0.036)	(0.090)	(0.046)	(0.069)	(0.067)	(0.065)
R-squared	0.045	0.079	0.056	0.063	0.064	0.065
Panel D.						
Input diversification	-0.330***	0.212	-0.122	-0.143	-0.425**	0.294
(1-Herfindahl in 1997)	(0.142)	(0.292)	(0.157)	(0.238)	(0.171)	(0.192)
R-squared	0.046	0.079	0.056	0.063	0.065	0.064
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,255	2,410	2,390	2,350	2,367	2,369
Manufacturing sectors	114	114	113	114	114	114

Note: The table reports the estimates of a linear probability model of a dummy variable for stating that a particular factor is a severe obstacle to doing business on a U.S. measure of contract dependence and a U.S. measure of input diversification controlling for regional fixed effects. More precisely, the observations are managers' assessments of the obstacles to doing business in 10 transition countries. The dependent variable takes value one if the manager declares that the factor is a very severe obstacle to doing business. Non-responses and refusals are treated as missing values. The wording of the question is: "As I list some factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment." Standard errors are clustered at the manufacturing sector level. * denote a significant estimate at the 10% level, ** at 5%, *** at 1%. Source: Authors' computations based on BEEPS 2009 (EBRD-WB), Nunn (2007).

Figure 3.5 and Figure 3.6 provide preliminary graphical evidence on the results of our identification strategy. In Figure 3.5, we split the industries into quintiles, according to their contract dependence. High corruption exposure industries are in the upper quintile, and low corruption exposure industries are in the lower quintile. For each region, we calculate the quality

of management practices in each of those two groups. We report their relationship with regional corruption on Figure 3.5. For both groups of firms, we regress management quality on regional corruption. For highly contract-dependent firms, regional corruption is associated with a significant decrease in management quality. By contrast, management quality appears to be almost completely independent of regional corruption for firms with low contract dependence. The difference of slopes between the two groups of firms is statistically significant at the 1% level.

Figure 3.5.a. Regional average corruption (proportion of firm sales paid as bribes)
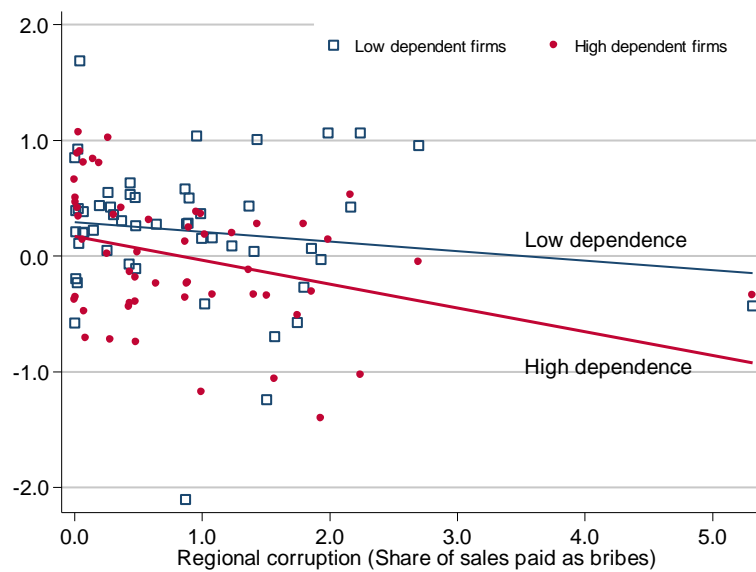
Figure 3.5.b. Regional household corruption (households' assessment of the frequency of bribes)
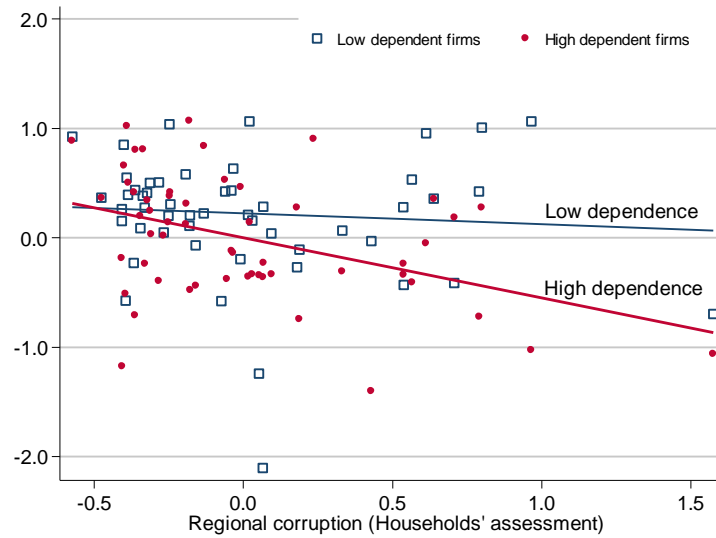
Figure 3.5 Management quality of high and low dependent to contract firms across regions

Note: High and low dependent to contract firms are the top and bottom quintile firms based on the U.S. measure of contract dependence. The figure plots average regional management quality for the highest and lowest quintile of the distribution of contract-dependent firms against corruption in the region. Each dot represents the average management quality in a region for the low dependence and high dependence groups. The two fitted lines represent the different effects of corruption on management quality for the low dependence and high dependence groups of firms. Source: Authors' computations based on MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), and Nunn (2007).

3.4.3   Impact of measurement error

The estimates of Specification 2 may be biased by two forms of measurement error. First, technological demand for firm inputs in transition countries may not be identical to the U.S. Second, regional corruption is imperfectly measured. Survey reports of corruption are likely to be approximate and partly based on the respondent's beliefs, since the corrupt practices are illicit and secretive. In a politically repressive environment, firms may use non-response or false response as a self-protection mechanism (Jensen et al., 2007). Firms may also respond to regional public sector corruption by avoiding to deal with government officials, and the amount of paid bribes can in this case understate the actual corruption levels (Olken and Barron, 2009; Sequeira and Djankov, 2011). In addition, the measures of regional corruption are not based on all firms or all households in the regions, as some firms and households have not been sampled, while others

have not responded to the questions on corruption. Both forms of measurement errors may result in biased estimates of the effects of regional corruption on management practices.

It could be objected that our measure of contract dependence, based as it is on U.S. data, constitutes an imperfect proxy for technological demand for different inputs within transition countries. We believe, however, that this concern is of limited importance since we focus solely on manufacturing industries (Rajan and Zingales, 1998), and use a disaggregated classification of industries that is capable of capturing similarly produced goods across different countries. However, it is also possible that differences in technologies between countries and between regions will produce bias in our difference-in-differences estimates. This type of measurement error might lead to under- or overestimating γ in Specification 2: U.S.-based proxies might mirror industry-specific effects and U.S. industry-specific idiosyncrasies. This measurement error may be correlated with certain regional industry characteristics. For instance, regions that are affected by lower levels of corruption may display industry characteristics that are similar to those of the U.S. manufacturing firms. This non-classical measurement error could well lead to the impacts of corruption being overstated (Ciccone and Papaioannou, 2007, 2010). By contrast, if U.S. industry idiosyncrasies are orthogonal to region-specific industry characteristics, that will produce an attenuation bias and lead to an underestimation of the real impact of corruption. To estimate consistently how corruption affects management quality imposes the use of a contract-dependence measure that avoids reflecting a given institutional environment. Accordingly, our baseline approach is to instrument the interaction term between contract dependence in U.S. manufacturing industries and regional corruption by using manufacturing dummies interacted with regional corruption. A simple rationale for these instruments is that they do not depend on the characteristics of U.S. manufacturing industries, or on specific characteristics of the regions in which manufacturing industries operate. More precisely, we use a 4-digit manufacturing industry sensitivity to contract institutions and more aggregated industry dummies[19]. The reduced form specification of the two stage least squares strategy is interesting in its own right.

It estimates the differential effect of corruption in manufacturing industry s,γ_s:

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[19] Ciccone and Papaioannou (2010) examine the case in which industry fixed effects and industry measures of dependence to corruption are measured at the same level of aggregation.

$$y_{isrc} = \sum_s \gamma_s . C_{rc}^* . 1_{i \in s} + x_{isrc} \beta + \alpha_{sc} + \delta_{rc} + \zeta_{isrc} \qquad (3)$$

where C_{rc}^* is a measure of corruption in region r. The estimator, γ_s, is consistent, when the number of regions is large. Here, we have 56 regions, the same number of observations as in most cross-country studies of industries (Ciccone and Papaioannou, 2010; Fisman and Love, 2007). We have s instruments and Equation 2 is overidentified. This allows for testing the validity of our instrumental variables' strategy.

The final variable needed to estimate the system of equations 2 and 3 is a measure of regional corruption, C_{rc}^*. In the baseline specification of Ciccone and Papaioannou (2007, 2010), C_{rc}^* is equal to C_{rc}. As argued in Section 3.2, our preferred measure is the proportion of annual sales, paid as bribes, from the 2009 BEEPS survey. The main advantage of this measure is the provision of a clear scale for the level of corruption. However, this corruption measure is subject to large measurement error. Therefore, we choose the household perception of corruption, from the LITS 2006, to compute our preferred instruments. The joint use of firm and household surveys has two main advantages. First, the household survey covers a less selected set of respondents, and its larger sample size may have a better representation at the regional level. Second, the use of independent reports from different surveys on corruption can lead to more consistent instrumental variable estimates if the measurement errors of the two surveys are uncorrelated (Ashenfelter and Krueger, 1994; Ammermueller and Pischke, 2009). The LITS measure of regional corruption is not directly related to firm perception or experience. Furthermore, household perceptions contain significant information about corruption (Olken, 2009). This strategy aims to overcome the benchmarking bias, caused by the fact that our measure of contract dependence is computed from U.S. input-output data, and the measurement error on the reporting of bribes as a proportion of sales.

3.5   Empirical results

3.5.1 Reduced form and main empirical estimates

We begin our empirical investigation by reporting the results of the reduced form Specification 3 (p. 138). We examine how each of these industries performs in terms of management quality, when regional corruption increases.

$$y_{isrc} = \sum_s \gamma_s . C_{rc}^* . 1_{i \in s} + x_{isrc}\, \beta + \alpha_{sc} + \delta_{rc} + \zeta_{isrc} \qquad (3)$$

Table 3.6 displays the results of simple F-tests for the differential effects of regional corruption by manufacturing industry. We test if the sensitivity of management practices to corruption is equal across manufacturing industries. More precisely, we test H_0 : for all s, $\gamma_s = \gamma$ in specification 3. The rejection of H_0 also implies that corruption has a significant effect on the management of manufacturing firms.

Table 3.6 reports the results of the F-tests for three industry classifications and two sets of control variables. We group manufacturing industries into industries based on the ISIC3.1 classification. Our preferred level of industry classification is the ISIC3.1 2-digit level, and we report, as robustness checks, the results of a coarser classification, and a more granular classification. In all specifications, the F-tests are clustered at the regional times the coarse manufacturing industry level. In all but two of the 18 specifications we estimate, we reject the null hypothesis of equal effect of corruption on management quality, at the 1% significance level. For the remaining two specifications, we reject the null hypothesis of equal effect of corruption, across manufacturing industries, at the 5% significance level. There is strong evidence that different manufacturing industries adopt different management practices in response to changes in regional corruption, and that regional corruption affects management practices.

Table 3.6 displays the estimated industry-specific sensitivities to corruption, as measured by the household assessment of the frequency of bribes, when dealing with public officials, from the LITS 2006. Panel A reports the estimates of industry sensitivity to corruption using a 2-digit classification on the solid line, while the vertical bars represent the 90% confidence interval. Manufacturing industries are ranked based on their sensitivity level to corruption, with more negative numbers indicating industries for which regional corruption has a higher impact on

management quality. Panel B displays similar estimates for a 3-digit classification. Each number corresponds to the relative impact, of the industry exposure to regional corruption, on managerial practices, estimated from equation 3. Manufacturing industries are ranked in a consistent order. Panel A ranges from the recycling and food industries, the two industries least affected by corruption, to the manufacturing of coke, refined petroleum products and nuclear fuel, and the manufacturing of medical, precision and optical instruments, watches and clocks, which are the two industries most affected by corruption. Similarly, Panel B, manufacturing of recycling and transport equipment, appears the least affected by regional corruption, while management quality in the industries of refined petroleum products, optical instruments, and photographic equipment, appears extremely sensitive to regional corruption. This provides evidence that the identification strategy we pursue in this chapter does not rely on a particular statistical specification.

Table 3.6 Non-parametric tests for differential effects of corruption within regions across manufacturing sectors

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10 manufacturing sectors						
F-test frequency of bribes	2.977			2.801		
(BEEPS 2009) [p-value]	[0.001]			[0.002]		
F-test frequency of bribes		2.796			2.805	
(LITS 2006) [p-value]		[0.002]			[0.002]	
F-test proportion of sales paid as bribes			2.776			2.027
(BEEPS 2009) [p-value]			[0.003]			[0.030]
R-square	0.203	0.197	0.198	0.235	0.231	0.231
Panel B. Controlling for 22 manufacturing sectors						
F-test frequency of bribes	1.800			1.682		
(BEEPS 2009) [p-value]	[0.017]			[0.031]		
F-test frequency of bribes		4.120			4.665	

(LITS 2006) [p-value]		[0.000]			[0.000]	
F-test proportion of sales paid as bribes			5.100			4.062
(BEEPS 2009) [p-value]			[0.000]			[0.000]
R-square	0.254	0.260	0.264	0.283	0.292	0.290
Panel C. Controlling for 59 manufacturing sectors						
F-test frequency of bribes	5.768			3.635		
(BEEPS 2009) [p-value]	[0.000]			[0.000]		
F-test frequency of bribes		7.908			4.471	
(LITS 2006) [p-value]		[0.000]			[0.000]	
F-test proportion of sales paid as bribes			9.377			14.75
(BEEPS 2009) [p-value]			[0.000]			[0.000]
R-square	0.362	0.366	0.373	0.386	0.391	0.398
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x 11 sectors)	385	385	385	385	385	385

Note: The table reports F-test and its p-value for the differential effect of corruption on manufacturing sectors within a region. Formally, the model is, $Y_{isrcs}=\alpha_s \cdot C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\varepsilon_{isrc}$, with λ_{sc} , manufacturing sector times country fixed effects, and δ_{rc} regional fixed effects. α_s is the measure of sensitivity to corruption of manufacturing sector s. C_{rc} is our measure of corruption and X_{isrc} a set of control variables. We test H0: for all s, $\alpha_s= \alpha$. The F-test is clustered at the regional x industry level. A p-value below 0.1 denotes a rejection of the null hypothesis of equal sensitivity to corruption at the 10% level, below 0.05 at 5%, below 0.01 at 1%, respectively.

1. Noise controls: interviewer characteristics (gender, a quadratic function in age, highest degree completed) and interview characteristics (7 dummies for the days of the week, 4 dummies for the time of the day - morning, lunch time, afternoon or evening -, the duration of the interview in minutes, and a quadratic trend in the date of the interview allowing for business cycle effects).

2. Additional control variables include a quadratic function of size (number of full-time employees), a dummy for unknown size, dummy variables by type of ownership, dummy variables by size of municipality and a dummy variable if the establishment is part of a larger firm. Source: Authors' computations based on MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB).

Table 3.7 makes use of the differential effects of corruption across manufacturing industries to implement our difference-in-differences identification strategy. We assume that industries that are more dependent on contracts will be more affected by regional corruption, and

that this dependence is fully captured by our U.S. measure of dependence to institutions. We report the estimated interactions between the U.S. industry dependence on institutions and the three different measures of regional corruption, according to Specification 2. Column 1 starts with the managers' assessment of corruption frequency in the interaction of their firms with public officials. Columns 2 and 3 include the household assessment of the frequency of corruption and the proportion of annual sales paid in bribes, as reported by managers. Columns 3 to 6 report the estimates of the same interaction terms but control for a set of interview, interviewer and firm characteristics. Panels A to C display the estimates using a coarse-grained industry classification, and the 2-and 3-digit ISIC3.1 classifications, respectively. In all specifications, the estimated effect of corruption on average management practices is more negative for firms that are more dependent on contractual institutions. The coefficients here can be interpreted as the effect of regional corruption for those firms whose dependence on contracts equals 1. As the average contract dependence is 89%, the estimates are naturally larger than those of the simple OLS specifications reported in Table 4. Evaluated at the mean value of contract dependence, our estimates suggest that an increase of one standard deviation in the frequency of regional corruption translates into approximately 0.6 standard deviation decrease in management quality (-0.43 x 0.89 x 1.50, Panel B, Column 5). The effect of regional corruption measured by the proportion of sales paid as bribes is slightly smaller. A one standard-deviation increase in this measure of corruption is associated with a decrease in management quality of 0.4 standard deviation (0.93 x 0.89 x 0.47, Panel B, Column 6). Compared to our descriptive specifications, our difference-in-differences specification leads to a larger estimated effect of corruption on management practices. For example, an increase of one standard deviation of household assessment of corruption was associated with a decrease in management quality by around 1/10 standard deviation (0.43 x 0.25, Table 3.4, Panel D, Column 5).

Remarkably, the inclusion of extra controls only translates into very minor shifts in the coefficients of our corruption variables (Table 3.4, Panels A to C). Since our data is non-experimental, the possibility of industry shocks being correlated with contract dependence could be a source of concern. However, we find that accounting flexibly for most industry-country shocks (i.e. shocks that affect firms differently at the most detailed industry classification) seems to have a negligible effect on our estimates. This suggests that contract dependence is in practice a source of variation, which is separate from other industry-specific shocks. This fact, and the

evidence presented above that contract-dependent firms do not tend to overreport other aspects of the industry environment as business barriers, reinforces our belief that we are estimating the causal effect of corruption on management practices.

Table 3.7 Difference-in-differences estimates by contract-dependence of the manufacturing sectors (same note as table above)

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-0.618			-0.682		
x Contract dependence	(1.158)			(1.269)		
Frequency of bribes (LITS 2006)		-1.451***			-1.583***	
x Contract dependence		(0.551)			(0.579)	
Proportion of sales paid as bribes			-0.722**			-0.719**
x Contract dependence			(0.286)			(0.313)

	(1)	(2)	(3)	(4)	(5)	(6)
R-square	0.191	0.193	0.193	0.225	0.226	0.226
Panel B. Controlling for 22 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-1.106			-1.195		
x Contract dependence	(1.156)			(1.252)		
Frequency of bribes (LITS 2006)		-1.406***			-1.507***	
x Contract dependence		(0.529)			(0.561)	
Proportion of sales paid as bribes			-0.529*			-0.465
x Contract dependence			(0.312)			(0.346)
R-square	0.244	0.245	0.244	0.273	0.275	0.274
Panel C. Controlling for 59 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-0.252			-0.242		
x Contract dependence	(0.906)			(1.091)		
Frequency of bribes (LITS 2006)		-1.438**			-1.559**	
x Contract dependence		(0.688)			(0.720)	
Proportion of sales paid as bribes			-0.511			-0.445
x Contract dependence			(0.395)			(0.446)
R-square	0.343	0.345	0.344	0.367	0.369	0.368
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions xindustry)	386	386	386	386	386	386

Table 3.8 reports the estimates of our difference-in-differences specification correcting for the benchmarking bias, from the use of U.S. industry dependence to contracts. In this instrumental variable specification, the point estimates are all negative, statistically significant, and of similar magnitude to the estimates reported in Table 3.7 that did not correct for the U.S. benchmarking bias. It is important to estimate this specification because if manufacturing industries, in low corruption regions share more similarities with U.S. manufacturing industries compared to manufacturing industries in high-corruption regions, the previous OLS estimates could be upward biased. We are confident that our instruments appear relevant and valid. In all specifications, the instruments exhibit a strong correlation with the endogenous regressor. The First-stage F-statistics are above 15 and the Kleibergen-Paap tests reject the null hypothesis of weak instruments at the 1% level. Therefore, weak instrument biases are unlikely to be a concern (Stock et al., 2002). Furthermore, we fail to reject the null hypothesis of the Hansen-test with large p-values, above 0.4. There is no evidence that our instruments are invalid or that there is strong heterogeneity in the effect of corruption across manufacturing industries (Angrist and Pischke, 2008). This approach yields stronger evidence that regional corruption tends to lead to the deterioration of management quality in manufacturing industries. Even if regional corruption may be measured with some error, we find strong empirical evidence that it matters for management practices.

Table 3.8 Difference-in-differences estimates by contract-dependence of the manufacturing sectors correcting for U.S. benchmarking bias

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-1.080			-1.138		
x Contract dependence	(0.767)			(0.847)		
Frequency of bribes (LITS 2006)		-1.207***			-1.288***	
x Contract dependence		(0.429)			(0.454)	
Proportion of sales paid as bribes			-0.467**			-0.462**
x Contract dependence			(0.212)			(0.222)
Panel B. Controlling for 22 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-2.651**			-1.406*		
x Contract dependence	(1.276)			(0.723)		
Frequency of bribes (LITS 2006)		-1.259***			-1.239***	
x Contract dependence		(0.399)			(0.420)	
Proportion of sales paid as bribes			-0.575**			-0.504**
x Contract dependence			(0.231)			(0.248)
Panel C. Controlling for 59 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-0.837			-1.259		
x Contract dependence	(0.728)			(1.009)		
Frequency of bribes (LITS 2006)		-1.358***			-1.419***	
x Contract dependence		(0.412)			(0.433)	
Proportion of sales paid as bribes			-0.516**			-0.445*
x Contract dependence			(0.245)			(0.263)
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: The table reports the estimates of the equation $Y_{isrc}=\alpha.exp_s.C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\epsilon_{isrc}$, with λ_{sc}, manufacturing sector times country fixed effects, and δ_{rc}, regional fixed effects. Exp$_s$ is the measure of sensitivity to corruption computed using the U.S. input-output table. C_{rc} is the regional proportion of sales paid as bribes and X_{isrc} a set of control variables. We control for the U.S. benchmarking bias by instrumenting

the interaction term, $\exp_s \cdot C_{rc}$, using a full set of manufacturing sector dummies interacted with regional corruption. 1. Noise controls: interviewer characteristics (gender, a quadratic function in age, highest degree completed) and interview characteristics (7 dummies for the days of the week, 4 dummies for the time of the day - morning, lunch time, afternoon or evening -, the duration of the interview in minutes, and a quadratic trend in the date of the interview allowing for business cycle effects).

2. Additional control variables include a quadratic function of size (number of full-time employees), dummy variables by type of ownership, by age of the establishment, by size of municipality, and a dummy variable if the establishment is part of a larger firm.

Table 3.9, panel A presents our preferred empirical estimates that correct for the measurement error on our preferred measure of corruption, the average proportion of sales paid as bribes. More precisely, we instrument the interaction between (U.S. measures of) dependence to corruption, and the average proportion of sales paid as bribes in the region, using industry dummies interacted with the household perception of regional corruption. Therefore, the specification controls for both the benchmarking bias, stemming from using U.S. manufacturing industry dependence to institutions as a proxy for industry specific characteristics, and the measurement error on the proportion of sales paid as bribes. All the point estimates of the interaction term are nearly five times larger than in Table 3.8 that did not account for measurement error on regional corruption. The standard errors are also larger. This indicates that the estimates of a simple difference-in-differences specification are likely to suffer from attenuation bias. The estimates are stable across specifications between -1.80 and -2.60. To evaluate more precisely the magnitude of the estimates, we compare the industry in the first quartile of dependence on corruption (low dependence, 0.88) with a typical industry in the third quartile of dependence (0.97). The average estimate of corruption of -2.5 predicts that the management quality of a more contract-dependent industry would decrease by 0.5 points more than the management quality of a less dependent industry, if regional corruption increases from the level of North to West Ukraine. This represents a large differential from the median Ukrainian firm in terms of management quality to the upper quartile firm. In comparison with other factors that may affect management quality, the effect of corruption is substantial and plausible.

Panel B explores how robustly our estimates stand up to some additional changes in our difference-in-differences specifications. At the national level, corruption correlates highly with increased economic development (La Porta et al., 1997; Ades and Di Tella, 1999; Treisman, 2000,

2003). If institutionally dependent industries are also more dependent on the level of education in the workforce, and if regional corruption is correlated with education, our estimates could be biased. We therefore add three interaction terms between our U.S. measure of dependence on contractual institutions and regional education, inter-individual trust, and the proportion of the population aged 15 to 65, that is out of the labor force or unemployed. The point estimates and standard errors of these specifications, which include additional controls, are very similar to those reported in Panel A. To further confirm that our results are not driven by product market competition, we estimated regressions controlling for that phenomenon. We used the managers' self-reported measure of the number of their competitors coded as five dummy variables, namely for unknown number, no competitor, one, two to five, and more than five competitor firms. The answers represent 6.9, 3.9, 3.5, 30.2, and 55.5% of the sample, respectively. The results led to exactly the same conclusions as those presented here, and are therefore omitted. A likely reason that this modification did not produce significant changes to the results is that the manufacturing industry-country fixed effects capture most of the variation in product market competition.

Our empirical findings are strongly supported by the theoretical model of Acemoglu et al. (2007), which predicts that contract-dependent firms will have lower productivity, and undertake less investment, in regions with ineffective contract legislation and enforcement. This issue may be particularly strong in transition countries where the markets of intermediate goods are thin (Blanchard and Kremer, 1997). In the absence of alternative suppliers, firms may not be able to avoid the detrimental effects of corruption on the enforcement of the contracts. Indeed, alternatives to formal contracts such as informal contracts and reputation games would require downstream firms to have many potential input suppliers. More generally, our estimates of the impact of corruption on management practices corroborate the findings of Sequeira and Djankov (2011), who find that corruption significantly affects the production choices of firms. In the context of bribery payments at African ports, they find that firms are willing to use alternative road trips and pay higher (real) trucking costs to avoid having to pay higher bribes.

Table 3.9 Difference-in-differences estimates instrumenting the proportion of sales paid as bribes by household's perception of regional corruption

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10, 22 and 59 manufacturing sectors						
Proportion of sales paid as bribes						
x Contractual dependence	-1.831*	-1.985*	-3.026**	-2.895**	-2.084*	-2.288*
(Nunn, 2007)	(1.075)	(1.143)	(1.321)	(1.310)	(1.192)	(1.298)
F-test (First stage)	1.704	0.829	0.981	0.863	3.036	1.800
Kleibergen-Paap	13.44	9.967	18.26	16.81	49.45	43.64
Hansen J-statistics	8.059	10.27	26.62	27.54	53.47	51.55
Panel B. Adding regional controls						
Proportion of sales paid as bribes	-2.525*	-2.617*	-3.439**	-3.186**	-2.529**	-2.274*
x Contractual dependence (Nunn, 2007)	(1.306)	(1.381)	(1.523)	(1.487)	(1.258)	(1.185)
Primary education or below	3.079	2.836	0.483	0.771	-1.075	-1.608
x Contractual dependence	(2.509)	(2.579)	(3.690)	(3.654)	(2.960)	(2.908)
Unemployed or out of labor force	-11.879**	-11.459*	-18.243*	-17.161*	-9.466	-7.628
x Contractual dependence	(5.950)	(6.123)	(9.313)	(9.254)	(6.986)	(6.909)
Inter-individual trust	1.508*	1.574*	-1.878	-1.935	-0.706	-1.012*
x Contractual dependence	(0.797)	(0.852)	(1.184)	(1.187)	(0.540)	(0.601)
F-test (First stage)	0.902	0.934	0.605	0.546	2.024	1.208
Kleibergen-Paap	14.14	16.36	15.43	14.07	41.35	35.68
Hansen J-statistics	7.795	8.087	23.09	23.99	50.45	50.36
11 Industries x country fixed effects	Yes	Yes				
22 Industries x country fixed effects			Yes	Yes		
59 Industries x country fixed effects					Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Additional control variables		Yes		Yes		Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: Same note as table above. Source: Authors' computations based on the MOI survey, BEEPS 200, LITS 2006 (EBRD-WB), Nunn (2007).

3.5.2　Robustness check and heterogeneity of the effect

One potential problem with the previous analysis is that our measures of regional corruption are affected by sampling errors. When we work on the full sample, the 2SLS estimate is much larger than the OLS estimate (-0.464 and -3.014) even though the difference between the two estimates is not significant. This result may be due to measurement error on the usual proportion of sales paid as bribes, if the regional proportion of sales paid as bribes is biased by the small number of firms interviewed in the BEEPS survey. Classical measurement error would result in an attenuation bias on the OLS estimator. Assuming that the variance in the error affecting our measurement of regional corruption decreases with the number of firms interviewed in the BEEPS survey, the bias should decrease with the number of firms observed in the region. If this interpretation is correct, the difference between the OLS and the 2SLS estimates should also decrease when focusing on regions in which more firms were interviewed for the BEEPS survey.

Table 3.10 provides a comparison of OLS and 2SLS estimates using the same instruments as in Table 3.9 (i.e., household assessment of regional corruption interacted with manufacturing industry dummy variables), but restricts the sample to regions with at least 19 and 49 firms that were interviewed during the BEEPS survey. However, the OLS and 2SLS estimates remain nearly unchanged when we restrict the sample to these regions (even though the 2SLS estimator becomes more imprecise as the number of observations becomes smaller). Therefore, our estimates do not appear driven by regions where our measure of corruption is based on a small number of respondents. We further confirm this result by investigating the sensitivity of our estimates to the inclusion of specific countries. We jackknife the sample of countries excluding a country at a time and re-estimate our preferred difference-in-differences specification using OLS and 2SLS as in Table 3.9 and Table 3.10 (Columns 1 and 2). The point estimates are always negative and highly statistically significant for OLS and 2SLS (Figure 3.7, Panels A and B). However, the magnitude of the point estimates is sensitive to the inclusion of two of the survey countries. Specifically, suppressing Uzbekistan makes the magnitude of the estimates significantly larger for both OLS and 2SLS, while suppressing Romania reduces partly the estimated effect through 2SLS. We interpret this pattern as evidence that our estimates are not driven by some country specific factors.

Table 3.11 investigates the heterogeneity of the effect of corruption on management quality. Bloom et al. (2009) and Bloom et al. (2012) argue that foreign-owned establishments may be less impacted by regional factors and contribute to spreading the management practices of their headquarters to branches. If this relationship holds, we would expect the coefficient of our interaction term between contract dependence and regional corruption to be closer to zero for establishments that belong to multinational companies. Indeed, our findings indicate that foreign-owned establishments are on average better managed than domestic companies. However, the management quality of foreign companies is also affected by regional corruption in the same way that the management quality of domestic firms is. Similarly, we do not find significant differences in the effect of corruption on management quality between government-owned and other firms, and between large (above 250 full-time employees) and smaller firms. The negative effect of corruption on management quality remains significant across firms.

Figure 3.7.a OLS estimates
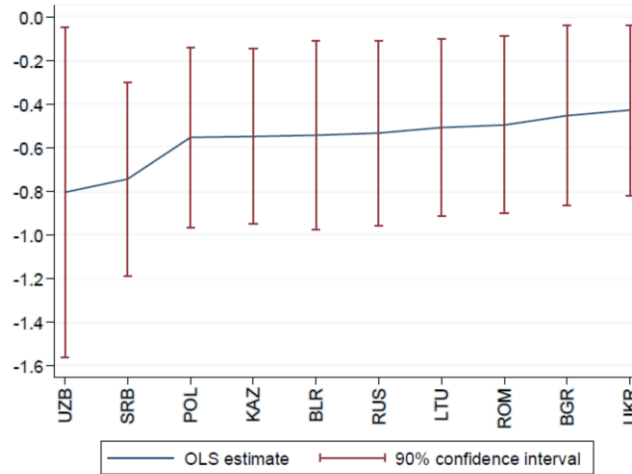
Figure 3.7.b 2SLS estimates
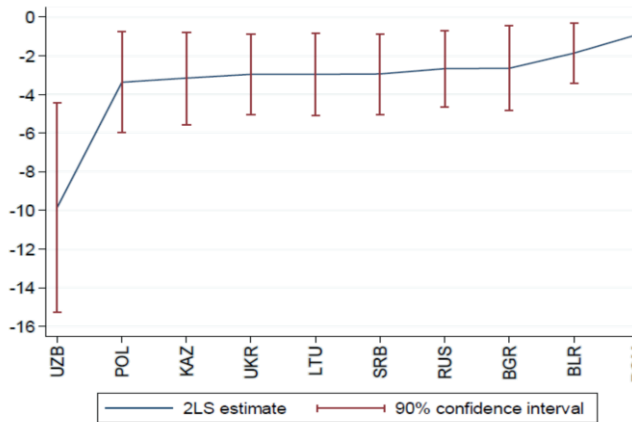
Figure 3.6 Sensitivity analysis: estimated effects of corruption using the difference-in differences

<u>Note:</u> The figure reports the estimates of the equation $Y_{isrcs}=\alpha.exp_s.C_{rc}+X_{isrc}\ \beta+\lambda_{sc}+\ \delta_{rc}+\ \varepsilon_{isrc}$, with λ_{sc} , manufacturing sector times country fixed effects, and δ_{rc} regional fixed effects. Exps is the measure of sensitivity to corruption computed using the U.S. input-output table. Crc is the regional proportion of sales paid as bribes and X_{isrc} a set of control variables. The specification is estimated by OLS and 2SLS as in Tables 10 and 11. The countries are dropped one by one. <u>Source:</u> Authors' computations based on MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), Nunn (2007).

Table 3.10 Difference-in-differences estimates of the effect of corruption, different controls

Dependent variable:	Average quality of management practices		
	Full sample	BEEPS firms in the	BEEPS firms in the

	OLS	2SLS	region > 19 OLS	2SLS	region > 49 OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Controlling for 22 manufacturing sectors						
Proportion of sales paid as bribes						
x Contract dependence	-0.464*	-3.014**	-0.493*	-2.825**	-0.395	-2.938**
(Nunn, 2007)	(0.271)	(1.366)	(0.273)	(1.279)	(0.272)	(1.473)
F-test (First stage)		1.368		0.850		0.976
Kleibergen-Paap [p-value]		16.99		16.41		19.63
Hansen J-statistics [p-value]		22.27		30.12		29.06
22 Industries x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: The table reports the estimates of the equation $Y_{isrc}=\alpha.exp_s.C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\varepsilon_{isrc}$, with λ_{sc}, manufacturing sector times country fixed effects, and δ_{rc}, regional fixed effects. Exp_s is the measure of sensitivity to corruption computed using the U.S. input-output table. C_{rc} is the regional proportion of sales paid as bribes and X_{isrc} a set of control variables. We control for the U.S. benchmarking bias by instrumenting the interaction term, exps. C_{rc}, using a full set of manufacturing sector dummies interacted with household assessment of corruption.

1. Noise controls: interviewer characteristics (gender, a quadratic function in age, highest degree completed) and interview characteristics (7 dummies for the days of the week, 4 dummies for the time of the day - morning, lunch time, afternoon or evening -, the duration of the interview in minutes, and a quadratic trend in the date of the interview allowing for business cycle effects).

2. Additional control variables include a quadratic function of size (number of full-time employees), dummy variables by type of ownership, by age of the establishment, by size of municipality, and a dummy variable if the establishment is part of a larger firm.

Source: Authors' computations based on the MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), Nunn (2007).

Table 3.11 Variation in the difference-in-differences estimates of the effect of corruption across different firms

Dependent variable:	Average quality of management practices					
	Foreign-owned establishments		Large establishments > 249 employees		State-owned establishments	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Controlling for 22 manufacturing sectors						
Proportion of sales paid as bribes						
x Contract dependence	-0.591*	-3.719**	-0.578*	-2.876*	-0.616**	-3.334**
(Nunn, 2007)	(0.311)	(1.970)	(0.306)	(1.603)	(0.306)	(1.816)
x…………x Foreign-owned	-0.051	0.245				
	(0.085)	(0.347)				
x…………x Large firm			-0.108	-0.083		
			(0.095)	(0.203)		
x…………x State-owned					-0.050	0.210
					(0.163)	(0.461)
Foreign-owned establishment	0.205	-0.050				
	(0.131)	(0.287)				
Large establishment (> 249 employees)			0.302***	0.275*		
			(0.109)	(0.157)		
State-owned establishment					-0.033	-0.335
					(0.207)	(0.450)
F-test (First stage)		1.013		1.044		0.782
Kleibergen-Paap [p-value]		25.87		27.99		29.86
Hansen J-statistics [p-value]		41.88		49.92		43.64
22 Industries x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: The table reports the estimates of the equation $Y_{isrc}=\alpha.exp_s.C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\varepsilon_{isrc}$, with λ_{sc}, manufacturing sector times country fixed effects, and δ_{rc}, regional fixed effects. Exp_s is the measure of sensitivity to corruption computed using the U.S. input-output table. C_{rc} is the regional proportion of sales paid as bribes and X_{isrc} a set of control variables. We control for the U.S. benchmarking bias by instrumenting the interaction term, $exp_s. C_{rc}$, using a full set of manufacturing sector dummies interacted with household assessment of corruption.

1. Noise controls: interviewer characteristics (gender, a quadratic function in age, highest degree completed) and interview characteristics (7 dummies for the days of the week, 4 dummies for the time of the day - morning, lunch time, afternoon or evening -, the duration of the interview in minutes, and a quadratic trend in the date of the interview allowing for business cycle effects).

2. Additional control variables include a quadratic function of size (number of full-time employees), dummy variables by type of ownership, by age of the establishment, by size of municipality, and a dummy variable if the establishment is part of a larger firm.

Source: Authors' computations based on the MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), Nunn (2007), and.

3.6   Detailed management practices, centralization and firm performance

In this section, we proceed to a detailed investigation of management practices in our secondary quest to determine management quality: the monitoring of the production process, the presence of medium to long-run targets, the presence of sufficient incentives in human resources policy, and the efficiency of the production process in the establishment. These various categories of management practice are not independent one of the other. For example, HR (Human Resource) policies are related to closer output monitoring, and to how often and how many production performance indicators are generated. We also relate regional corruption to an establishment's decision-making process. Finally, although our principal focus is the impact of corruption on management quality, we also investigate the effects of corruption on more directly measurable aspects of firm performance.

3.6.2   Detailed management practices

Table 3.12 reports the estimates for the aggregate index of monitoring in the production process. This aggregate index takes into account the number of performance indicators monitored in each establishment and shows how extensive is the monitoring of how effectively a company is achieving its various business objectives, and their review frequency by top and middle managers. Panel A reports OLS estimates of the descriptive specification 1, while Panel B reports OLS estimates of the difference-in-differences specification 2, and Panel C reports the instrumental variable estimates of specification 2 that control for the U.S. benchmarking bias. We focus on the household perception of corruption based on the frequency of bribes reported by households in the LITS survey. This is because the household measure of corruption is regionally representative,

whereas the firm measure is more subject to sampling error. This is because the regional estimates based on the BEEPS survey are based on fewer observations: 93 managers versus, on average, 165 households in the LITS. There is a negative correlation between regional corruption and monitoring in the production process (Column 1, Panel A). This negative relationship is also observed between, contract dependence and monitoring. More highly contract-dependent firms, in more corrupt regions, appear to have significantly reduced levels of monitoring of the production process (Column 1, Panels B and C).

A significant absence of formal maintenance procedures, of quality control methods and of inventory may be related to weak development strategies and an inability to set targets. Column 2 of Table 3.12 investigates the relationship between corruption and the setting of production targets. We investigate how far managers of an establishment lay down a time frame for the production targets of their principal product. This time frame covers both short-term (less than one year) and short- and long-term (more than three years) production targets that are set simultaneously or independently. Firms' exposure to corruption seems to be associated with the lack of a time frame for production targets for the main product. This finding could be linked to the negative impact of corruption on the monitoring quality, the review and coverage of monitoring indicators, which are a valuable tool for the setting of long-term targets. Firms that operate under the burden of a corrupt environment conceivably have a pressing incentive to avoid monitoring their production processes, simply because the non-availability of this information could decrease the risk of public officials approaching them to extort still higher bribes. At the same time, there could be an increased likelihood of undetected theft in firms that implement only limited monitoring and possess only low-quality data systems measuring production performance indicators and general outputs and inputs (Bloom et al., 2011).

We then investigate the components of human resource management to detect which specific human resource policies are the most affected by corruption. Columns 3–6 of Table 3.12 show calculations of the relationship between corruption, a general index of worker incentives, workforce turnover, and the educational levels of both production workers and administrative employees (including managers). The general index of worker incentives we use aims to capture a) how rewards are distributed when production targets are achieved (i.e., no rewards; only top and middle management is rewarded; all staff is rewarded); b) the establishment's main policy toward

employees who fail to meet output expectations (i.e., rarely or never moved from their current position; not removed for at least a year before action is taken; rapidly moved and retrained and dismissed if showing no improvement); and c) the rewards for the highest-performing employees. Judging by the figures in column 3, corruption appears related to the ease or difficulty of removing an employee from a position and an overall lack of an employment policy based on individual merit. However, the point estimates are not statistically significant at the 10% level when we consider the difference-in-differences specifications of Panels B and C.

Column 4 investigates the relationship between workforce turnover (measured as the proportion of employees that quitted the establishment over the last administrative year) and corruption. Consistent with a lack of incentives and rewards, contract-dependent firms have higher workforce turnover in more corrupt regions (Column 4, Panels B and C). This could mean that the effect from the lack of rewards for well performing employees dominates the effect from the lack of sanctions for employees, who do not meet managers' expectations. Columns 5 and 6 provide additional support for this interpretation. They examine the relationship between corruption and the human capital in the firm, measured as the proportion of employees with a college degree. More contract-dependent firms have a lower educated workforce in more corrupt regions. In particular, the proportion of administrative employees, including managers with a college degree, is significantly lower for contract-dependent firms in more corrupt regions (Column 6). The results are in line with the negative association between corruption and the quality of human resource policies in the public sector. The adoption of incentive policies and closer monitoring may deter corrupt practices by public officials (Olken and Pande, 2011).

Table.3.13 Column 1 looks at another dimension of management practices, namely, that of process management. Our finding is that there exists a negative—though insignificant—relationship between exposure to corruption and the aforementioned process management. This may be caused by the small degree of variation in managers' answers. Specifically, process management corresponds to the types of action taken when process problems arise. In this question, an overwhelming majority of managers (97%) replied that in the event of process problems occurring action is taken and preventive measures are put in place. Unfortunately for our analysis, the question omits other meaningful aspects of process management, for instance,

the time taken to resolve the problem or the frequency of occurrence of delays, which could provide us with a more rounded perspective on the effects of a corrupt environment.

Table 3.12 Corruption and different forms of management practices

Dependent variable: Average quality of management practices

	Monitoring	No target	Incentives	Turn-over	Proportion of college graduates	
					Production workers	Administrative workers
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 11 manufacturing sectors OLS						
Frequency of bribes	-1.057***	-0.011	-0.224**	0.141	0.087***	0.061
(LITS 2006)	(0.091)	(0.019)	(0.099)	(1.603)	(0.029)	(0.037)
R-square	0.237	0.114	0.180	0.126	0.244	0.259
# Observations	1354	1336	1354	1214	1201	1227
# clusters (regions)	56	56	56	56	56	56
Panel B. Controlling for 11 manufacturing sectors DID OLS						
Frequency of bribes	-1.876**	0.289***	-0.336	9.764*	-0.186	-0.378**
x Contractual dependence	(0.866)	(0.092)	(0.542)	(5.682)	(0.136)	(0.186)
R-square	0.241	0.193	0.180	0.174	0.294	0.317
# Observations	1354	1336	1354	1214	1201	1227
# clusters (regions x industry)	386	386	387	369	367	370
Panel C. Controlling for 11 manufacturing sectors DID-IV						
Frequency of bribes	-1.862***	0.303***	-0.266	8.229	-0.179	-0.367**
x Contractual dependence	(0.696)	(0.087)	(0.479)	(5.014)	(0.113)	(0.153)
F-test (First stage)	92.16	59.97	89.40	99.86	103.5	86.39
Kleibergen-Paap	37.36	32.47	36.09	30.85	33.14	34.23
Hansen J-statistics	10.61	13.65	10.82	3.378	16.45	13.25
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1354	1336	1354	1214	1201	1227
# clusters (regions x industry)	386	386	387	369	367	370

Note: The table reports the estimates of the equation $Y_{isrc}=\alpha.exp_s.C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\varepsilon_{isrc}$, with λ_{sc}, manufacturing sector times country fixed effects, and δ_{rc}, regional fixed effects. Exp_s is the measure of

sensitivity to corruption computed using the U.S. input-output table. C_{rc} is our measure of corruption and X_{isrc} a set of control variables. We control for the U.S. benchmarking bias by instrumenting the interaction term, exps.C_{rc}, using a full set of manufacturing sector dummies interacted with regional corruption.

1. Noise controls: interviewer characteristics (gender, a quadratic function in age, highest degree completed) and interview characteristics (7 dummies for the days of the week, 4 dummies for the time of the day - morning, lunch time, afternoon or evening -, the duration of the interview in minutes, and a quadratic trend in the date of the interview allowing for business cycle effects).

2. Additional control variables include a quadratic function of size (number of full-time employees), dummy variables by type of ownership, by age of the establishment, by size of municipality, and a dummy variable if the establishment is part of a larger firm.

3.6.3   Centralization

We next investigate internal policies underpinning how firms implement decisions. We define centralization as a measure of hierarchy and decision making in which responsibility for the firm's activities and any decision-making processes are concentrated in the hands of the group of managers, and not diffused among production employees. From Table 3.13 Column 2, it can be observed that, in contract-dependent firms, corruption produces a higher concentration of decision-making processes at managerial level compared to what occurs in less contract-dependent firms. The association between such definite decision process centralization and regional corruption is economically sizable. For a firm with median contract dependence, a one standard-deviation increase in regional corruption would be associated with a 0.4 standard-deviation increase in the centralization of the decision process (0.43 x 0. 93 x 0.26/0.26=0.40, Column 2, Panel C). This finding tends to confirm that, in regions where corruption is prevalent, structures that are more conservative and centralized have a tendency to linger on, while the delegation of responsibilities could be severely restricted to a totally closed network such as family members (Bloom and Van Reenen, 2010).

3.6.4   Firm performance

Table 3.13 Columns 3 to 6 investigate what direct impact corruption has on other aspects of resource allocation within firms and firm performance as derived from the MOI survey. Our finding is that corruption has a tendency to reduce innovation, as measured by two dummy variables, namely, first, whether a new product or service has been introduced in the course of the last three years, and, second, the likelihood of R&D investment having taken place over the last

fiscal year. More highly contract-dependent firms show lower innovation levels and undertake less R&D investments in more corrupt regions (Columns 3 and 4, and Panels B and C, respectively). This conclusion accords with Acemoglu et al.'s (2007) theoretical model, which predicts that in regions with greater levels of corruption and of contract incompleteness establishments will adopt less advanced technologies, and, moreover, that this will be the case more often in the more highly contract-dependent industries. As described by Acemoglu et al. (2007), contract institutions can then generate endogenous comparative advantage differences across regions. Our empirical findings are entirely consistent with this theoretical framework, since they show that the more highly contract-dependent firms situated in regions where corruption is more rampant tend to have relatively smaller markets. As proof of this, managers report that sales of their firms' principal product are largely confined to the same municipality in which the establishment is located rather than extending also to the national or international market (Column 5). On average, 21.3% of the managers state that the establishment's main market is local, 54.2% state that it is national, and 23.4% state that it is international. This effect appears mainly driven by a lack of competitiveness of contract-dependent firms on export markets (Column 6). The magnitude of the effect is economically sizable. When the household perceptions of the frequency of bribes increase by one standard-deviation (0.43), the estimate of Column 6 Panel C predicts that a firm at the last decile of contract dependence (0.98) would become by 11 percentage points less likely to mainly export its products to foreign markets compared to a firm at the first decile of contract dependence (0.68). As no more than 23.4% of the establishments export their main product, it becomes clear that corruption substantially shapes the manufacturing structure of regional exports. The two latter findings confirm the results observed in international trade patterns. Nunn (2007) and Chor (2010) find that countries with better contract enforcement export relatively more in industries that require relationship-specific investments.

Table 3.13 Corruption and different forms of management practices

	Oper- ations (1)	Central- ization (2)	Innovation (3)	R&D spending (4)	Main market	
					Regional (5)	International (6)
Panel A. Controlling for 11 manufacturing sectors OLS						
Frequency of bribes	-0.004	-0.066***	0.030	-0.021	-0.036	0.011
(LITS 2006)	(0.040)	(0.024)	(0.045)	(0.039)	(0.055)	(0.035)
R-square	0.233	0.163	0.184	0.219	0.209	0.369
# Observations	1354	1355	1348	1320	1343	1343
# clusters (regions)	56	56	56	56	56	56
Panel B. Controlling for 11 manufacturing sectors DID OLS						
Frequency of bribes	-1.101***	0.317**	-0.843***	-0.735***	0.919***	-0.945***
x Contractual dependence	(0.199)	(0.135)	(0.232)	(0.253)	(0.237)	(0.184)
R-square	0.212	0.246	0.234	0.254	0.263	0.408
# Observations	1351	1355	1348	1320	1343	1343
# clusters (regions x industry)	385	386	385	382	385	385
Panel C. Controlling for 11 manufacturing sectors DID-IV						
Frequency of bribes	-0.679	0.263**	-0.787***	-0.655***	0.859***	-0.863***
x Contractual dependence	(0.553)	(0.114)	(0.195)	(0.229)	(0.202)	(0.150)
F-test (First stage)	89.79	92.13	93.10	96.28	90.26	90.26
Kleibergen-Paap	36.20	37.36	37.83	36.02	36.38	36.38
Hansen J-statistics	10.61	19.93	8.12	7.85	8.77	11.55
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	1351	1355	1348	1320	1343	1343
# clusters (regions x industry)	385	386	385	382	385	385

3.7   Conclusion

In this chapter, we have provided empirical statistical evidence demonstrating incontrovertibly that corruption has a deleterious effect on the quality of firm management practices. One finding, which we believe to be of major importance, is that more highly contract-dependent firms, when operating in a corrupt business environment, will adopt less efficient management practices. For example, an increase in regional corruption from the level observed in West Ukraine to the level observed in East Ukraine would decrease the management quality of a typical establishment (one which has median contract dependence) by roughly *one* standard deviation. Such an effect is clearly large, albeit imprecisely estimated. Moreover, we believe that, if anything, we are considerably underestimating the effect of corruption on management practices. Generally, we would expect state-level corruption to be a particularly powerful driver of firm behaviors. Our study focuses, however, only on regional corruption, an important if only partial measure of corruption.

We have argued that our findings confirm that exposure to corruption is driven by a corrupt judicial system and contract dependence and not other omitted factors correlated with

industry contract dependence. Specifically, more highly contract-dependent firms do not appear more likely to state that other aspects of the business environment represent significant obstacles. Hence, comparing firms of the same region that are differently affected by corruption, and particularly corruption in courts, based on their dependence on contracts should be an effective way of dealing with the possible endogeneity concern that firms may engage in corrupt practices as a result of a dysfunctional institutional environment. As an alternative to our difference-in-differences specification estimated by OLS, we also present 2SLS estimates that control for measurement error on our measures of corruption and contract dependence. The 2SLS estimates are larger than our OLS estimates.

In relation to the theoretical framework, the third chapter evaluates in more depth the effect of regional corruption, depicting corruption embedded in society, on management practices displaying resource allocation within firms through the formal institutional channels of rule of law and governance. In regions when corruption is high, judicial quality is compromised, and the enforcement of contracts is weakened rendering contract-dependent firms more exposed to corruption, resulting in poor resource allocation decisions in terms of different aspects of management. The real-world impacts of corruption seem both to permeate management practices and to impact firms' resource allocation decisions and internal structure. The more corrupt the region is, the less likely are highly contract-dependent firms to monitor their processes, or to set production targets; conversely, they tend to be substantially more centralized than less contract-dependent firms, and take on administrative employees with lower levels of education. Additionally, corruption has a manifest effect on firm development and performance. Regional corruption is associated with lower levels of innovation and R&D investment, and lower export prospects for contract-dependent firms.

A drawback of our investigation is the cross-sectional nature of our data since management quality is only available for a single year. In addition, the study focuses on a specific channel through which corruption affects firms' resource allocation decisions, namely, contract dependence. It would be interesting to investigate additional institutional channels through which corruption can affect firms' resource allocation decisions and firm performance. It could also be interesting to evaluate different types of firms, to distinguish which other characteristics, apart from contract dependence, can make firms more dependent on corruption. Future work could

draw attention to other institutional factors that may affect firms' resource allocation and their development through other governance channels, and could use several waves of management measures to investigate the effects of institutional changes on firm management practices.

CHAPTER 4

4. E-government and corruption

4.1   Introduction

Following the analysis in chapter 2 and 3 on the mechanisms through which corruption can influence management decisions on the resource allocation of firms, on the fourth chapter of my thesis I turn the focus of the study on the determinants of corruption. Specifically, I investigate the effect of a public sector reform, e-government on corruption at the country and the firm-level. The chapter finds that e-government development can significantly reduce corruption levels. Countries that have developed e-services have seen a decrease in corruption. The research on e-government as a determinant of corruption has been very scarce, and with limited data sources to allow for any policy considerations. The data on e-government used in this chapter to unravel the effect e-government has on corruption levels have not been previously explored in the literature.

The theoretical underpinnings of this chapter, contextualised within the institutional framework draw attention to the effect of e-government on the reduction of corruption through its effect on the rule of law by imposing constraints in the executive and its effect on governance by reducing the discretionary power of public officials. Further, I investigate the subsequent effect of the improvements in rule of law and governance on the reduction of bribing practices by firms as a possible mechanism through which e-government can reduce country level corruption. The findings of the chapter form the base for ongoing research and analysis on the effect of public sector reforms that can effectively tackle corruption, through an institutional framework that can explain the multiple effects of public policies.

This chapter investigates the relationship between e-government and corruption across countries, using measures of e-government and corruption at the country level, and measures of firm experience of administrative processes. International organisations have pointed out the importance of e-government for good governance in particular across emerging economies (OECD, 2005; World-Bank, 2009). I expect the development of e-government to be associated with a

decrease of corruption at the country level. The main institutional channels through which e-government can reduce corruption is by its effect on the rule of law and grand corruption, its effect on governance and petty corruption, and its effect on bribing practices of firms.

A small literature has examined factors that can influence the adoption of e-government reforms, and the determinants of e-government reform success. These factors are particularly important to analyse, as e-government may be endogenously determined, and its adoption may be dependent on the institutional environment. Corruption could indicate a weak institutional and regulatory environment that would also prevent the success of e-government reforms. Corruption in developing countries has been found to hinder the development of human capital and inhibit the governance capabilities of e-government monitoring mechanisms, leading to failure in attempts to develop such mechanisms (Aladwani, 2016). Second, it can be argued that a corrupt political system would avoid reforms that increase transparency in the decision-making process as they could constrain the opportunities to extract bribes. Corrupt public officials are expected to decide on a basis of potential gains form corrupt activities and not on the public welfare. In this case resources will be mishandled by the tactful selection of projects. However a benevolent government may attempt to transform incentives, monitoring and penalties and even shut down corrupt administrative departments to address petty corruption (Lambsdorff, 2007).

Based on the institutional framework presented in the thesis, e-government development brings changes at the levels of governance and of formal institutions. At the level of governance, it reduces the discretionary power of public officials and can result in more efficient and transparent transactions. At the level of formal institutions, it increases transparency by imposing more constraints and higher levels of monitoring on the executive. At the same time, several factors related to the quality of governance in a country have been found to be predictors of e-government adoption and development.

First, successful implementation and development of e-government seems to be dependent on other governance factors and formal institutions. As the institutional framework shows, there are feedback effects between these two levels. The literature has found evidence that policies for developing web infrastructure and the use of open-source software, reforms of public administration and overall government effectiveness, and a drive for innovative solutions, as well as provision of citizen-centric services are indicators of e-government development, as

they provide a solid, well-functioning base for a successful e-government platform (Lakka et al., 2013; Sanchez et al., 2012; European Commission, 2016). In addition, other aspects of governance such as ICT policies and technology trade policies, and interoperability across borders are important as they can stimulate the use of technology in the public administration and improve capacity for e-government reforms (Lakka et al., 2013; European Commission, 2016).

In terms of formal institutions, the regulatory environment in relation to security of transactions (Lakka et al., 2013), and the quality of the judicial system are important determinants of e-government development (Aladwani, 2016). Decisions made at the resource allocation level, indicating country's capacity to adopt e-government can also influence the success of e-government reforms, such as the use of technologies, level and characteristics of education and human capital in a county. Specifically, the level of technology adoption and ICT education may increase demand from citizens and firms for e-government provisions. On the supply side, the education and skills of staff working on developing the platforms are also a determining factor in e-government success (Lakka et al., 2013; Aladwani, 2016). In particular, corruption may be associated with some of the factors determining the success of e-government, such as government effectiveness and the quality of the regulatory environment. Also, corruption could minimize incentives for hiring the most skilled staff to implement e-government reforms, and hiring less-skilled staff could lead to a lower quality of services offered, less useful and easy-to-use websites, and higher failure rates (Kumar et al., 2007; Aladwani, 2016).

Apart from its effect on e-government development and success, corruption could also influence the decision about e-government provision. Specifically, a corrupt political system may avoid the implementation of e-government reforms to protect the secrecy of their corrupt activities, as corrupt systems would seek to restrict transparency about how public resources are used (Ackerman and Palifka, 2016). However, there could be some exceptions to this, as corruption, notably petty corruption, may be prevalent at the level of local governments and not at the level of national government, as there can be significant variations of corruption levels between different local authorities (Shleifer and Vishny (1993). The provision of national e-government reforms may be directed at addressing petty corruption instead of grand corruption. In this way, politicians could use these reforms, directed at low to mid-level public officials, to influence public or international opinion in their favour and influence corruption ratings while

simultaneously avoiding taking steps to enhance transparency at the highest political level. As has been noted, for example, in Georgia there was significant and noteworthy progress in the fight against petty corruption, but types of grand corruption, such as corruption in the judiciary, still need to be addressed (Council of Europe, 2016).

Domestic pressure could also be exercised by other political parties and the media, as well as by the third sector and civil society organizations that publicize data on corruption. The pressure on political parties to adopt anti-corruption practices could be particularly strong after the revelation of political scandals of grand corruption. Corruption scandals exposed by the independent press, in the same way as economic and political crises, have been important drivers for change, such as reforms in the civil service (Ackerman and Palifka, 2016). Crises and scandals could generate changes in citizens' beliefs and tolerance of corruption. However, there is the risk that reforms that occur as a response to scandals may put corruption on the table but not always use resources appropriately, as there may be a need for immediate action without the advantage of long-term planning and the involvement of multiple actors and experts (Berensztein, 1998). International organizations, and economic and political unions may also apply pressure for e-government provision in the form for recommendations and common objectives. An example is the European Union, which has launched an e-government action plan for 2016-2020, to align objectives in the digital single market and speed-up digitization of services between member states although member states can pursue their own activities (European Commission, 2016).

The first effect of e-government as a public-sector reform is its effect on the institutional capability of countries, at the level of the rule of law. E-government can affect the division of power and impose constraints on the executive, by shifting the way the executive power of the government is delivered. E-government can strengthen legislature and increase the monitoring capacity of the executive in practice by imposing constraints on its power. Specifically, e-govenrment can support a strong legislature that can limit corruption at the executive level. It can provide monitoring to the legislature, elevating the risk for executives to engage in corrupt practices. This can limit grand corruption as the legislature's role of making laws will not be influenced by private interests. The legislature's power to constrain the executive and its ability to investigate its activities has been found to restrain the levels of corruption (Fish et al., 2015). A specific point of interest is the role of e-government on important legislative activities, the state

budget in particular, ensuring its effectiveness and transparency. E-government can strengthen the rule of law and improve accountability, to provide a transparent state budget with robust measurements of revenue and expenditure, and other lawmaking activities of the legislature as it increases the risk of exposure of corrupt activities for both the receiver and the supplier of unofficial payments by the existence of electronic records. The low information costs associated with e-government and the higher level of transparency of public decisions, such as public procurement processes could increase the accountability of governments towards their citizens, as well as reduce the costs to monitor large public administrations in countries with weak institutions (Shleifer and Vishny, 1993).

The second effect of e-government on the institutional capability of countries, is observed at the level of governance. E-government can ensure that the state can be better governed as e-government can provide a platform for better monitoring of the public mechanisms, and a better evaluation of the various processes. Weaknesses in the effectiveness of certain procedures can be easily observed and dealt with. The development of e-government can first ensure that the state itself is a well-working machine, with the digitalisation of processes, registration of citizens and assets, and optimisation of state agencies. The user-friendliness of certain services, the amount of electronic procedures, the number of users, their characteristics like their age group, could provide useful information to improve public services. These data could lead to important changes in citizen access to information and create an opportunity for governments to have a comparative perspective of the level of e-government in other countries and its efficacy, making it possible to use other countries examples to make certain processes more effective. E-government can ensure better management of the state and its public officials.

E-government could also improve the quality of transactions and contract institutions between firms and the state. E-government limits the scope for bribery and deviation from agreed contracts as it reduces the need for direct contacts between corrupt officials and citizens or businesses. Furthermore, e-government may decrease the costs of contract enforcement and deter tax evasion, by facilitating firms, households, and civil servants' monitoring.

The third effect of e-government on the institutional capability of countries, is at the level of resource allocation decisions of firms and citizens. E-government can ensure that information is clearly provided and easily accessible by firms and citizens, and that the interaction between firms

and the state is facilitated and can be achieved fully, or to a large extent, electronically. This can have important implications for business, save time and reduce costs, increase the ease of doing business and overcome bureaucratic barriers. E-government can reduce the extent of red tape for businesses in their dealing with public officials. Reducing the time needed to deal with government regulations could foster entrepreneurship (Ciccone and Papaioannou, 2007; Harding and Javorcik, 2011), decrease the costs of tax compliance (Wingender, 2008; Beck et al., 2011).

Therefore e-government can strengthen the institutional capability through improvements in the rule of law, governance and resource allocation for firms and households. The effects of e-government on these institutional channels can reduce corruption and support anti-corruption policies at the country level. Conducting business online reduces the opportunities to bribe and can promote business development and increase firm compliance with norms and regulations. These improvements can increase incentives for firms to move to the formal sector and limit corrupt practices. The improvements in citizens' interactions with the state could also increase citizens' trust in the government and public institutions, reduce corrupt practices and reinforce transparency in many aspects of dealing with the state. In turn, it could, for example, improve tax collection, as in countries where there is more institutional trust, citizens are more likely to be willing to pay their taxes or businesses may be more willing to comply with regulations and not resort to bribing. Citizens may also be willing to take up additional tax burdens for necessary reforms when there is effective institutional trust that could further promote economic development. West (2004) shows that e-government usage can increase citizens' belief on the effectiveness of their government, and encourage democratic responsiveness. Ensuring the availability and transparency of government functions and the ability of citizens and businesses to interact with the state online in clearly defined ways, can lead to a more inclusive, democratic, and equal society. E-government can act as a self-reinforcing mechanism that reduces both petty and grand corruption by reducing both the demand and the supply of bribes.

E-government can decrease corruption at the interface between the governments and businesses, and between governments and citizens. It can reduce petty corruption through two channels, by reducing the incentives to bribe as services become more efficient and by reducing the discretionary power of public officials and opportunities for bribes by offering services online. Indeed, the risk of public officials bearing consequences for their illegal demands, in a society

where citizens are more empowered and processes are clear, becomes higher and conclusive. More effective monitoring could also increase the risk of being caught and corrupt actions to be revealed. Apart from the reduced demand for bribes, the supply of bribes from businesses and citizens will also decrease because of the limited need for face-to-face interactions with public officials, and the availability of information on certain procedures, which decreases the risk of manipulation and extortionary demands by public officials. At the same time, e-government's role in promoting transparency could trigger social change. This can have a slow but long-lasting effect on increasing trust in institutions as well as interpersonal trust. Trust in institutions could act as a self-reinforcing mechanism in improving transparency and could lead to the decrease of both grand and petty corruption.

In this chapter I argue that the development of e-government can decrease corruption by strengthening the rule of law and imposing constraints on the executive, by reducing the discretionary power of public officials, and by improving the level of services offered to firms and citizens. I investigate the impact of e-government development on corruption using a large cross-country dataset building on data from the United Nations, the World Bank and the ICRG. By covering 182 countries over the 2003-2013 period, I observe large variations in the development of e-government services across countries and over time. I measure the level of e-government based on the online services offered by each country and I estimate static fixed-effects models to estimate its effect on corruption. A main empirical challenge is that corruption may also affect the level of e-government development and it is difficult to claim a causal effect of e-government development on corruption. In order to deal with any omitted variable biases, I implement country fixed-effect and first-difference estimators for unequally spaced panel data. I also estimate dynamic two-step GMM estimators (see Section 4.4) that allow controlling for possible feedbacks from lagged values of corruption. In some of these dynamic specifications I instrument e-government by using its lagged values. In all specifications I find that the development of online services by the state tends to decrease corruption. In addition, I investigate a possible channel of this effect, resource allocation in firms based on the ease of doing business, measured by the duration of administrative processes that firms face in their interaction with public officials. I find that progress in e-government is associated with a significant decrease in time spent for registering a business and a reduction of the administrative processes needed for exports. This is in line with the theoretical underpinnings of this chapter that the effect of e-government on

resource allocation of firms through strengthening formal institutions can have a feedback effect on the higher levels of the institutional hierarchy and reduce corruption at the country level.

The paper is organised as follows. Section 4.2 discusses the mechanisms that explain the relationship between corruption and e-government. Section 4.3 describes the measures of corruption and e-government and presents some descriptive statistics. Section 4.4 describes my identification strategy. Section 4.5 describes my main empirical findings on the effect of the e-government development on the level of corruption and investigates the effect of e-government on some indicators in doing business Section 4.6 presents some robustness checks. Section 4.7 concludes.

4.2   Theoretical Mechanisms and Contribution

The relationship between e-government and corruption builds on three main strands of the literature, the first discusses accountability and transparency in relation to improvements in openness, disclosure of information, and introduction of facilitating technologies, the second examines e-government and improvements in administrative processes, and the third discusses a few limited studies that discuss e-government and corruption.

Firstly, e-government's characteristics of openness, and access to information through technological improvements in public sector capacity have been associated with improvements in accountability and change in political preferences. Strenthening the accountability of politicians has been found to increase their incentives to respect their electoral mandates (Treisman, 2000; Fan et al., 2009). Ferraz and Finnan (2008, 2011) also document that disclosure of information on corrupt activities significantly decreases corruption, and that this effect is magnified when local media divulge broadly the information about corrupt practices. Openess and easy access to information may also contribute to changes in political preferences. Fujiwara (2010) documents that an electronic voting technology that introduced visual aids in Brazilian elections, and facilitated voting for the less educated, led to profound changes in electoral behaviour. The research showed that by increasing the share of voters with low education, the information technology tended to shift the preferences of the median voter towards less corrupt practices and specific public policies (Fujiwara, 2010). Therefore, e-government would be expected to increase accountability, and openness of public functions on the government level, which could better align

the interests of politicians with the interests of citizens', ensure transparency in government programmes and efficiency of the government.

Secondly, there are also a few case studies and anecdotal evidence that find e-government can encourage speed and efficiency in administrative processes and deter corrupt practices (Kim et al. 2009; Wescott, 2006; Cho and Choi, 2004). In Seoul, there is suggestive evidence, that the development of a system initiated to reduce corruption had a positive impact on the control of corruption, and its efficacy on administrative transparency and has been acknowledged by the United Nations, the OECD, and the World Bank (Cho and Choi, 2004). The system was initially developed at the local government level, but its success in tackling administrative inefficiencies and corruption, rendered the use of e-services invaluable and a similar system was promoted for the whole country of Korea. The OPEN system is an online system, launched in 1999, that discloses administrative processes and citizens can submit application online, and be informed on their applications and their status online for a range of public services. The goal of the project is to deter corrupt behavior of public officials and unfair demands to citizens. Citizens in Seoul embraced the initiative and online applications doubled in the first few years, whereas corruption was significantly reduced which is believed to be partly due to the development of the platform, among other anti-corruption strategies that were taken by the government (Kim et al., 2009).

Another known example of the efficacy of e-government on tackling corruption is the case of Andhra Pradesh in India (Prahalad, 2009). Andhra Pradesh is a state in India, with a population of 75 million, out of which around half are illiterate. The state was characterized by large, intrusive bureaucracy, however its Chief Minister in 1998 implemented a wide e-government program over a five-year period, during which many government services and information began to be available online, and the government became more citizen centric. Prahalad explains how corruption can increase during the transition period, as public officials may use their remaining discretionary power to the maximum before the new e-government platforms are established and records are digitized, but then is bound to decrease. Prahalad explains how poor, underdeveloped regions can make significant progress towards better governance through e-government (Prahalad, 2009), as in the case of Andhra Pradesh, through the establishment of internet kiosks, based on a public-private partnership, poor and illiterate people that could not use electronic services themselves

could still benefit from the new e-services with the help of kiosk operators. These "eSeva" internet kiosks had full coverage of the rural poor in the State by 2005, and citizen intreviews show that eSeva enjoyed high citizen satisfaction, as they commented on its speed, transparency, and the openness and visibility of transactions (Prahalad, 2009).

Finally, there is also a limited literature on the relationship between e-government and corruption, that find that e-government can reduce corruption (Andersen, 2009). However these studies use small samples of countries and time periods. In addition the literature on e-government and corruption has focused on composite indices of e-government readiness, that include human capital, and infrastructure, apart form online services, which rather reflect the capacity to absorb and make use of e-government development rather than e-government development per se. Other studies have also used the UN e-participation index, a complementary index to the e-government readiness index, which focuses on how online services are used to promote access to information by citizens (UN, 2012), the number of internet users, or the e-government data gathered by Darrell West, an assessment of government agencies based on information availability, service delivery, and accessibility (West, 2006). Andersen and Rand (2006) measure e-government based on the product of the composite UN index of e-government readiness and the UN index of e-participation, not allowing to make clear inferences on the impact of e-government on corruption. Andersen (2009) argues that increase in the use of e-government resulted in a drop in corruption levels over the period 1996-2006, in non-OECD countries. The methodological framework is built around the changes in corruption and e-government between 1996 and 2006. However the data have severe limitations, as the author uses the e-government data by Darrell West (West D. , 2006) only for one time period, the year 2006, and assumes that none of the 126 OECD and non-OECD countries of his sample had developed any e-government services in 1996. In addition when his specifications account for the initial level of corruption, the relationship between corruption and e-government remains significant only for non-OECD countries (Andersen, 2009). Furthermore Andersen et al. (2011) examined another related aspect, the impact of internet diffusion on corruption, based on the numbers of internet users per 100 people from the WB World Development Indicators. They investigate the impact of internet diffusion on 48 U.S. states and on a cross-country dataset of 113 countries, from the early 1990s to 2006, and argue that increasing internet use led to a decrease in corruption in the U.S., and across countries.

Building on this literature, this paper makes three important contributions. Firstly, The study of e-government and its impact on corruption and institutions forms a new interesting area of research, and raises particular importance on public policies in addressing corruption and their evaluation with respect to the different levels of the institutional hierarchy. The chapter highlights how this public policy can reduce corruption by strengthening formal institutions that can foster the creation, development and efficient operation of businesses and affecting the resource allocation decision of firm with respect to bribing.

Second, I construct a large sample of countries and time periods. Specifically, I build a large cross-country dataset covering 182 countries over the 2003-2013 period, by merging e-government indices from the United Nations (2014) and perception-based measures of corruption from the World Governance Indicators (Kaufmann et al., 2010). Secondly, I use different estimators to examine the relationship between e-government and corruption, including fixed effects, first differences, and a dynamic two-step GMM approach, and I estimate one possible channel for the effect of e-government development on corruption: the administrative corruption and business barriers experienced by firms.

Thirdly, I focus specifically on the effect of online services on the reduction of corruption. My main explanatory variable is the development of e-services by the state. By contrast, most studies on the impact of e-government on corruption have investigated composite indices of e-government. These composite indices on e-government do not allow clear conclusions on the effect of e-government on corruption and are subject to several limitations. Composite indices of e-government, based on online services, infrastructure, and human capital can provide an indicator of e-government capacity and readiness (see discussion above). However, these indices are subject to limitations as e-government readiness and capacity is not only based on infrastructure and human capital. Indeed, Prahalad explains how in the Indian state of Pradesh the internet kiosks circumvented the problems with low literacy rates and poor infrastructure. These internet kiosks operated throughout the state and citizens could conduct their businesses online (*i.e.* pay their bills, submit statements, or acquire information) with the help of trained private officials (Prahalad, 2009). Therefore e-government capacity can increase even in the absence of quality infrastructure and human capital, and composite indices of e-government may not

adequately capture this. The Online Services Index provides a direct measure of e-government that can be clearly interpreted in relation to corruption.

I estimate static fixed-effects models of the relationship between e-government and corruption. I also use a first difference estimator to avoid omitted variable biases and correlation between e-government and individual country characteristics. However, the development of e-government could also be linked to the level of corruption. For example, corrupt politicians could have low incentives to implement a successful e-government policy. Time varying omitted variable biases are also a serious concern. Even if I control for GDP per capita, countries with weak communication infrastructure may be limited to lower levels of e-government. To deal with these two endogeneity issues in the panel data specifications, I implement a dynamic two-step GMM estimator that allows controlling for lagged values of corruption. In these dynamic specifications, I also instrument the e-government by using its lagged values, up to three previous years. A simple rationale for these dynamic specifications is that lagged corruption controls for the underlying dynamic of corruption, and the existing incentives of politicians. Overall, the estimated cross-country time-series specifications tend to show a positive association between e-government and a decrease in corruption.

My identification strategies bring the following results. First, without controlling for the endogeneity of e-government I find a robust negative correlation between e-government development and corruption, over time between 2003 and 2012 countries that have developed e-services have also seen a decrease in corruption. For the assessment of corruption I use a measure of corruption that captures perceptions of the level that public power is exercised for individual gain, and for the assessment of e-government I use a measure of public services provided online by the state that is described in more details in section 4.3. The development of e-government appears to reduce the level of corruption even when I introduce a large number of control variables that have been associated with corruption, such as education, trade openness, public debt or the level of natural resources (Ades and Di Tella, 1997; Mauro , 1997; Tornell and Lane, 1999; Persson et al., 2003; Lambsdorff, 2005; Delavallade, 2006; Caselli and Michaels, 2013). Importantly, I also control for possible feedback from lagged values of corruption. Second, I confirm the negative relationship between e-government and corruption using a dynamic two-step GMM approach. This specification addresses the risk of potential endogeneity and possible

biases in my country-fixed estimates that control for lagged values of corruption. To strengthen the validity of these findings I use lagged values of e-government as instruments for e-government and lagged values of corruption in my dynamic specifications. Lagged values of e-government may control for a trend in the development of e-government technology, not directly associated with current government policies. Across all specification the relationship between e-government and corruption remains negative and significant.

Finally, I explore the mechanisms that may drive the effect of e-government on corruption and the impact of e-government development on the ease of doing business. Under the assumption that bribes are partly seen as a way to avoid inefficient state regulation (Leff, 1964), and taking into account that the e-government improves the quality of public services, firms and citizens should have less incentives to pay bribes when a government implements efficient online-services. I use the World Bank Enterprise Surveys to investigate how business processes are facilitated when e-government increases. In this empirical investigation, I pay particular attention to the time frame required to complete necessary administrative processes, such as registering a business, preparing and paying taxes, time needed for imports and exports, contract enforcement and resolving insolvency. The time required for several administrative processes decrease significantly with the development of e-government. These estimates provide suggestive evidence that e-government progress at the macroeconomic level works through an improvement in the quality of the business environment.

4.3   Data and Preliminary Evidence

4.3.1   Data selection and Measurement

E-government programs that offer public services online have been developed to promote a more equal access to these services by citizens and firms. E-government can be defined as the utilization of the world-wide-web and the internet for the delivery of government information and services to citizens. The E-government Development Index (EGDI) not only assesses website developments, which I am trying to identify with the Online Services Index (OSI), it also entails aspects of infrastructure capacity and levels of education, in order to assess how a country is using information technologies and identify best practices on institutional progress and strengthening public sector capacity (UN, 2012). E-government could broadly incorporate all governmental and

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public information and communication technology (ICT) platforms and applications (Ronaghan, 2002). Countries face important challenges on how to design appropriate e-government strategies and programs that incorporate new technologies in order to overcome issues with human capital and underdeveloped infrastructure, and ensure equal access to e-services .

E-government reforms are expected to lead to more transparent and efficient public services to businesses and citizens but are not without challenges, they require a modernisation and adaptation of public administration, and a change in the information infrastructure. Therefore, the development of e-government and integrated online service delivery has focused on these two important channels, the increase in state capacity, in terms of human capital and infrastructure, to be able to facilitate and improve the provision of information and services on important issues, and the increase in the reach and engagement of citizens, ensuring equal access, in particular for vulnerable and marginalized groups (UN, 2012).

The investigation of e-government as a determinant of corruption has been very limited, and has not explored a sufficient amount of data sources, across time, to assess its impact on corruption. I build a data set to anayse this relationship based on three main data sources which covers an unbalanced panel of 182 countries over 2003-2013.

My main explanatory variable of interest is the Online Services Index (OSI) of E-government published by the United Nations (UN, 2012). The OSI shows the scope and quality of online services. It is based on the E-Government Survey and it is one of the three measures used for the calculation of the e-government index. The E-Government Survey is an extensive survey of all 193 United Nations member states. However, corruption indices cover only 182 countries. My sample therefore covers 182 countries over six years: 2003, 2004, 2005, 2008, 2010, and 2012. The survey assesses the national websites and the delivery of e-government policies and strategies both for the general public and for specific sectors. It aims to address the challenges faced by countries by tracking their progress in developing their e-government programs globally over time. These challenges include issues such as how to encourage greater use of e-government and at the same time promote and ensure equal access to e-services, how to invest and balance resources in order to incorporate new technologies; and finally, how to design appropriate e-government strategies and programs that can help to overcome human resources inadequate capabilities, lacking infrastructure, as well as language and content.

In order to be able to analyse the effect of e-government development I derive a set of Online Service Index (OSI) values, each country's government related website. These included the websites of the related ministries of education, labour, social services, health, finance, and environment as well as the national central administration portal, the e-services and e-participation portal, and other local portals. The OSI is quite strenuous to compose, as there are several challenges in reviewing each country's online presence. These challenges include issues with data collection and analysis, language barriers, population size effects, selecting the appropriate site/ URL at the national level and/or identifying ministerial websites, the process time spent for any given country websites depending on how extensive the online presence is, the quality of the actual websites both in terms of design and user-friendliness, and finally the extent of the content offered. The OSI assessment questionnaire consists of four sections corresponding to the four stages of e-government development i.e. emerging, enhanced, transactional, and connected, which respectively spans from government websites providing limited/basic information to citizen-centric websites, where e-services are targeted to citizens and information, and data and knowledge are shared between state agencies through integrated applications (UN, 2012).

I merged the UN e-government indices with a measure of corruption from the World Bank and the ICRG, and control variables from the World Bank World Development Indicators (March 2015 update), for the years 2003, 2004, 2005, 2008, 2010, and 2012. The measures of corruption at the country level come from the World Bank World Governance Indicators (Kaufmann et al., 2010), and from the International Country Risk Guide (ICRG). Both the WGI and the ICRG index are specifically designed to allow for cross-country comparability. WGI is a composite index, based on 22 data sources. This measure entails perceptions of the level that public power is exercised for individual gain, and it encompasses petty administrative corruption, and grand corruption. The WGI Control of Corruption measure reflects perceptions of the extent to which public power is exercised for private gain, including petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Its values range from approximately -2.5 (weak) to 2.5 (strong) governance performance (Kaufmann et al., 2010). The corruption measure by the ICRG is based on the perceptions of a panel of country experts. Some researchers recognise limitations in the use of this corruption measure (Estrin et al., 2013), as small changes should be interpreted with cautious since the measure is standardised each year and dynamics may be distorted.

However my analysis includes year-fixed effects which alleviates part of this problem. Finally, the measure of firm barriers to doing business comes from the World Bank Enterprises Survey that covers around 80 countries over the period of 2003-2013. Though firm-level data cover a smaller sample of countries than in my main analysis using cross-country panel data, they allow to investigate some of the channels through which e-government services may affect corruption and to confirm my main findings.

4.3.2   Preliminary Evidence

The level of online service delivery and the progress made on development of online services differs widely from country to country. Europe is leading on e-government development and online service delivery. Americas is second, followed by Asia, Oceania and Africa. The Republic of Korea, Australia, France, United Kingdom, Canada and Bahrain are amongst the most developed countries with respect to e-government. On the contrary Congo, Somalia, Haiti, Chad and Afghanistan have the lowest scores among the 193 UN member counties. In the middle of the rankings stand countries like China, Turkey, the Philippines, Bulgaria and Ukraine (UN, 2012).
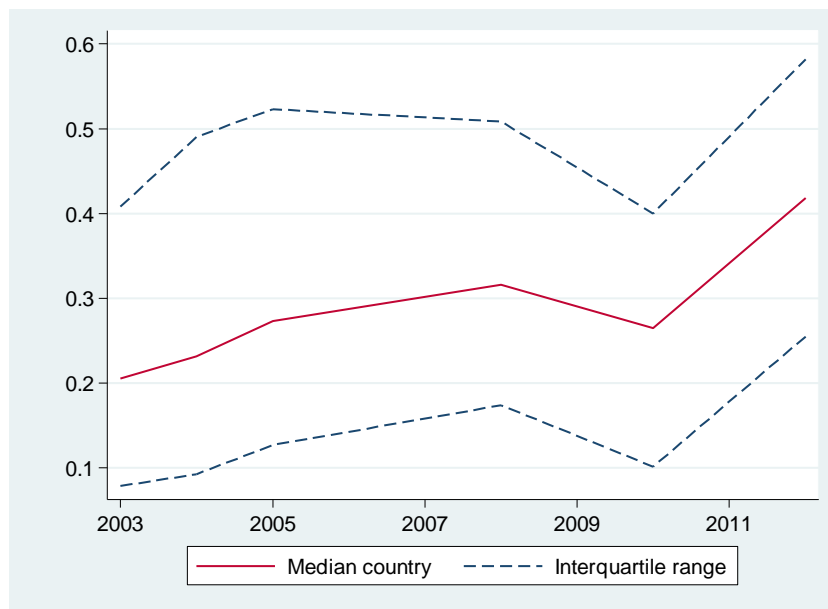
Figure 4.1 E-services index, median country performance and the interquartile range

The provision of e-government services has increased over time for most countries. Figure 4.1 shows the e-services index versus time for the median country i.e. the country separating the

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data between the 50% higher and 50% lower. There is a clear upward trend in the provision of e-government services, with a small decline between 2008 and 2010, which could be attributed to the global economic crisis and the stricter government spending budgets, thus a possible lower investment in e-services. The interquartile range lines show that the same upward trend is followed by most countries over the world. Indeed, the first quartile changes are parallel to the median, showing that most countries have developed some form of e-services over time, thus denoting a global tendency. At the same time, the third quartile which corresponds to the countries with the most developed e-services increases very quickly between 2003 and 2005, before displaying a slower rate of development of additional e-services.
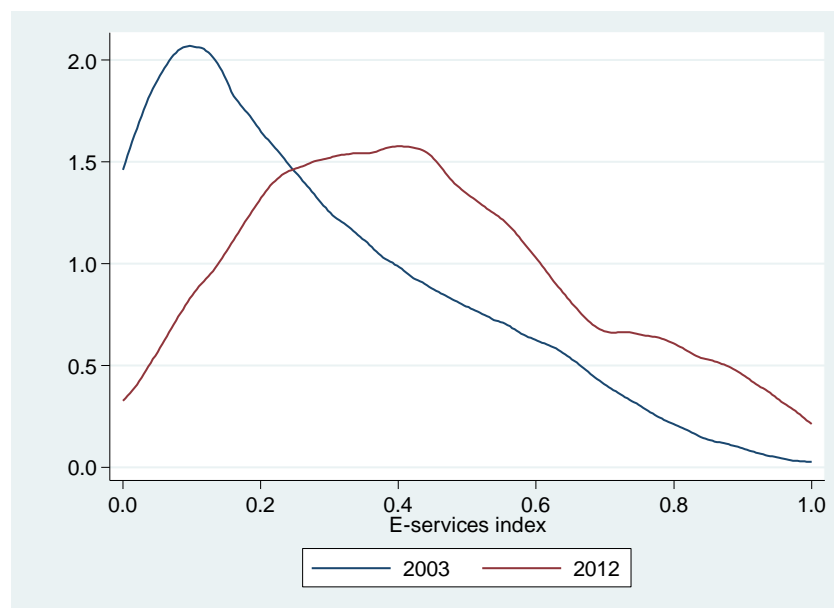
Figure 4.2 Distribution of the e-services index across countries in 2003 and 2012

Note: The Figure reports Kernel density estimates of the e-services index in 2003 (blue) and 2012 (red) that approximate the density of e-services across countries.

Figure 4.2 shows clearly, similarly with the findings in Figure 1, that the amount of countries introducing or moving towards more implementation of E-services has dramatically changed over the decade between 2003 and 2012. The figure reports Kernel density estimates (Cox, 2005) of the distribution of the e-services index across countries in 2003 and 2012. The estimated density plot in 2003 suggests a log-normal distribution, in which the majority of the countries has a low e-services index around 0.1. After 10 years, the density plot in 2012 has

changed, with the majority of countries having an e-services index around 0.4, which would be an increase of almost 50% according to the plot.

There is a positive relationship between the development of e-services and the reduction of corruption. Figure 4.3 shows the change in e-services country by country between 2003 and 2012 and compares it to the reduction of corruption over the same time period. Countries that made the most progress in e-government are the ones who reduced the most corruption. The estimated positive relationship between the development of e-services and the reduction of corruption is statistically different from zero at the 1% level using an heteroskedasticity robust asymptotic t-test.
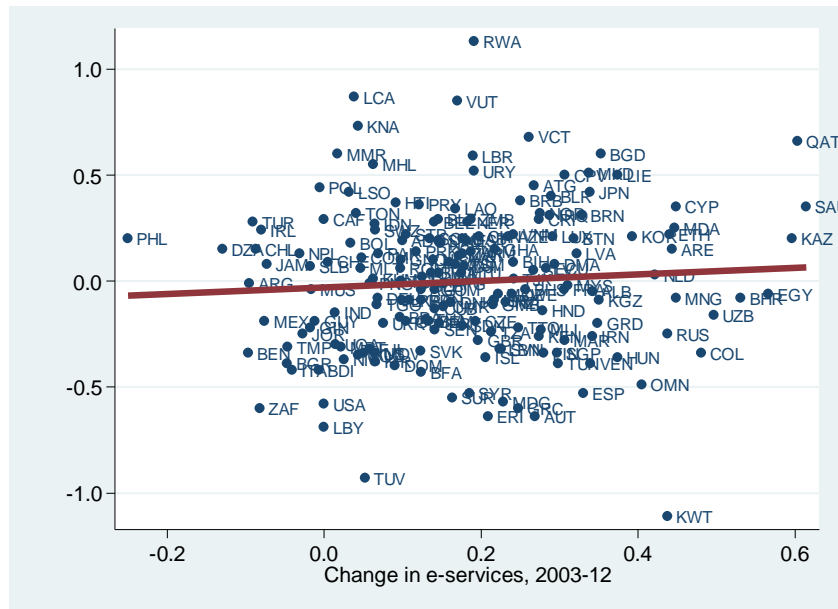
Figure 4.3 Changes in e-services and control of corruption, 2003-2012

On the same note, Figure 4.4 shows the relationship between the online service index and corruption controlling for country and year fixed-effects for the full sample of countries and survey time span (2004-2013, where e-government is lagged). The suggested trend is positive and there are no clear outliers in this plot, and this relationship appears statistically significant at the 1% level using an heteroskedasticity robust asymptotic t-test.
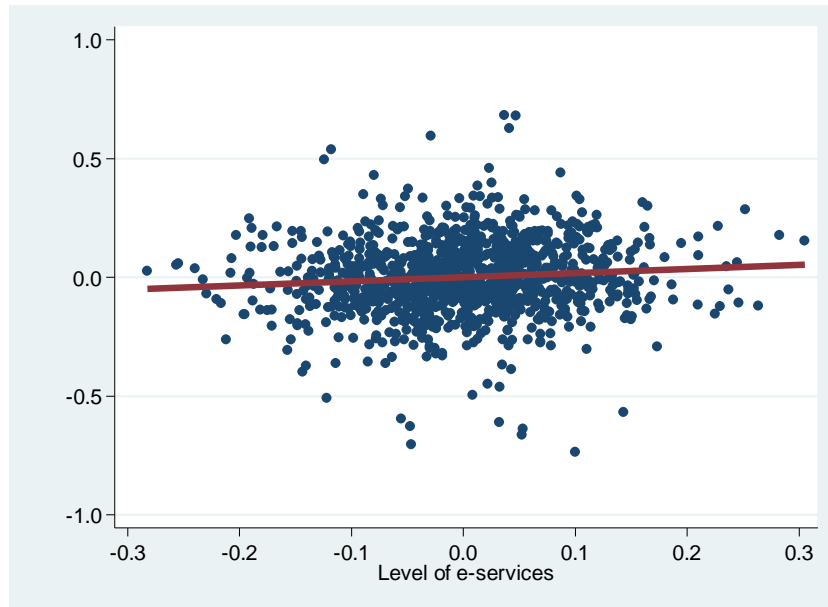
Figure 4.4 Relationship between level of e-services and control of corruption

4.4   Empirical Srategy

I use the aggregate index of the UN to describe country specific progress in e-government (UN, 2012). I focus on the development of e-services that assess the content and features of national websites, including the national central portal, e-services portal and e-participation portal, as well as the websites of the related ministries of education, labour, social services, health, finance, and environment, as applicable.

My main assumption is that the development of e-services reduces the scope for bribes and the discretion of public employees. Therefore, I relate the change in corruption with the development of e-services. More precisely, the estimated equation is:

$$Corr_{it} = \beta EGov_{it-1} + \gamma X_{it-1} + \alpha_i + \delta_t + \varepsilon_{it} \qquad (1)$$

Where i is an index for country and t is an index for year. X_{it-1} is a vector of control variables and α_i and δ_t are country and year fixed effects. In this model, I assume that I will be able to measure the effect of e-government development by investigating the level of corruption in the following year. Thus, the main variable of interest $EGOV_{it-1}$ is lagged by one period, as I want to

measure the effect that e-government development has on corruption, and I expect its impact not to be contemporaneous (Acemoglu et al., 2014). Indeed, corruption perceptions evolve slowly e.g. (Ackerman and Tina, 2001) and some of the surveys used to construct the control of corruption indicator are only updated every few years (Kaufmann et al., 2010; Cary et al., 2014)[20]. Moreover, e-government services at time t correspond to different periods of the year[21], which means that these e-services may just have been introduced and not available to firms and households over most of year t. In robustness checks, I use alternative specifications using difference over four year intervals (long differences) that allow to take only into account large changes in e-services and corruption and mitigates issues related to the measurement of short-term changes in corruption (Hausman and Grilisches, 1986).

All other potential covariates, as well as interaction effects which are included later, are in the vector X_{it-1}, which is lagged to avoid putting endogenous variables on the right-hand side of the regression. My baseline control variable is the log GDP per capita (in constant million 2005 US dollars) that indicates the country's overall level of development. E-services is much more likely to suffer from endogeneity concerns when the lagged effects of GDP per capita are not controlled for as the development of E-services can be correlated with past levels of development which also affect changes in corruption.

First I estimate equation (1) using country fixed effects, then I use first-difference and GMM estimators.[22] In all specifications, the standard-errors are clustered at the country level to take into account heteroskedasticity and within country autocorrelation.

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[20] When data sources are updated only once every two or three years, Kaufman et al. (2010) use data lagged by one or two years from these sources to construct the estimates of control of corruption in year t.

[21] April-May for the 2003 and 2004 indices, July-August 2005 for the 2005 index, October-November 2007 for the 2008 index. The exact survey periods are not reported for 2010 and 2012 (UN, 2003, 2004, 2005, 2008, 2010 and 2012).

[22] As the measure of e-government is only available in specific years, for the pooled OLS and the fixed effect estimators, I only keep years for which I have observations for e-government in t-1: 2004, 2005, 2006, 2009 and 2011, 2013. The first-difference estimator takes into account the changes in corruption over: 2004-2005, 2005-2006, 2006-2009, 2009-2011, and 2011-2013.

The first-difference estimators remove the unknown country fixed effects estimator and improve the regression robustness.[23] However, this is partly complicated here as the measure of e-services is only available in specific years. This is a minor concern as I expect the relationship between e-services and corruption to be driven by long-term changes rather than short-term variations. Specifically, I implement a first-difference estimator for unequally spaced panel (McKenzie, 2001; Baltagi, 2005). I define the wave of the UN e-government survey as: 2003 as wave 1, 2004 as wave 2, 2005 as wave 3, 2008 as wave 4, 2010 as wave 5, and 2012 as wave 6. I index the different waves by w, and t remains an index for years. I compute the first differences of equation (2):[24]

$$Corr_{it(w)} = \beta EGov_{it(w)-1} + \gamma X_{it(w)-1} + \alpha_i + \delta_{t(w)} + \varepsilon_{it(w)} \qquad (2)$$

Where $t(w)$ is the year of the wave (w) of the UN e-government survey. I define the first difference over two waves of the UN survey as:

$$\Delta_w Corr_{it(w)} = Corr_{it(w)} - Corr_{it(w-1)} \qquad (3)$$

This gives:

$$\Delta_w Corr_{it(w)} = \beta \Delta_w EGov_{it(w)-1} + \gamma \Delta_w X_{it(w)-1} + \Delta_w \delta_{t(w)} + \Delta \varepsilon_{it(w)} \qquad (4)$$

Furthermore, I introduce dynamic GMM estimators to control for possible feedbacks from lagged value of corruption towards the development of an e-government strategy:

$$Corr_{it(w)} = \rho Corr_{it(w)-1} + \beta EGov_{it(w)-1} + \gamma X_{it(w)-1} + \alpha_i + \delta_{t(w)} + \varepsilon_{it(w)} \qquad (5)$$

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[23] As the measure of e-government is only available in specific years, for the pooled OLS and the fixed effect estimators, I only keep years in my corruption data, for which I have observations for e-government in t-1: 2004, 2005, 2006, 2009, 2011, 2013. The first-difference estimators take into account the changes in corruption over: 2004-2005, 2005-2006, 2006-2009, 2009-2011, and 2011-2013.

[24] I have only one fixed effect for years and the waves of the e-government surveys as they are perfectly collinear.

In the first differenced equation, endogeneity may arise if $Corr_{it(w)-1} - Corr_{it(w-1)-1}$ is correlated with $\varepsilon_{it(w)} - \varepsilon_{it(w-1)}$, the argument of Anderson-Hsiao (Anderson and Cheng, 1981) implies that $Corr_{it(w-1)-1}$, $Corr_{it(w-1)-2}$, $Corr_{it(w-1-3}$ etc. are valid instruments for $\Delta_w Corr_{it(w)-1}$ in the first-difference version of equation (5).[25] As suggested by Roodman (Roodman D., 2006), I use these instruments with a 2-step GMM estimator. I experiment with two different identifying assumptions and two set of instruments. First, I only consider the lagged value of corruption as weakly exogenous and all the other variables as strongly exogenous. I instrument $\Delta_w Corr_{it(w)-1}$ with $Corr_{it(w-1)-1}$. This specification is just identified and the instrumental variable estimator is equivalent to the GMM estimator. In another specification, I use $Corr_{it(w-1)-1}$. and interactions with year dummies. A simple rationale for using lagged value interacted with year dummies is that they use more moment conditions that could bring efficiency gains through GMM if the additional instruments are relevant. Second, I consider all right-handside variables has weakly exogenous. The second set of instruments include $Corr_{it(w-1)-1}$, $EGOV_{it(w-1)-1}$,.$X_{it(w-1)-1}$ and interactions with year dummies.

4.5 Empirical results

In Table 4.1 I control for country and year fixed effects, which take into account that countries with more developed online services are different from countries with less developed online services in many permanent characteristics that are not observed and that may also affect corruption. I also allow for richer countries to have lower corruption controlling by the level of GDP per capita as argued by Treisman (2000) (Column 1). Second, I allow for mean-reverting dynamics and persistent effects in corruption (t-1) that may be endogenous to the development of online services and different control variables (Columns 2 to 6). As a robustness check, I include additional control variables that have been found to be correlated with the level of corruption and could also explain the development of e-services (Knack and Keefer, 1995; Acemoglu et al. 2000; Treisman, 2000; Acemoglu et al. 2005; Seldadyo and de Haan, 2006): the development of telecom

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[25] This argument is based on the assumption that the disturbance term is un-correlated over time (t), that is ε_{it} are serially uncorrelated shocks. In this set-up, there is no need to instrument if the waves of the UN-surveys are spaced by more than 1 year.

infrastructure[26] and the UN human capital index[27], the presence of natural resources, the openness to trade (as measured by the ratio of imports and exports divided by GDP), and the (log of the) population. The indices for telecom infrastructure and human capital are from the UN e-government dataset, while all the other variables are taken from the WB WDI dataset and the IMF public debt database, 2013 update (Abbas, 2010).

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[26] The Telecommunication Infrastructure Index is the average of five indicators which include: a) the estimated internet users per 100 inhabitants (as % of population), b) the number of main fixed telephone lines per 100 inhabitants, c) the number of mobile subscribers per 100 inhabitants, d) the number of wireless broadband subscriptions per 100 inhabitants and e) the number of fixed broadband subscriptions per 100 inhabitants.

[27] The Human Capital index is a weighted average of four indicators which include: a) Adult literacy measured as the percentage of people aged 15 years and above who can both read and write, b) gross enrolment ratio measured as the combined primary, secondary and tertiary education gross enrolment ratio as a percentage of the population of school age for that level, c) expected years of schooling which a child of a certain age can expect to receive in the future and d) mean years of schooling provides the average number of years of education completed by a country's adult population (25 years and older).

Table 4.1 Corruption and development of online services, 2004-2013

Estimator:	Country fixed effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Control of Corruption t-1		0.556***	0.557***	0.557***	0.567***	0.570***
(ρ)		(0.046)	(0.046)	(0.043)	(0.036)	(0.038)
Online services index t-1	0.151*	0.100**	0.104**	0.102**	0.090*	0.085*
	(0.086)	(0.048)	(0.047)	(0.050)	(0.047)	(0.048)
Log GDP per capita t-1	0.207**	0.111**	0.107*	0.103*	0.0476	0.027
	(0.101)	(0.056)	(0.057)	(0.0563)	(0.052)	(0.054)
Per-capita growth t-1			0.127	0.114	0.375**	0.412**
			(0.137)	(0.145)	(0.152)	(0.177)
Human capital t-1				0.171	-0.180***	-0.188*
				(0.149)	(0.060)	(0.111)
Infrastructure t-1				0.0580	0.120	0.135
				(0.103)	(0.102)	(0.106)
Log population t-1					0.016	-0.003
					(0.087)	(0.091)
Trade openness t-1					-4.539	-5.623
					(3.229)	(3.437)
Natural resources/GDP t-1					-2.583	0.152
					(10.54)	(11.70)
Public debt/GDP t-1						-0.017
						(0.021)
# observations	1,070	1,070	1,069	1,062	1,011	975
# countries	182	182	181	181	176	170
R-squared	0.976	0.985	0.985	0.985	0.986	0.986
R-squared (adjusted)	0.971	0.981	0.981	0.982	0.983	0.983

Note: All regressions control for country and year fixed effects. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level.
Source: WB WDI, UN e-government dataset, WB WGI, IMF public debt data set and author's computations.

It can be deducted from Table 4.1 that there is a robust relationship between the control of corruption and e-government, which is not affected when more control variables are inserted, and it does remain statistically significant in all cases at the 10% significance level or higher.

In Table 4.2 I further investigate if the effect of the development of online services could be explained by other characteristics of the governance structure (Column 1). It is also allowed for past values of corruption up to t-3 years to affect the development of online services (Column 2). The country-fixed effect estimator is biased with a lagged dependent variable (Nickell, 1981), so

the country fixed effect model is estimated by imposing different value for the autoregressive coefficient as in Acemoglu et al. (2015) (Column 3 to 6).

Similarly from Table 4.2 it can be observed that the robust relationship between the control of corruption and e services still holds, thus rendering it independent of the remaining control variables. The estimator magnitude remains at similar levels even when the imposed value for the autoregressive coefficient of the Control of Corruption at t-1 is doubled in value (ρ =0.4 to 0.8). The effect of e-services still remains statistically significant in all cases at the 10% significance level or higher, while none of the remaining control variables seem to be significant.

Table 4.2 Corruption (with lag effects) and development of online services, 2004-2013

Estimator:	Country fixed effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Control of Corruption t-1	0.537***	0.492***	ρ =0.4	ρ =0.6	ρ =0.7	ρ =0.8
	(0.060)	(0.066)				
Control of Corruption t-2		0.111				
		(0.071)				
Control of Corruption t-3		-0.025				
		(0.040)				
Online services index t-1	0.096*	0.098**	0.109**	0.099**	0.094**	0.089*
	(0.054)	(0.050)	(0.054)	(0.047)	(0.047)	(0.048)
Log GDP per capita t-1	0.0793	0.107*	0.138**	0.0959*	0.075	0.054
	(0.154)	(0.059)	(0.067)	(0.056)	(0.052)	(0.052)
Per-capita growth t-1	0.158	0.124	0.105	0.116	0.121	0.127
	(0.145)	(0.145)	(0.168)	(0.140)	(0.128)	(0.119)
Human capital t-1	0.058	0.173	0.161	0.174	0.180	0.187
	(0.109)	(0.139)	(0.132)	(0.156)	(0.171)	(0.187)
Infrastructure t-1	0.021	0.056	0.093	0.052	0.032	0.011
	(0.084)	(0.108)	(0.126)	(0.103)	(0.097)	(0.097)
Log population t-1	0.023	0.023	0.051	-0.002	-0.029	-0.055
	(0.084)	(0.084)	(0.110)	(0.077)	(0.068)	(0.067)
Rule of law t-1	0.038					
	(0.050)					
Regulatory quality t-1	-0.005					
	(0.052)					
Political stability t-1	-0.005					
	(0.020)					
Voice and accountability t-1	0.059					
	(0.043)					
# observations	1,061	1,062	1,062	1,062	1,062	1,062
# countries	181	181	181	181	181	181
R-squared	0.985	0.985	0.958	0.920	0.865	0.735
R-squared (adjusted)	0.982	0.982	0.948	0.902	0.834	0.675

Note: All regressions control for country and year fixed effects. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level. Source: WB WDI, UN e-government dataset, WB WGI, IMF public debt data set and author's computations.

Tablee 4.3 displays the estimates of first-difference specifications (Columns 1 and 2), the Anderson-Hsiao estimators (Columns 3 and 4) and two-step GMM estimators[28] (Columns 5 and 6).

In all specifications, the effect of the development of e-services on corruption is negative and statistically significant in all cases at the 10% significance level apart from Column 5, where $\Delta_w Corr_{it(w)-1}$ is instrumented by $Corr_{t(w-1)-1}$ and $\Delta_w EGOV_{it(w)-1}$ by Online services index t(w-1)-1 and both instruments are fully interacted with time dummies. However, when the full set of independent variables in first difference is instrumented by its past values in t(w-1)-1 and interactions with time dummies (Column 6), the effect of e-services on corruption is negative, statistically significant at the 1% level and not qualitatively different from the specifications in Table 4.1 and Table 4.2

In Table 4.4, I investigate whether online services have different impact on corruption across countries according to their initial institutions. The sample of countries is divided in three thirds according to the initial level of corruption in 2000 (Columns 1 to 3) and to the level of per-capita GDP (purchasing power adjusted) in 2000 (Columns 4 to 6). I choose the year 2000 as baseline observation as it is well before my sample and not directly affected by the developments of e-services and corruption over 2003-2013. It can be observed that the lagged value of corruption is statistically significant at the 1% significance level in all cases, while the e-services seem to be significant (at 10% level) only in highly corrupt countries. However, the interesting aspect emerging from this analysis is that there is some suggestive evidence showing that online services have a larger effect on the reduction of corruption in more corrupt and poorer countries with almost double coefficient magnitude between Columns 1 and 3 and Columns 4 and 6 respectively.

Table 4.3 Corruption and development of online services, 2004-2013 (IV,GMM method)

Estimator:	OLS		IV		GMM (2 step)	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Control of Corruption t-1			0.535**	0.618**	0.591***	0.494***
			(0.253)	(0.258)	(0.166)	(0.074)
Online services index t-1	0.129**	0.128**	0.116*	0.260**	0.102	0.186***
	(0.053)	(0.053)	(0.061)	(0.131)	(0.091)	(0.059)
Log GDP per capita t-1	0.113	0.097	0.026	-0.014	0.039	0.063
	(0.071)	(0.080)	(0.090)	(0.099)	(0.081)	(0.057)
Per-capita growth t-1		0.073	0.116	0.141	0.162	0.203***
		(0.098)	(0.119)	(0.120)	(0.112)	(0.075)
Human capital t-1		0.245*	0.435	0.462	0.584***	0.263**
		(0.130)	(0.267)	(0.281)	(0.196)	(0.122)
Infrastructure t-1		0.024	-0.075	-0.110	-0.150	-0.050
		(0.130)	(0.144)	(0.150)	(0.122)	(0.102)
Log population t-1		0.138	0.024	-0.033	-0.079	-0.059
		(0.212)	(0.153)	(0.154)	(0.137)	(0.093)
# instruments			1	2	10	35
F-test			4.0	2.7	2.7	3.5
Under-identification			6.2**	5.6**	22.3***	68.0***
Hansen-J (p-value)					0.336	0.165
# observations	888	878	878	878	878	878
# countries	181	181	181	181	181	181
R-squared	0.010	0.022				
R-squared (adjusted)	0.003	0.010				

Note: All regressions control for year fixed effects. Column 3, control of Corruption t-1 is instrumented by Control of Corruption t-2. Column 4, control of Corruption t-1 is instrumented by Control of Corruption t-2 and Online services index t-1 by Online services index t-2. Column 5, control of Corruption t-1 is instrumented by Control of Corruption t-2 and Online services index t-1 by Online services index t-2 and both instruments are fully interacted with time dummies. Column 6, the instruments are all independent variables in t-2 interacted with time dummies. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level. As my dataset is an unequally spaced panel dataset, I cannot conduct the standard AR(1) and AR(2) statistics, as I don't have yearly data to conduct these standard tests. I only have yearly data for 2003-5. Source: WB WDI, UN e-government dataset, WB WGI, IMF public debt data set and author's computations.

Table 4.4 Corruption and development of online services according to economic development in 2000, 2004-2013

Estimator:	Country fixed effects					
Samples defined :	Corruption in 2000			Per-capita GDP (PPP) in 2000		
	High	Medium	Low	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)	(6)
Control of Corruption t-1	0.602***	0.438***	0.671***	0.449***	0.587***	0.661***
	(0.068)	(0.072)	(0.048)	(0.088)	(0.055)	(0.048)
Online services index t-1	**0.166***	0.113	**0.089**	**0.180**	0.117	**0.101**
	(0.099)	(0.085)	(0.063)	(0.145)	(0.078)	(0.063)
Log GDP per capita t-1	0.148**	0.008	0.135	0.222*	0.088	-0.056
	(0.058)	(0.172)	(0.123)	(0.128)	(0.080)	(0.108)
Per-capita growth t-1	0.136	0.391	0.216	0.223	0.304**	-0.021
	(0.147)	(0.347)	(0.311)	(0.316)	(0.132)	(0.132)
Human capital t-1	-0.238*	0.294	0.212	0.173	-0.176	-0.833**
	(0.126)	(0.229)	(0.166)	(0.200)	(0.291)	(0.359)
Infrastructure t-1	-0.077	0.018	0.162	-0.143	-0.114	0.170
	(0.202)	(0.213)	(0.143)	(0.355)	(0.114)	(0.151)
Log population t-1	-0.044	0.016	-0.088	-0.222	-0.008	-0.012
	(0.215)	(0.195)	(0.104)	(0.347)	(0.202)	(0.070)
# observations	345	363	343	348	344	344
# countries	58	62	58	59	58	58
R-squared	0.924	0.915	0.975	0.928	0.963	0.984
R-squared (adjusted)	0.905	0.893	0.969	0.910	0.953	0.980

Note: All regressions control for country and year fixed effects. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level.
Source: Authir's computations based on WB WDI, UN e-government dataset, WB WGI, IMF public debt data set.

Table 4.5 examines which administrative processes benefit most from the development of e-government online services. It estimates the relationship between the (log) duration of administrative processes related to business registration, taxes, imports and exports, contract enforcement, and resolving insolvencies. The impact of e-government on businesses has not yet been thoroughly researched and identified. From the table it can be observed that the development of online services is associated with a decrease in the duration of some administrative processes, specifically when registering a business, preparing and paying taxes, in imports and exports (Columns 1 to 4), thus having a positive effect against bureaucracy. However, e-g the significance level of 5% and 10% is only observed in Columns 1 and Column 4, the time needed for registering a business and for exports respectively.

Table 4.5 Development of online services and duration of administrative processes 2004-2013

	(Log) duration in days of the process for:					
	Registering a business	Preparing and paying taxes	Imports	Exports	Contract enforcement	Resolving insolvency
Estimator:	Country fixed effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Online services index t-1	-0.463**	-0.044	-0.185	-0.189*	0.003	0.058
	(0.224)	(0.121)	(0.113)	(0.100)	(0.038)	(0.065)
Log GDP per capita t-1	-0.565	-0.370*	-0.190	-0.185*	-0.046	-0.123
	(0.382)	(0.201)	(0.121)	(0.104)	(0.072)	(0.105)
Per-capita growth t-1	0.268	0.127	0.0145	0.120	-0.135	0.004
	(0.397)	(0.280)	(0.194)	(0.194)	(0.131)	(0.140)
Human capital t-1	0.030	-0.003	0.098	0.032	0.001	0.221
	(0.397)	(0.108)	(0.069)	(0.053)	(0.052)	(0.149)
Infrastructure t-1	-0.098	-0.274	-0.237	-0.127	0.0912	0.0915
	(0.540)	(0.250)	(0.201)	(0.160)	(0.117)	(0.164)
Log population t-1	0.496	0.377	-0.166	-0.182	-0.179	0.185
	(0.637)	(0.326)	(0.188)	(0.152)	(0.137)	(0.212)
# observations	992	842	846	846	992	894
# countries	176	176	176	176	176	158
R-squared	0.829	0.960	0.960	0.962	0.972	0.949
R-squared (adjusted)	0.790	0.948	0.949	0.951	0.966	0.937

Note: All regressions control for country and year fixed effects. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level. Source: Author's computations based on WB WDI, UN e-government dataset, WB WGI.

4.6   Robustness checks

In Table 4.6, I investigate the sensitivity of my main empirical results to the timing of measurement of corruption perceptions and the development of e-services. I focus on changes in e-services and corruption over long-term periods. In principle, this allows to reduce concerns about the lagged assessment of changes in corruption and issues about the exact timing of the availability of e-services. In Columns 1, 2 and 3, I use 4-year differences. Specifically, I estimate:

$$Corr_{it(w)} = \beta EGov_{it(w)} + \gamma X_{it(w)} + \alpha_i + \delta_{t(w)} + \varepsilon_{it(w)} \qquad (6)$$

Where *t(w)* is equal to 2004, 2008 or 2012. In columns 2 and 3, I rely only on difference over 2004-08 and 2008-12 to investigate if the effects of e-services on corruption depend on the early stages of internet or are the same over the whole time-period 2004-12. There is some evidence that the effect of the development of e-services had a stronger negative effect on corruption over 2004-08 than 2008-12. However, when the years 2004-12 are pooled together in Column 1 the estimate is stronger and more significant than in Table 4.1 Column 1. This is reassuring as it suggests that, if anything, my baseline estimates relying on short-term variations may be downward biased.

Table 4.6 Robustness to the timing of measurement of corruption and e-services

Estimator:	First-differences over four years					
Dependent variable:	Corruption in year t			Corruption in year t+1		
Time period:	2004-12	2004-08	2008-12	2004-12	2004-08	2008-12
	(1)	(2)	(3)	(4)	(5)	(6)
Online services index t	0.202***	0.275**	0.089	0.204**	0.324**	0.025
	(0.076)	(0.131)	(0.108)	(0.085)	(0.132)	(0.116)
Log GDP per capita t	0.226***	0.207*	0.429***	0.152	-0.025	0.392***
	(0.086)	(0.113)	(0.137)	(0.093)	(0.139)	(0.131)
# observations	353	177	176	353	177	176
# countries	179	177	176	179	177	176
R-squared	0.038	0.030	0.056	0.023	0.031	0.052
R-squared (adjusted)	0.030	0.019	0.045	0.015	0.020	0.041

In Columns 4 to 6, I repeat the same specification but I assume that there may be some lags in the effects of the development of e-services as in my baseline specification in Table 3.1. More precisely, I use control of corruption in year t+1 as dependent variable. The results are qualitatively unchanged compared to Columns 1 to 3, if anything they are slightly larger for the whole 2004-12 period and the initial 2004-08 period.

Finally, Table 4.7 investigates the robustness of the results to alternative measures of corruption using a country fixed-effect panel data model. More precisely, the share of firms paying bribes to "get things done" is used with regard to customs, taxes, licenses, regulations, services, and the like (Column 1). I use the measure of control of corruption and regulatory quality from World Governance Indicators (Columns 2 and 6), the percentage of firms paying bribes from World Bank WDI (Column 3), and the transparency, accountability, and corruption in the public sector rating from the World Bank's Country Policy and Institutional Assessment (CPIA). Finally, I use the ICRG index of corruption and bureaucratic quality (Columns 1 and 5). For all three measures, an increase in online public services is correlated with a decrease in corruption. For Columns 3, 5 and 6 it seems that e-services reduce the percentage of firms paying bribes and increases the bureaucratic and regulatory quality respectively. Although in all measures the expected trend is shown, the data do not have statistical significance at least to the threshold level of 10%. However, this could be associated with the smaller number of observations, which strongly affects the significance level.

Table 4.7 Corruption, quality of government and e-services, 2004-2013

	Corruption (ICRG)	Corruption (WGI)	Firms paying bribes (%)[1]	Transparency of public sector[2]	Bureaucratic quality (ICRG)	Regulatory quality (WGI)
Estimator:	Country fixed effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Online services t-1	0.064	0.120	-21.97	0.401	0.024	0.029
	(0.214)	(0.080)	(36.11)	(0.304)	(0.041)	(0.078)
Log GDP per capita, t-1	-0.106	0.096	-21.27	0.229	0.247	0.466***
	(0.249)	(0.110)	(22.83)	(0.318)	(0.176)	(0.106)
Per-capita growth t-	0.373	0.607*	-2.085	0.768*	0.062	0.111
	(0.394)	(0.312)	(84.53)	(0.404)	(0.123)	(0.195)
Human capital t-1	0.312	-0.046	-147.3	-0.185	-0.721	-0.0978
	(0.398)	(0.285)	(140.7)	(0.271)	(0.766)	(0.119)
Infrastructure t-1	0.287	-0.112	-12.29	0.270	-0.237**	-0.246
	(0.580)	(0.249)	(42.78)	(0.536)	(0.117)	(0.210)
Log population t-1	0.442	0.266	-4.788	-1.532*	0.418	0.208
	(0.380)	(0.237)	(72.10)	(0.910)	(0.261)	(0.163)
# observations	651	651	173	368	651	1,062
# countries	131	131	105	78	131	181
R-squared	0.941	0.985	0.877	0.902	0.994	0.977
R-squared (adjusted)	0.925	0.981	0.628	0.871	0.992	0.971

Note: All regressions control for country and year fixed effects.
1. Informal payments to public officials are the percentage of firms expected to make informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services, and the like.
2. CPIA transparency, accountability, and corruption in the public sector rating (1=low to 6=high). Transparency, accountability, and corruption in the public sector assess the extent to which the executive can be held accountable for its use of funds and for the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for administrative decisions, use of resources, and results obtained. The three main dimensions assessed here are the accountability of the executive to oversight institutions and of public employees for their performance, access of civil society to information on public affairs, and grand corruption by narrow vested interests. The standard-errors are clustered at the country level. *** denotes an estimate significant at the 1% level, ** at the 5% level, and * at the 10% level. Source: WB WDI, UN e-government dataset, WB WGI, and author's computations.

4.7   Conclusion

In the fourth chapter of my thesis I investigate possible mechanisms to reduce corruption. In particular I examine e-government and the impact of this public sector reform in the reduction of corruption through its impact on the rule of law and governance. The chapter finds that e-government development can significantly reduce corruption levels. It forms the base for ongoing research on the effect of public policies that can effectively tackle corruption through an institutional framework that can explain the multiple effects of public sector policies.

E-government reduces the opportunity for petty corruption, as public employees are more easily monitored. Another mechanism is that bribes may no longer be used to "grease" the system by firms and citizens as the system becomes more efficient. Sequeira (2012) has a similar argument for tariff. Bribes decrease with the reduction of tariffs, as there are fewer incentives for firms to bribe, since the normal "public service" is better. In other words, e-government reduces the opportunity for petty corruption, when public employees and firms agree to pay bribes to "improve" a public service for a particular customer only, by making public services more efficient (Sequeira and Djankov 2011).

E-government can theoretically improve and deepen the level and quality of democracy and strengthen formal institutions, rule of law and governance in a country. Its impact on reducing corruption and promoting transparency can ensure a viable mechanism to protect the established public institutions. The role of e-government may also be important as a channel to affect the overall culture and norms of a society. It could act as a stepping stone to a more open society where information is easily accessible, where the interaction between businesses or citizens and the state can be conducted through clearly defined and simplified electronic processes, and where the mischiefs of public mechanisms can be easily depicted and dealt with.

In this chapter, I argued that e-government affects the level of corruption. I find that more advanced e-government implementation can lead to a decrease in corruption. I use several specifications to avoid potential endogeneity and possible feedbacks form lagged values of corruption. I present country fixed effects, first differences and two-step GMM estimates that rely and different identifying assumptions. In all specifications, the effect of the development of e-

government on corruption remains significant. Advances on the provision of online services offered by the state are associated with a decrease in corruption.

The measure I use to examine the effect of e-government on corruption is the UN Online Services Index, to clearly identify e-government development. Other studies investigating the effect of e-government on corruption, either use limited data on e-government, indicators of internet usage, or composite indices of e-government, arguing that infrastructure and human capital can provide a better capture of e-government readiness and capacity. The digital divide may indeed limit the benefits of e-government; low levels of human capital and infrastructure can impose barriers to e-government adaptation and usage. Poor and low-educated people may not be able to take advantage of the e-government services, leading to an equity problem (West D. M., 2005). However, based on the experiment in the State of Andhra Pradesh in India, there is evidence that barriers from low levels of human capital and infrastructure can be circumvented and poor, illiterate people can still enjoy the benefits of e-government with established internet centres and trained staff to provide them with assistance (Prahalad, 2009). Also, the effect of e-government on corruption is expected to be driven by the increased efficiency of public services, which is not directly related to infrastructure and human capital. The digitization of many processes, with documents submitted and stored electronically, results in more organized procedures, and less chances of documents being misplaced or lost. In order to establish e-government platforms and allow for certain processes to be conducted electronically I would expect the steps required to be clear and logical to follow, with information available online, avoiding having different "versions" of what is required based on public officials' demands. Therefore, I believe that the use of the Online Services Index provides the most accurate and clear method to identify e-government and its impact on corruption levels.

I examine one particular channel through which e-government can reduce corruption, by investigating the ways it can affect resource allocation decisions of firms and their bribing practices. As e-government strengthens the rule of law, and governance it can consequently reduce bribing practices of firms and the amount of bribes offered as transaction with the public sector are facilitated and they can surpass lengthy bureaucratic processes and contact with public officials. Through examining the effect of e-government in changes in corruption in firms, at the level of resource allocation, the effect of e-government in reducing corruption at the country level

can be explained. The change in corrupt practices of firms feeds back to the level of governance by reducing petty corruption and at the level of the rule of law by reducing grand corruption, thus generating changes on the embeddedness of corruption in a country and the tolerance to corruption, that I partly capture by the measures of corruption at the country level.

The effect of e-government on corruption appears multifaceted and it also affects the business environment and corruption at the firm level. E-government is found to be associated with a faster administrative processes and an ease of doing business. Specifically, the time needed to register a business, and the administrative processes for exports are reduced. The actual effects of e-government on corruption may be larger and there may be other channels through which e-government affects corruption. The chapter examined corruption at the country level and corruption reported by firms, however it did not examine other channels like citizen perception or experience of corruption.

Chapter 5

5. Conclusions

5.1   Introduction

This doctoral thesis is based on an interdisciplinary approach, as corruption has political, social, and economic aspects and implications, and should be examined in all its different dimensions to produce a comprehensive and original study. The thesis examines the effect of corruption, as an informal institution, on resource allocation decisions of firms, such as management practices that are linked to firm performance; these effects operate through altering the functioning of formal institutions; rule of law and governance.

Building upon the institutional theory, I first have developed the analytical framework for the analysis of corruption, its effects, and determinants. A plethora of studies have contributed effectively to the existing knowledge and understanding of the phenomenon of corruption. Still, the embeddedness of corruption at every stage of the institutional hierarchy and the interdependence between the different stages remain largely unexamined. The thesis produces a new categorization of corruption and associated institutions at each level of the institutional hierarchy, the dynamic links between them, and their evolving process. The thesis presents four associated and interdependent categories of corruption and associated institutions, based on Williamson's Hierarchy of Institutions (1975, 1987, 2000), adapted and extended in the context of corruption.

Following a detailed theoretical institutional framework related to the context of corruption, and an exploration of different categories of corruption and their association with firm performance, a robust econometric framework was implemented in order to examine the channels through which corruption affects firm resource allocation decisions, such as management practices, as well as the effect of public policy in reducing corruption at country level through reducing corruption in transactions between firms and the state. In doing so, I found that corruption as an informal institution can have an effect on the resource allocation decisions of firms and households through affecting formal institutional channels; in order to evaluate the effect of public policies, these channels need to be defined and disentangled. The setting of post-

communist transition countries was particularly well suited for the study of different types of corruption, rule of law, governance, and individual decisions of firms and households, and their interconnectedness. This study was based on the institutional framework presented earlier in the thesis, yet the framework can be applied to other countries to provide useful insights on the evaluation of public policies to reduce corruption.

Building on the NIE literature of Aoki (2001, 2007), Williamson (2000), and other institutional theory, the conceptual framework for corruption presented in the thesis recognizes the importance of informal institutions and their embeddedness in all other levels of institutions. However, it also identifies important feedback effects from other levels to informal institutions. The framework shows how corruption, if embedded in citizens' beliefs, will largely shape the quality of formal institutions, governance, and resource allocation mechanisms. Simultaneously, decisions made at the level of resource allocation, governance, and formal institutions could influence norms and practices, which could then provide opportunities for or, conversely, constrain institutional change. This is partly because of exogenous outcomes in the other three institutional levels. Specifically, even if institutions are endogenously selected, their effects cannot be endogenously determined since there is an absence of complete information and inability to attain the desirable effects under information asymmetry (Shvetsova, 2003). Economic policies and their respective outcomes, technological policies, public sector reforms such as e-government, trade policies and trade technology, membership of an economic or political union and the respective pressures for reform, could all lead to shifts in the culture, norms, and observed behavioural patterns in the country, and different institutional arrangements. It is also important to note that changes in outcomes in some of these levels, such as economic policies that result in economic growth, may bring a superficial temporary change in observed behaviours but it may only be another side of the same coin; people behaving differently in a growing economy does not mean beliefs changed, but rather their expression did. However, if these outcomes such as growth are present for a long period, they would be expected to influence informal institutions.

The thesis contributes to the existing literature on corruption and institutions by demonstrating the embeddedness of corruption at every level of the institutional hierarchy, by using a number of corruption measures to identify the effects and determinants of corruption, and by unveiling the links between corruption and institutions. Finally, the thesis contributes to

knowledge by the specific empirical findings of each chapter. These contributions are described in more length in this chapter. The chapter concludes by discussing possible extensions and further research work.

5.2 Corruption at every level of the institutional hierarchy

The research presented in this thesis examined the growing theoretical literature on corruption, institutions, and resource allocation decisions of firms that can be related to firm performance. It showed the interdependence of corruption, as an informal institution, with formal institutions and resource allocation at firm and household level. The thesis demonstrated how corruption could be present in every aspect of the institutional hierarchy. Corruption as an informal institution, interpreted more specifically as the general public tolerance to corruption, is at the highest level of the institutional hierarchy, whereas some specific patterns in corrupt behavior belong to the lower levels.

The research also used measures of corruption, at different levels of the industry, region, or country, focusing on corruption embedded in the society, to proxy for corruption as a cluster of specific aspects of informal institutions, showcasing the norm of corrupt practices. However, corruption could be present at the second institutional level, the rule of law, as grand corruption, in which firms bribe in exchange for influencing regulations and government decrees undermining the rule of law. Corruption could also be evident at the third institutional level, governance, as petty corruption influences the play of the game and transactions between firms, or households, and public officials. Finally, corruption is also evident at the fourth institutional level, resource allocation, when bribing practices of firms or households are examined, including allocation of effort by managers.

5.3 Multiple measures of corruption

The thesis took advantage of specific and detailed measures of corruption, both petty and grand corruption, and corruption at different levels, namely industry, region, and country. I based this on data on firms and households available for transition economies, as well as cross-country measures to examine the interrelation between corruption, other institutions, and resource allocation decisions of firms, and the impact of public policy in reducing corruption. The study

undertook a thorough theoretical and empirical study of corruption and its embeddedness in society.

For the examination of these different levels of corruption, many distinct measures of corruption were used. Specifically, the petty corruption is proxied in the thesis as (i) the estimated percentage of total annual sales that firms give to unofficial payments, (ii) corruption perceived as a barrier to doing business, and frequency of unofficial payments at both (iii) firm and (iv) household level. For measuring grand corruption, I looked at the unofficial payments that firms make to government officials in order to affect laws and regulations. For the estimation of corruption at country level I used indices of country-level corruption based on the evaluation of experts taking into account aspects of both petty and grand corruption. The plethora of measures of corruption used in this thesis to capture different aspects of corruption and its embeddedness in society is an important contribution of the thesis to the understanding of the multifaceted nature of corruption.

5.4   Links between corruption and institutions at different levels of the hierarchy

This thesis highlights the embeddedness of corruption at every institutional level and the linkages and interdependence with other institutions. While numerous studies have contributed effectively to the existing knowledge and understanding of the phenomenon of corruption and its determinants, the links and interdependence between the institutional environment and different forms of corruption and associated institutional factors remain largely unexamined. Institutional progress, in terms of judicial quality, the development of a competitive business environment without barriers to entry, a simple and efficient framework for registering and operating a business, an efficient public administration with reduced discretionary power of public officials, and the quality of contract institutions, can have a strong positive impact on the success of any anti-corruption reform policy and on the actual reduction of corruption levels. More specifically, the success of any public policy needs to be based on the understanding of the interdependence of corruption and other institutions and resource allocation decisions of firms and households.

In this direction, further to presenting the multifaceted presence of corruption in a society through its presence at each institutional level, the thesis demonstrates that every form of

corruption can be affected and can be determined by other institutions at each level of the institutional hierarchy. Specifically, the thesis supports the proposition that corruption at industry, regional, and country level is negatively associated with firm performance as it can affect institutions in areas such as competition and firm resource allocation choices; a corrupt environment can create distortions in the operations of firms and create additional costs and delays for firms, driving resources away from efficiency. The thesis also investigates a specific mechanism through which corruption as an informal institution can affect resource allocation decisions of firms, through the erosion of judicial quality and specifically through the weakening of contract institutions. Finally, the thesis investigates how institutions and public policies, specifically e-government, can have an impact on the reduction of corruption through influencing the formal institutional channels, by changing public administration, and by reducing bureaucracy in transactions and the discretionary power of public officials.

5.5   Empirical findings of the thesis

The thesis presents corruption at the highest level of the institutional hierarchy, at the level of informal institutions and also at the level of formal institutions, rule of law, and governance, as well as at the individual resource allocation decision level. Specifically, at the top level of the institutional hierarchical order (the level of informal institutions), the thesis looks at corruption at industry, regional, and country level, with a focus on the frequency of corruption, captured by firms and households. At the subsequent level below, the high order formal institutions setting (the formal rules of the game), widespread corruption can affect judicial quality and independence and undermine the rule of law. At the third institutional level, corruption can affect governance and weaken contract dependence. At the resource allocation level, corruption can affect management practices and other choices such as investment in research and development that are linked to firm performance. However, the thesis also looks at the feedback mechanisms that are prevalent according to Williamson (2000) from resource allocation to the functioning of formal institutions that in turn can influence societal norms and unwritten codes of conduct at the level of informal institutions. Resource allocation decisions of firms and households, with respect to bribing and other corrupt practices, can affect formal institutions through petty corruption at the level of governance, when firms or households bribe for overcoming bureaucratic delays and get access to licenses, and through grand corruption at the

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level of the rule of law, when firms bribe in exchange for affecting government decrees and regulations. Through these feedback mechanisms, resource allocation decisions of firms and their practices with respect to corruption can affect formal institutions and generate slow changes of behavior and beliefs regarding corruption that are embedded in society. The effect of widespread corruption on formal institutions and on resource allocation of firms as well as the feedback mechanisms are highlighted and discussed in the thesis from a different perspective in each chapter.

The thesis proceeds by empirically investigating the relationship between corruption and firm performance using firm-level data in Southern Europe, Eastern Europe, and Central Asia. Comparing the different countries, corruption appears negatively associated with firm sales at the aggregate country level. However, at firm level the results show that each firm is affected differently by corruption. This likely reflects the engagement of firms in different corrupt practices. I distinguish the effect of "petty corruption," when firms engage in corrupt practices and bribes to government officials, from the effect of "grand corruption," when firms actively initiate private payments in exchange for changes in the content of government decrees that affect their business. At the individual firm level, corruption is not found to be negative for firm performance. However, at regional and country level I find that cumulative effects matter: firms do not internalize the aggregate costs of corruption, which remain negative and significant for all firms. The study disentangles the impact of corruption at firm, sector, regional, and country level, and unveils the negative external and contextual effects of corruption.

Chapter 2 shows how corruption is embedded in every aspect of the institutional hierarchy, from informal institutions at the highest level to formal institutions, governance, and resource allocation decisions of firms. It demonstrates the importance of corruption when it becomes a widespread practice, at industry, regional, and country level, as a proxy for informal institutions, as this is shown to be negatively associated with firm performance. The chapter also shows how resource allocation decisions, such as bribing practices, are also particularly important as they can feed back to the other levels of the institutional hierarchy, through petty corruption that reduces the quality of governance, and through grand corruption that hampers the rule of law. The effect of individual firm practices on these formal institutions of rule of law and of governance can generate a slow change of behavior and norms associated with corrupt practices

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at the highest level of embeddedness in society. The chapter argues that the level of embeddedness at the top of the institutional hierarchy can be evaluated in different contexts, at industry, regional, and country level. Indeed, norms and corrupt practices may significantly differ not only between countries but also between different industries and different regions: business culture has local character as well as national. Through this analysis the chapter shows how all levels of the institutional hierarchy are interlinked in the context of corruption. The chapter forms the theoretical basis for Chapters 3 and 4 when evaluating the feedback effect of resource allocation of firms to embedded behaviours through petty and grand corruption.

Chapter 3 is based on the institutional framework discussed in Chapter 1 and on the underpinnings of Chapter 2 that posit that firms' resource allocation decisions can feed back to the highest institutional level of embeddeness of corruption in society through governance and the rule of law. Specifically the third chapter of the thesis investigates how resource allocation decisions of firms, as well as household bribing practices, can weaken governance through petty corruption and debilitate the rule of law through grand corruption, resulting in widespread regional corruption. Further, regional corruption can affect management practices and other resource allocation decisions of firms, such as research and development decisions that are linked to firm performance. The two channels through which regional corruption can affect these resource allocation decisions of firms are corruption in the judicial system at the level of the rule of law and reducing contract enforcement mechanisms at the level of governance. The chapter investigates how management practices and other resource allocation decisions of firms are affected in firms where corruption is widespread at regional level and when firms are more contract-dependent, which means that firms are more exposed to the deficiencies of a corrupt judicial system and to weak contract institutions. It argues that widespread corruption will negatively affect resource allocation decisions of firms if firms are exposed to the other two levels of the institutional hierarchy: governance and the rule of law, through contract dependence.

The chapter argues that corruption can decrease aggregate productivity by affecting resource allocation in firms and specifically by deteriorating firm management practices. It investigates the impact of regional corruption on the management quality of firms within the manufacturing sector in Central and Eastern Europe, by utilizing a newly constructed dataset merging a survey of firm management practices and regional measures of corruption from

household and firm surveys. The chapter uses a difference-in-differences instrumental variable methodology to measure the manufacturing industries' sensitivity to corruption using their level of dependence on contract institutions. Controlling for regional and manufacturing industry country-fixed effects, it shows that firms in more contract-dependent industries located in more corrupt regions tend to have lower management quality, a more centralized decision-making process, and less educated administrative workers. In more corrupt regions, other resource allocation decisions of firms are also influenced; contract-dependent firms are characterized by lower investments in R&D and smaller product markets. The falsification tests performed in the study show that contract-dependent firms do not seem affected by other business barriers; instead they systemically report corruption as a more severe barrier to doing business, and in particular corruption in the judicial system. This reinforces the theoretical underpinnings of this chapter that regional corruption affects the resource allocation decisions of firms and in particular management practices through the channels of poor judicial quality and weak contract institutions in the presence of corruption.

After examining the channels through which corruption can affect resource allocation decisions and firm performance, in the fourth chapter of the thesis, I focus on the determinants of corruption by analyzing the effect of one specific public policy, e-government. The fourth chapter of the thesis investigates in detail a new possible determinant of corruption at country and firm level: e-government development. The investigation of e-government as a determinant of corruption has been very limited, and has not explored a sufficient amount of data sources, across time, to assess its impact on corruption. To my knowledge the data used to identify the impact of e-government on corruption levels have not yet been explored in the research. I conclude that the development of e-government will play a substantial role in the global anti-corruption effort.

The theoretical underpinnings of this chapter, based on the institutional framework, are that e-government can affect both (i) the rule of law, through affecting the division of power and the way the executive power of the government is delivered, and (ii) the quality of governance via the quality of bureaucracy, by reducing the discretionary power of public officials and delivering services online. I examine one particular channel through which e-government can reduce corruption, by investigating its effects on the resource allocation decisions of firms and their bribing practices. As e-government strengthens the rule of law and governance it can

consequently reduce firms' bribing practices; e-government can improve governance and firms can avoid lengthy bureaucratic processes and contact with public officials without offering a bribe in order to facilitate transactions with the public sector. The development of e-government and provision of more interactive government services to citizens is expected to reduce the levels of administrative corruption. The strength of e-government implementation is expected to reduce the amount of bribes paid by firms. Through examining the effect of e-government on changes in corruption in firms at the level of resource allocation, the effect of e-government in reducing corruption at country level can also be better understood. The change in corrupt practices of firms feeds back to the level of governance by reducing petty corruption and to the level of the rule of law by reducing grand corruption, thus generating changes in the embeddedness of corruption and in the tolerance to corruption, which I partly capture by the measures of corruption at country level. The study of e-government and its impact on corruption and institutions forms a new interesting area of research, and raises the particular importance of public policies in addressing corruption and their evaluation with respect to the different levels of the institutional hierarchy. The chapter highlights how this public policy can reduce corruption by strengthening formal institutions that can foster the creation, development, and efficient operation of businesses, affecting the resource allocation decisions of firm with respect to bribing.

5.6 Future research agenda

One possible channel that I want to investigate in the future is financial dependence of firms, which can affect their resource allocation decisions, and firm performance in regions that are highly corrupted. My current research has underlined that corruption affects firm behavior and that this effect depends on the level of contractual dependence of manufacturing sectors. However, financial services could also be affected by corruption. Therefore, the main question that I want to explore relates to the mechanisms through which institutions, particularly corruption, can affect firm performance and resource allocation through hampering access to finance across firms. In this case, firms that are more dependent on finance would be expected to be more hampered by corruption. Firm access to finance influences the cost of capital, the level of investment, the degree of technological transfer, and the distribution of gains, while financial services rely heavily on contracts and their enforcement. Firms that want to expand their operations have to finance their growth either through their own cash flows, equity, debt, or

informal loans. Corruption, and in particular corrupt courts, may lower the returns of financial intermediaries and reduce firms' access to external finance. Since services provided by the financial sector are largely immobile, I expect firm capital structure and investment decisions to be influenced by regional corruption.

Moreover, the existing literature shows that corruption could influence corporate finance through firms' capital structure and access to external finance.[29] In regions with higher levels of corruption and worse contract enforcement, I expect the financial structure of the firms to be biased towards debt rather than equity or FDI (Foreign Direct Investment), because debt contracts are usually cheaper to enforce and international debt contracts rely partly on creditor countries' legislation. FDI investors have also to obtain licenses, permissions, and authorizations to build and operate plant, interacting constantly with corrupt officials. Furthermore, minority equity investors are particularly vulnerable to expropriation by corporate managers and block shareholders in corrupt countries. Indeed, Acemoglu and Johnson (2005) document that weak property rights and contract institutions reduce equity markets' development. Corruption may not only influence the forms of financial intermediation but also the overall access to finance. Djankov et al. (2007) show that low creditor rights decrease the extent of private credit. Hence I want to test how corruption affects resource allocation decisions, with respect to the forms of financial intermediation by weakening formal institutions, and if corruption lowers firm performance in firms that are more dependent on finance and located in more corrupt regions.

As an extension of the research conducted in Chapter 4, I aim to examine one related aspect of e-government development and its impact on corruption, which is the development of e-transparency. The E-transparency Index is a governance index that assesses the online services provided by anti-corruption websites globally. Its purpose is to rank anti-corruption websites, from the point of view of the citizens. The index assesses the quality and level of the website, based on the online services offered. The first level of online services includes the provision of information regarding corruption, whereas the most integrated level includes an interactive capacity, between citizens and the state or other anti-corruption agencies and civil society organizations. An example

[29]More generally, the question of institutions and the impact of services on downstream manufacturing firms has been explored by Svaleryd and Vlachos (2005) and Arnold et al. (2011).

of interactive ability between citizens and the state is the ability of citizens to submit online complaints regarding corrupt activities.

A part of the E-transparency Index is based on the Online Service Index by the United Nations that together with a Human Capital Index and a Telecommunication Index form the UN E-Government Index, which I analyzed in Chapter 4. The E-transparency Index is based on the classification used by the Web Content Accessibility Guidelines, also from the UN, for the assessment of websites, but will be adapted for the specific case of corruption. The aim of the E-transparency Index is not the assessment of government services in total, but of online services and the level of information provided around the specific area of corruption. The index is concerned with the services provided to citizens on corruption, specifically, and the power of citizens to be informed on corruption and what constitutes a corrupt act, and to report corrupt activities.

Apart from the subject area difference with the UN Online Service Index, the E-transparency Index assesses websites differently in its determination of citizen power regarding corruption. It not only assesses the online services of government websites but also other anti-corruption agencies and civil society organizations working against corruption. This approach leads to a strong indicator of overall provision of online information to citizens on anti-corruption issues. However, for the purpose of comparison within and across countries, the E-transparency Index also provides the separate ranking of services of government websites on corruption, and the ranking of all other anti-corruption agencies.

The development of the E-transparency Index addresses partly some of the limitations that exist in the available datasets that attempt to measure corruption. Variables measuring corruption have inherent limitations and the empirical results are dependent on the source of the measures of corruption, and the specific types of corruption. Additional measures of corruption, such as those measured by the E-transparency Index that I intend to develop, can provide an additional robust measure of corruption, looking specifically at the anti-corruption capacity, the governance level, that can address some of the inherent measurement problems of corruption and provide an additional useful measure for the evaluation of public policies.

This index will first be calculated for the transition countries and will be used to assess its impact in reducing corruption levels, as it captures specific aspects of online service development. It will also serve as a different measure of corruption that overcomes many problems and biases in the identification of corruption that arise because of underreporting and because of differences in perceptions, as it is based on actual data that can be compared across countries. After the initial evaluation of countries in transition, I aim to calculate the index for additional countries, to be able to better evaluate the impact of e-transparency on levels of corruption. I expect that improvements in this governance index will lead to reduction of corruption, as it can affect resource allocation decisions of individuals and firms and their bribing practices.

APPENDICES

Appendix A1. Definitions and sources of the variables used in Figure 1.2 (Chapter 1)

World Bank – World Governance Indicator in 2014 – 2015 update

http://info.worldbank.org/governance/wgi/index.aspx#home

World Bank – World Development Indicators in 2014 – 2016 update

GDP per capita, PPP (current international $) (NY.GDP.PCAP.PP.CD). GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current international dollars based on the 2011 ICP round.

http://databank.worldbank.org/data/reports.aspx?source=2&series=NY.GDP.PCAP.PP.CD&country=

EBRD – Transition Indicators 2014 - Governance and enterprise restructuring

The indicator reflects the judgment of the EBRD's Office of the Chief Economist about country-specific progress in transition. The scores are based on the following classification system:

1. Soft budget constraints (lax credit and subsidy policies weakening financial discipline at the enterprise level); few other reforms to promote corporate governance.

2. Moderately tight credit and subsidy policy, but weak enforcement of bankruptcy legislation and little action taken to strengthen competition and corporate governance.

3. Significant and sustained actions to harden budget constraints and to promote corporate governance effectively (for example, privatisation combined with tight credit and subsidy policies and/or enforcement of bankruptcy legislation).

4. Substantial improvement in corporate governance and significant new investment at the enterprise level, including minority holdings by financial investors.

5. (4+) Standards and performance typical of advanced industrial economies: effective corporate control exercised through domestic financial institutions and markets, fostering market-driven restructuring.

http://www.ebrd.com/what-we-do/economic-research-and-data/data/forecasts-macro-data-transition-indicators.html

EBRD – Transition Indicators 2014 - Competition policy

The indicator reflects the judgment of the EBRD's Office of the Chief Economist about country-specific progress in transition. The scores are based on the following classification system:

1. No competition legislation and institutions.

2. Competition policy legislation and institutions set up; some reduction of entry restrictions or enforcement action on dominant firms.

3. Some enforcement actions to reduce abuse of market power and to promote a competitive environment, including break-ups of dominant conglomerates; substantial reduction of entry restrictions.

4. Significant enforcement actions to reduce abuse of market power and to promote a competitive environment.

5. (4+) Standards and performance typical of advanced industrial economies: effective enforcement of competition policy; unrestricted entry to most markets.

http://www.ebrd.com/what-we-do/economic-research-and-data/data/forecasts-macro-data-transition-indicators.html

Table A1. Countries used for computations in Tables 1.2 and 1.3 (Chapter 1)

WGI, 2010	BEEPS 2005	BEEPS 2009	LITS 2006
Albania	Albania	Albania	Albania
Armenia	Armenia	Armenia	Armenia
Azerbaijan	Azerbaijan	Azerbaijan	Azerbaijan
Belarus	Belarus	Belarus	Belarus
Bulgaria	Bulgaria	Bulgaria	Bulgaria
Croatia	Croatia	Croatia	Croatia
Estonia	Estonia	Estonia	Estonia
Georgia	Georgia	Georgia	Georgia
Hungary	Hungary	Hungary	Hungary
Kazakhstan	Kazakhstan	Kazakhstan	Kazakhstan
Kyrgyz Republic	Kyrgyz Republic	Kyrgyz Republic	Kyrgyz Republic
Latvia	Latvia	Latvia	Latvia
Lithuania	Lithuania	Lithuania	Lithuania
FYR Macedonia	FYR Macedonia	FYR Macedonia	FYR Macedonia
Moldova	Moldova	Moldova	Moldova
Mongolia		Mongolia	Mongolia
Montenegro	Montenegro[1]	Montenegro	Montenegro
Poland	Poland	Poland	Poland
Romania	Romania	Romania	Romania
Russian Federation	Russian Federation	Russian Federation	Russian Federation
Serbia	Serbia[1]	Serbia	Serbia
Slovak Republic	Slovak Republic	Slovak Republic	Slovak Republic
Slovenia	Slovenia	Slovenia	Slovenia
Tajikistan	Tajikistan	Tajikistan	Tajikistan
Turkey			
Turkmenistan			
Ukraine	Ukraine	Ukraine	Ukraine
Uzbekistan	Uzbekistan	Uzbekistan	Uzbekistan

1. The 2005 observation for the entity "Serbia and Montenegro" is used here for both Serbia and Montenegro.

<u>Source:</u> Author's own elaboration

Table A2. Correlations between the different measures of corruption at the country level[1] (Chapter 1)

Variable	Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Frequency of corruption (Petty Corruption), BEEPS	2009, (1)	1.0								
	2005, (2)	0.7	1.0							
Average corruption, unofficial payments as % of sales (Petty Corruption) BEEPS	2009, (3)	0.2	0.0	1.0						
	2005, (4)	0.6	0.6	0.2	1.0					
Grand corruption, BEEPS	2005, (5)	0.2	0.4	0.0	0.2	1.0				
Corruption as a business barrier, (Petty Corruption), BEEPS	2009, (6)	0.6	0.6	0.0	0.7	0.2	1.0			
	2005, (7)	0.4	0.6	0.0	0.3	0.7	0.4	1.0		
Frequency of corruption (Petty Corruption), LITS	2006, (8)	0.8	0.7	0.0	0.7	0.3	0.5	0.5	1.0	
Corruption, (Petty and Grand Corruption)WGI	2010, (9)	-0.9	-0.7	-0.3	-0.7	-0.1	-0.5	-0.3	-0.7	1.0

1. The table displays Spearman's rank correlations. Only 28 transition countries are considered here (see also appendix Table A1). Comparator countries of the 2005 BEEPS are not taken into account. The observation for Serbia and Montenegro in 2005 is merged with Serbia and with Montenegro in subsequent years.

Source: Author's own elaboration.

Table A3. Correlations between the different variables (Chapter 4)

	Corruption			E-government index, t-1			Country characteristics, t-1			
	WGI, t	ICRG, t	E-gov	OSI	Infrastructure	Human capital	GDP pc	Growth	Log pop	Open. trade
Corr (WGI)	1.00									
Corr (ICRG)	0.88	1.00								
Corr t-1	0.99	0.88	1.00							
Online-services t-1	0.68	0.61	0.68	1.00						
Human Capital t-1	0.56	0.45	0.56	0.62	1.00					
Telec. infras--tructure t-1	0.88	0.79	0.88	0.75	0.65	1.00				
Log GDP per Capita t-1	0.82	0.67	0.83	0.69	0.76	0.87	1.00			
Growth t-1	-0.17	-0.15	-0.17	-0.04	0.08	-0.17	-0.12	1.00		
log pop t-1	-0.25	-0.15	-0.25	0.16	-0.14	-0.15	-0.26	0.15	1.00	
Op. Trade t-1	0.23	0.16	0.23	0.13	0.22	0.24	0.24	0.02	-0.44	1.00
Nat. Ress. t-1	-0.35	-0.33	-0.35	-0.33	-0.20	-0.32	-0.11	0.09	-0.08	0.02

Note: Year (t)= 2004, 2005, 2006, 2009, 2011 and 2013.
Corruption is the control of corruption variable from the WB WGI.
Source: WB WDI, UN e-government dataset, WB WGI, ICRG and author's computations.

APPENDIX B

B.1 Detailed corruption questions (BEEPS)

We use the BEEPS 2009 survey to compute regional corruption. We use information for all firms in manufacturing sectors and services. In addition to the 11 manufacturing sectors surveyed in the MOI survey (food, textiles, garments, chemicals, plastics & rubber, metallic mineral products, basic metals, fabricate metal products, machinery and equipment, electronics, and other manufacturing plants), the BEEPS survey includes information on services (wholesale and retail trades, services of motor vehicles - section G -, and hotel and restaurants - section H -), computer and related activities (IT), the construction sector - section F -, and the sector of transport, storage and communications - section I -. By contrast, the BEEPS survey does not contain information on real estate and renting activities, financial intermediation, and public and utilities sectors. We use median weights for all computations involving the 2009 survey[30].

The share of sales paid as bribes comes from three questions in the BEEPS survey 2009. The main question is the following: It is said that establishments are sometimes required to make gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose (j7a). If the respondent reports the total amount of bribes rather than the share of sales paid as bribes (j7b), the total amount of bribes is divided by the total sales of the last complete fiscal year (question d2). Refusals and "don't know" answers have been coded as missing.

The barrier to growth measure of corruption comes from the question: As I list some factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is no obstacle, a minor obstacle, a moderate obstacle, a major obstacle, or a very severe obstacle to the current operations of this establishment (corruption question j30f).

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[30]Median weights correspond to an adjustment of the stratum of the survey. Median weights include in the projection population the answering establishments and the active establishments that could not be reached.

Answers are recoded from 0, no obstacle, to 4, very severe obstacle. Refusals and "don't know" answers are coded as missing.

B.2 Variance decomposition formula

In Table 1, we decompose the total variance in these regional averages into the parts of the variance within and between countries using the relationship:

$$\frac{1}{R}\sum_c\sum_r (x_{cr} - x_{..})^2 = \frac{1}{R}\sum_c\sum_r (x_{cr} - x_{c.})^2 + \frac{1}{R}\sum_c R_c (x_{c.} - x_{..})^2 \ ,$$

where r is an index for regions, and c is an index for countries. xcr is a particular measure of corruption averaged at the regional level. x.., xc. are unweighted overall and country averages. There are R_c regions in country c. R is the total number of regions across all countries in our sample.

B.3 Matching industry classifications

We match the US I-O industry classication to the ISIC3.1 industries used in the MOI survey, by constructing a concordance using the I-O classication to NAICS 97 concordance from the U.S. Bureau of Economic Analysis (BEA) and concordance between the NAICS97, NAICS02 and ISIC3.1 from the U.S. Bureau of Labor Statistics (BLS).

More precisely, we use the following files:

-http://www.bea.gov/national/zip/ndn0306.zip (NAICS-IO.xls and NAICSUseDetail.txt)

- http://www.economics.harvard.edu/faculty/nunn/files/contract intensity IO 1997.xls;

- http://www.census.gov/eos/www/naics/concordances/1997 NAICS to 2002 NAICS.xls;

- http://www.census.gov/eos/www/naics/concordances/2002 NAICS to ISIC 3.1.xls.

We map the I-O 6-digit classification to the NAIC97, then to the NAICS2002, and to the ISIC3.1 classifications. There are some ISIC3.1 industries that overlap several I-O codes, and we use equal weights when we aggregate the I-O industries to the 4 digit ISIC3.1 classication. In

the end, for each 4-digit ISIC3.1 industry of the MOI survey, we have 1997 benchmark U.S. data

on the concentration of inputs and the fraction of inputs that is either sold on an organized

exchange market, have listed prices, or inputs that do not belong in either of the previous

categories.

Figure B.1..a. Firm share of sales paid as bribes

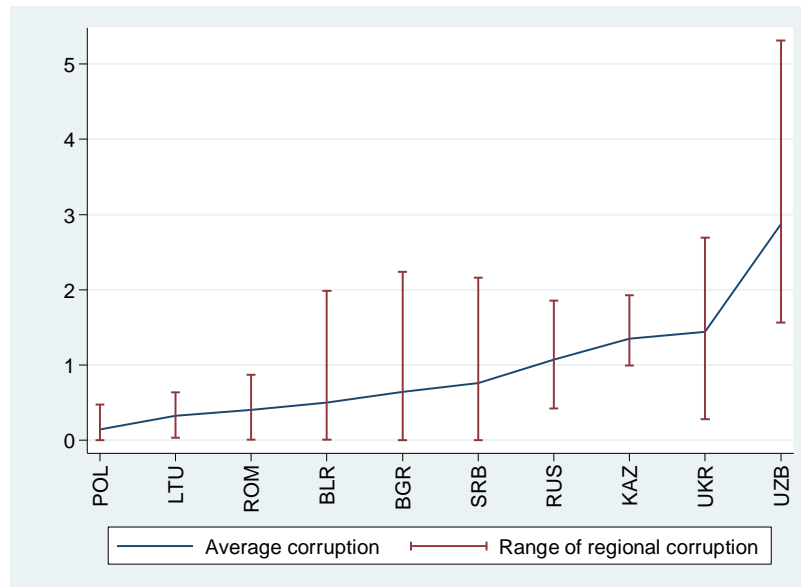Figure B.1.b. Household assessment of the frequency of corruption
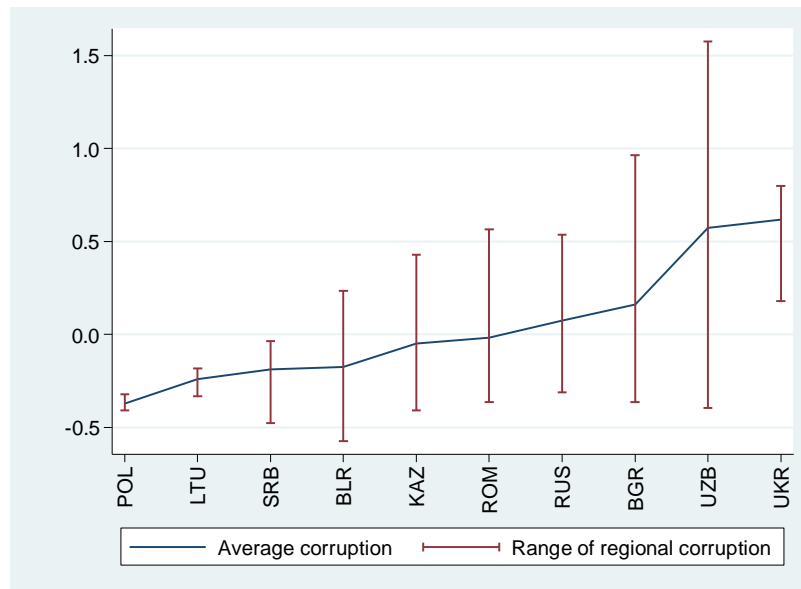

Figure B.1. Corruption by country and regional dispersion

<u>Note:</u> The graphs show regional levels of corruption. The solid line represents the un-weighted-country average of regional measures of corruption. The vertical bars denote minimum and maximum levels. <u>Source:</u> BEEPS 2009, LITS 2006 (EBRD-WB), and authors' computations.

Table B.1. Contract dependence by manufacturing sectors

10 manufacturing sectors, less dependent of contracts	Contract dependence
Manufacture of malt liquors and malt	0.11
Manufacture of grain mill products	0.38
Manufacture of vegetable and animal oils and fats	0.47
Production, processing and preserving of meat and meat products	0.52
Manufacture of prepared animal feeds	0.59
Manufacture of tobacco products	0.60
Manufacture of basic precious and non-ferrous metals	0.60
Processing and preserving of fruit and vegetables	0.60
Manufacture of dairy products	0.64
Manufacture of veneer sheets; manufacture of plywood, laminboard, particle board and other panels and boards	0.65
10 manufacturing sectors, more dependent of contracts	
Manufacture of industrial process control equipment	0.99
Manufacture of jewellery and related articles	0.99
Manufacture of office, accounting and computing machinery	0.99
Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy	0.99
Service activities related to printing	1.00
Publishing of newspapers, journals and periodicals	1.00
Other publishing	1.00
Printing	1.00
Manufacture of macaroni, noodles, couscous and similar farinaceous products	1.00
Reproduction of recorded media	1.00

Note: Contract dependence of manufacturing sectors at the ISIC3.1 4 digits level. The measure is the share of relationship-specific inputs used by each US manufacturing sector in 1997. It is computed using Nunn (2007) share of inputs neither traded on open markets nor listed on leaflets at the 6-digit I-O classification level. It is converted to ISIC3.1 sectors using the BEA correspondence between the I-O classification and the NAICS 1997 and the BLS correspondence files between NAICS 1997 and 2002 and NAICS 2002 and ISIC3.1. Source: Nunn (2007), Rauch (1999) and authors' computations.

Table B.2. Product complexity by manufacturing sectors

10 manufacturing sectors, with less complex product	(minus) Herfindahl
Manufacture of malt liquors and malt	-0.24
Manufacture of vegetable and animal oils and fats	-0.21
Manufacture of pumps, compressors, taps and valves	-0.20
Manufacture of tobacco products	-0.19
Processing and preserving of fish and fish products	-0.18
Publishing of newspapers, journals and periodicals	-0.18
Tanning and dressing of leather	-0.18
Manufacture of steam generators, except central heating hot water boilers	-0.17
Manufacture of dairy products	-0.17
Other publishing	-0.17
10 manufacturing sectors, with more complex product	
Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	-0.06
Manufacture of fertilizers and nitrogen compounds	-0.06
Manufacture of parts and accessories for motor vehicles and their engines	-0.06
Manufacture of other general-purpose machinery	-0.05
Recycling of non-metal waste and scrap	-0.05
Manufacture of other fabricated metal products n.e.c.	-0.05
Manufacture of other non-metallic mineral products n.e.c.	-0.05
Manufacture of basic precious and non-ferrous metals	-0.05
Manufacture of other textiles n.e.c.	-0.04
Manufacture of motor vehicles	-0.04

Note: Product complexity is (minus the) Herfindahl index computed from the BEA 1997 benchmark use table by industry at the 6-digits I-O level. It is converted to ISIC3.1 sectors using the BEA correspondence between the I-O classification and the NAICS 1997 and the BLS correspondence files between NAICS 1997 and 2002 and NAICS 2002 and ISIC3.1. The presented index is minus the usual Herfindahl index and higher values indicate sectors with lower input concentration. Source: BEA 1997 benchmark use table by industry and authors' computations.

Table B.3. Correlations between different metrics of institutional dependence by manufacturing sectors

	Contract dependence				Concentration of inputs		
	Share of inputs neither sold on exchange markets nor having listed prices		Share of inputs not sold on exchange markets		Herfindahl (minus)	Gini (minus)	Share 20 (minus)
	(lib)	(cons)	(lib)	(cons)			
Panel A. Linear correlations between metrics of institutional dependence							
Contract dependence (lib)	1.00						
Contract dependence (cons)	0.93	1.00					
Contract dependence based on exchange (lib)	0.62	0.59	1.00				
Contract dependence based on exchange (cons)	0.66	0.62	0.95	1.00			
(minus) Herfindahl index	0.29	0.29	0.14	0.19	1.00		
(minus) Gini index	0.33	0.33	0.29	0.35	0.69	1.00	
(minus) Shareof the 20 most important inputs	0.38	0.37	0.32	0.38	0.70	0.98	1.00
Panel B. Non-linear correlations between metrics of institutional dependence							
Contract dependence (lib)	1.00						
Contract dependence (cons)	0.86	1.00					
Contract dependence based on exchange (lib)	0.62	0.58	1.00				
Contract dependence based on exchange (cons)	0.64	0.56	0.95	1.00			
(minus) Herfindahl index	-0.03	-0.07	0.10	0.17	1.00		
(minus) Gini index	0.17	0.13	0.31	0.39	0.72	1.00	
(minus) Shareof the 20 most important inputs	0.18	0.14	0.32	0.40	0.69	0.99	1.00
# Manufacturing sectors	126	126	126	126	126	126	126

Note: Contract dependence of manufacturing sectors at the ISIC3.1 4 digits level. The measure is the share of relationship-specific inputs used by each US manufacturing sector in 1997. It is computed using Nunn (2007) share of inputs neither traded on open markets nor listed on leaflets at the 6-digit I-O classification level. (Minus the) Herfindahl index, (minus the) Gini index, (minus the) share of the 20 most important inputs computed from the BEA 1997 benchmark use table by industry at the 6-digits I-O level. All measures are converted to ISIC3.1 sectors using the BEA correspondence between the I-O classification and the NAICS 1997 and the BLS correspondence files between NAICS 1997 and 2002 and NAICS 2002 and ISIC3.1.
Source: Nunn (2007), Rauch (1999) and authors' computations.

Table B.4. Difference-in-differences estimate using the index of product complexity
(minus the Herfindahl index of inputs)

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-7.953			-7.531		
x Product complexity	(6.605)			(7.036)		
Frequency of bribes (LITS 2006)		-9.046***			-9.752***	
x Product complexity		(3.087)			(3.238)	
Share of sales paid as bribes (BEEPS 2009)			-5.627***			-5.634***
x Product complexity			(1.669)			(1.785)
R-squared	0.192	0.193	0.194	0.225	0.227	0.227
Panel B. Controlling for 22 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-2.549			-2.293		
x Product complexity	(4.220)			(4.348)		
Frequency of bribes (LITS 2006)		-6.347**			-7.145**	
x Product complexity		(2.804)			(2.833)	
Share of sales paid as bribes (BEEPS 2009)			-4.030**			-4.200**
x Product complexity			(1.707)			(1.857)
R-squared	0.244	0.245	0.245	0.273	0.275	0.275
Panel C. Controlling for 59 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-3.462			-4.802		
x Product complexity	(4.122)			(4.175)		
Frequency of bribes (LITS 2006)		-4.403			-5.506*	
x Product complexity		(2.934)			(2.951)	
Share of sales paid as bribes (BEEPS 2009)			-1.907			-2.613
x Product complexity			(2.179)			(2.250)
R-squared	0.344	0.344	0.344	0.368	0.369	0.368
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: The table reports the estimates of the equation $Y_{isrc}=\alpha.exp_s.C_{rc}+X_{isrc}\beta+\lambda_{sc}+\delta_{rc}+\varepsilon_{isrc}$, with λ_{sc}, manufacturing sector times country fixed effects, and δ_{rc}, regional fixed effects. Exp_s is the measure of sensitivity to corruption computed using the US input-output table. C_{rc} is our measure of corruption and X_{isrc} a set of control variables.
1. Noise controls include interviewer characteristics (gender, a quadratic in age, highest degree) and interview characteristics. The later include 7 dummies for the days of the week, 4 dummies for the time of the day (morning, lunch time, afternoon or evening), the duration of the interview (in minutes), and a quadratic trend in the date of the interview allowing for business cycle effects.
2. Additional control variables include a quadratic function of size (number of full-time employees), a dummy for unknown size, dummy variables by types of ownership, dummy variables by size of municipality and a dummy variable if the establishment is part of a larger firm.
Source: MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), and authors' computations.

Table B.5. Difference-in-differences estimate using the index of product complexity (minus the Herfindahl index of inputs) and correcting for US benchmarking bias

Dependent variable:	Average quality of management practices					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Controlling for 10 manufacturing sectors						
Frequency of bribes (BEEPS 2009)						
x Product complexity	0.836			0.758		
Frequency of bribes (LITS 2006)	(5.745)			(5.870)		
x Product complexity		-7.871***			-8.645***	
Share of sales paid as bribes (BEEPS 2009)		(2.872)			(2.997)	
x Product complexity			-3.453**			-3.628**
Frequency of bribes (BEEPS 2009)			(1.584)			(1.611)
Panel B. Controlling for 22 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	3.089			2.580		
x Product complexity	(4.349)			(4.196)		
Frequency of bribes (LITS 2006)		-5.511*			-6.076**	
x Product complexity		(2.853)			(2.913)	
Share of sales paid as bribes (BEEPS 2009)			-4.197***			-4.329***
x Product complexity			(1.193)			(1.227)
Panel C. Controlling for 59 manufacturing sectors						
Frequency of bribes (BEEPS 2009)	-2.080			-1.276		
x Product complexity	(3.539)			(3.779)		
Frequency of bribes (LITS 2006)		-4.244			-4.993	
x Product complexity		(3.188)			(3.157)	
Share of sales paid as bribes (BEEPS 2009)			-2.980**			-3.482***
x Product complexity			(1.308)			(1.337)
Industry x country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Noise controls				Yes	Yes	Yes
Additional control variables				Yes	Yes	Yes
# Observations	1,355	1,355	1,355	1,355	1,355	1,355
# clusters (regions x industry)	386	386	386	386	386	386

Note: 1. Same note as table above
2. Additional control variables include a quadratic function of size (number of full-time employees), a dummy for unknown size, dummy variables by types of ownership, dummy variables by size of municipality and a dummy variable if the establishment is part of a larger firm.
Source: MOI survey, BEEPS 2009 and LITS 2006 (EBRD-WB), and authors' computations.

Table B.6. Correlations between management practices

	Quality of management practices					Absence of target	Subjective management quality			Centra--lization
	Average	Monitoring	Targets	Incentives	Operations	target	Overall	People	Process	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Experience based measures of management quality										
Average	1.00									
Monitoring	0.50	1.00								
Targets	0.72	0.12	1.00							
Incentives	0.71	0.04	0.52	1.00						
Operations	0.59	0.09	0.16	0.22	1.00					
No target	0.28	0.19	0.40	0.06	0.06	1.00				
B. Subjective self-assessment of management quality										
Overall	0.16	0.00	0.08	0.15	0.17	0.00	1.00			
People	0.19	0.04	0.08	0.15	0.20	-0.02	0.74	1.00		
Process	0.20	0.05	0.07	0.17	0.21	-0.01	0.77	0.72	1.00	
C. Other establishment characteristics										
Centralization	-0.02	0.07	-0.06	0.01	-0.06	0.01	-0.07	-0.09	-0.02	1.00
Establishment size	0.09	0.08	0.11	0.02	0.03	0.05	-0.07	-0.03	-0.03	0.03

<u>Note</u>: The Table reports pair-wise linear correlations between different metric of the quality of management practices. <u>Source:</u> MOI 2010 (EBRD-WB) and authors' computations.

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