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Greasing the wheels of change: the impact of corruption on firms? innovation in transition economies

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Abstract

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ABSTRACT

Conventional wisdom indicates a negative relationship between corruption and economic activities. However, recent studies suggest heterogeneous consequences on individual firm performance, given differences in organizational structures, strategies, industry regulations and surrounding institutions. Using responses from 7,000 firms in 30 transition economies, this study examines the impact of bribes on firm innovation. Due to numerous and rapid changes experienced over the past decades, these countries exhibit anomic conditions propitious for mass propagation of corruption. I argue that in these anomic settings, bribes present as a more efficient alternative to introduce innovative products to markets. Secondly, this effect is accentuated by the existence of "organized" corruption, which reduces the overall financial burden and informational asymmetry that firms face in their local environments. Finally, the efficiency of bribes is mitigated by the quality of existing formal (control of corruption) and informal (trust) institutions.

Keywords: Corruption; innovation; transition; institutions; trust; anomie

INTRODUCTION

Innovation is acknowledged as the main engine of economic development and competitiveness (Romer 1991; Cameron 1996; Rosenberg 2004), and the question of what drives innovation has been investigated by numerous scholars (McCann & Oxley 2012). Overall, these studies have identified both firm (e.g. R&D investment, foreign technology licensing, level of competition) and country characteristics (e.g. industrial clusters, human capital, innovation policies) that affect the rates of innovation across countries (Furman, Porter, & Stern 2002; Lederman 2010). However, despite a large body of work examining these issues, evidence of the impact of institutional characteristics on innovation remains scant (Anokhin & Schulze 2009; Gorodnichenko, Svejnar, & Terrell 2010).

Among these institutional idiosyncrasies, corruption –i.e. the abuse of public power for private benefit - has both economy-wide (Mauro 1995) and firm-specific (Rodriguez, Uhlenbruck, & Eden 2005) implications. Seldom seen as a necessary "grease" to circumvent bureaucratic obstacles, inefficient public procurements and rigid legislation (Leff 1964; Lien 1990; Huntington 1968), corruption can be beneficial to entrepreneurial endeavors and economic growth in dysfunctional institutional settings (Egger & Winner 2005; Levy 2007; Méon & Weill 2010). Oppositely, corruption may *"sand"* economic endeavors through increased transaction costs and uncertainty (Shleifer & Vishny 1993; Fisman & Svensson 2007), misallocation of resources (Rose-Ackerman 1998) and barriers to investments (Cuervo-Cazurra 2006; Hakkala, Norbäck, & Svaleryd 2008). However, while the relation between corruption levels and standard economic indicators, such as growth (Mauro 1995; Campos, Dimova, & Saleh 2010), foreign direct investments (Cuervo-Cazurra 2006; Meschi 2009), trade flows (Dutt & Traca 2010), productivity (Rosa, Gooroochurn, & Gorg 2010; Asiedu & Freeman 2009) and human

development (Rose-Ackerman 1998; Akcay, 2006) have received significant attention, scholars have yet to address how individual firms in different institutional settings react to corruption (Uhlenbruck et al. 2006; Galang 2012).

Building on anomie theory (Durkheim 1897; Merton 1938) and institutional arguments (Kostova 1999; Scott 2001), I move the discussion of corruption towards examining its effect on firm innovation and propose several contributions. First, answering recent calls to explore this complex phenomenon (Anokhin & Schulze 2009), I hypothesize that corruption has a positive impact on firm innovation in emerging markets via two channels: (i) by allowing access to decision making processes, therefore reducing uncertainty (Leff 1964), and (ii) by providing a way to overcome bureaucratic obstacles and sub-par public services (such as licenses, permits) associated with introduction of innovations in the market (Lui 1985). Secondly, I propose a negative relationship between local environmental heterogeneity (defined as the dispersion of bribes at the level of a sector-region-city unit) and firm innovation. As local volatility of bribe practices increases due to informational asymmetries, firms' willingness to pay and real-options (Svensson 2003), the efficiency of bribes in facilitating innovation will decrease, as firms will find increasingly difficult to match the expectations of corrupt bureaucrats (Drugov 2010). This effect is moderated by the amount of bribes, so that firms with large bribes in heterogeneous environments will enjoy greater leverage. Finally, considering corruption as a more efficient substitute for weak institutions (Infante & Smirnova 2009; Vaal & Ebben 2011), I propose that the impact of corruption on innovation to be moderated by the quality of existing (formal and informal) institutions.

These hypotheses are tested using data on 7,000 firms in 30 transition economies from Central Asia and Eastern Europe. These countries exhibit significant heterogeneity in terms of corruption

practices (Uhlenbruck et al. 2006), institutional quality (Meyer et al. 2009), and national innovative infrastructure (Krammer 2009). Results indicate that bribes have a positive effect on firm innovation. This finding is robust to alternative specifications, controls and measurement proxies, strongly supporting the "greasing the wheel" hypothesis. Operating in heterogeneous local environments has a negative effect on average firm innovative performance; however, larger bribes, even in such environment, translate into additional innovations being introduced. Finally, the quality of existing institutions (formal and informal) reduces the efficiency of bribes in the deployment of new products, confirming prior theoretical conjectures (Acemoglu & Verdier 2000).

LITERATURE AND THEORETICAL BACKGROUND

Innovation and its determinants

Over the past five decades, scholars have made significant progress in understanding drivers of economic growth. As result, there is clear consensus on the significant role of innovation in this process (Romer 1991; Cameron 1996; Rosenberg 2004). Regardless, innovation remains a concept open to interpretations, and researchers employ different proxies (i.e. patents, R&D expenditures) to capture it. This study adopts a common definition in the context of firm-level surveys, namely product innovations- i.e. the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses- (Olso manual, 2005).

An important question that remains unanswered is what factors enable (or hinders) innovation (McCann & Oxley 2012). Many scholars have been addressed this question, and their results suggest that both country- and firm-specific factors are important. Furman, Porter, & Stern (2002) find that the amount of inputs (R&D spending, manpower), strength of academic

activities, technological specialization, available human capital and policy choices (with respect to trade, science or R&D) shape countries' ability to innovate. Moreover, these factors are deeply rooted in the microeconomic (firm) successes of a nation (Lederman 2010). Thus, while firm (i.e. size, competition, external linkages) and industry (technological maturity, competitive position) specifics are undeniable related to innovative performance, disentangling their effects from those of macro-economic factors successfully requires further assessment (Filippetti & Archibugi 2011).

Corruption and its economic implications

Scholars have proposed various definitions of corruption in the literature pending on its source (private sector, public sector or both), size (petty versus grand corruption) and intended goals (to influence policies, lawmakers; ease administrative burden, etc.). Generally, it is defined as an abuse of public power for private gain (Tanzi & Davoodi 1997; Uhlenbruck et al. 2006). Within this framework, "abuses" commonly include accepting, soliciting or extorting bribes for private benefits, patronage, nepotism and embezzlement. In this study, I consider corruption as cash payments made by firms for influencing the actions of a public official in terms of acquiring an advantage or speeding up the approval of new products (innovations) to the market.

Both theoretical and empirical studies have proposed explanations for differences in corruption activities worldwide. The demand side is directly linked to the discretionary power of the state through governmental mechanisms such as regulations, authorizations, taxation and public provisions (Tanzi & Davoodi 1997). Moreover, corrupt practices are determined by government size, political and historical factors (Goel & Nelson 2010). From the supply side, variation in bribing rates is explained by firms' "ability to pay" and their "refusal power" (Svensson 2003)

contingent upon different institutional (Martin et al. 2007) and managerial (Collins, Uhlenbruck, & Rodriguez 2009) characteristics.

The effect of corruption on economic activities has been a topic of debate for the last 40 years. One branch of literature suggests corruption to be a significant burden through bribes and queuing costs (Fisman & Svensson 2007), increased uncertainty (Shleifer & Vishny 1993), and inefficient public provisions (Mauro 1995; Rose-Ackerman 1998). Estimated values of these losses ranges are around US$1.5 trillion per year (Kaufmann, Kraay, & Mastruzzi 2009) bearing significant effects on both firms (Rodriguez, Uhlenbruck, & Eden 2005; Uhlenbruck et al. 2006) and economies (Mauro 1995) as whole. Empirically, there is a broad consensus with respect to the negative effects of corruption (Campos, Dimova, & Saleh 2010) and prior research suggests detrimental effects on economic growth (Mauro 1995), productivity levels (Asiedu & Freeman 2009; Rosa, Gooroochurn, & Gorg 2010), trade (Dutt & Traca 2010), foreign direct investments (Cuervo-Cazurra 2006; Meschi 2009), and social development (Rose-Ackerman 1998).

However, much of this literature ignores the fact that the structure, prevalence and effects of corruption are contingent on the quality of institutions in place (Méon & Weill 2010). Thus, an opposite stream of literature advocates the "greasing the wheels" hypothesis, in which corruption serves as a necessary lubricant or institutional alternative, particularly salient in weak institutional settings (Vaal & Ebben 2011). According to this view (Leff 1964; Huntington 1968), bribery can help overcome government ineffectiveness, excessive bureaucracy and rigid legislation that impedes efficient economic activities. Using similar reasoning, Nye (1967) suggests that corruption can spur economic development through investments, offering firms the means to cut red tape and entrepreneurial incentives. Therefore, in the case of non-discriminatory and competitive bribes corruption helps attaining allocation efficiency (Lien 1990). Moreover,

certain level of corruption is perceived as an acceptable concession for development, given the high costs related of its prevention (Acemoglu & Verdier 2000).

Building on these theoretical predictions, a growing body of literature presents evidence for the "greasing" hypothesis. Mendez & Sepulveda (2006) provide empirical support for non-linear positive relationship between growth rates and corruption levels. Egger & Winner (2005) identify positive effects on foreign direct investment patterns, suggesting a contribution to the equalization of worldwide FDI flows. Méon & Weill (2010) observe that corruption has positive effects on efficiency in countries where institutions are less effective. These results are consistent with additional findings on firm (Vial & Hanoteau 2010) and entrepreneurial performance (De Jong, Tu, & Van Ees 2012) in emerging markets.

Corruption and innovation

Concerning the impact of corruption on innovation, the literature remains surprisingly silent. Several studies develop theoretical arguments for this relationship under different settings. Murphy, Shleifer, & Vishny (1993) suggest that public rent-seeking activities such as corruption or lobbying, attack innovators through an inelastic need for governmental services and larger cash-constraints than incumbents, resulting in higher risks, uncertainty and vulnerability. However, this scenario builds upon two critical assumptions: first, innovation comes exclusively from the entrant and second, the governmental official has monopoly power over the demand for bribes. Refining these underlining arguments, Blackburn & Forgues-Puccio (2009) show that the effect of corruption depends on the degree of coordination among bureaucrats of their rent-seeking behavior. Thus, countries with organized corruption networks are likely to exhibit both lower amounts of bribes and more innovation. Finally, in terms of empirical results, Anokhin &

Schulze (2009) examine the effects of corruption on entrepreneurship and innovative performance at the country-level finding weak evidence for a curvilinear relationship. Moreover, pending on the proxy used (patents or realized innovations), the authors document both a negative and a positive relationship between corruption and innovation across countries.

Hypotheses

I employ arguments from anomie and institutional theories in the development of my hypotheses because it stresses the importance of both context and rules on firm strategies, such as innovation (Martin et al. 2007; Scott 2001). Anomie theory (Durkheim 1897) suggest that pressure to succeed can displace normative control mechanisms, providing an interesting tool to examine firms' balancing of ethical and strategic choices (Martin et al. 2007). Institutional theory has been employed to provide insights on firm strategies (Mike et al. 2009), especially in the context of emerging economies (Hitt et al. 2000). Furthermore, corruption is likely a result of existing institutional environment, so any examination of firm behavior should include such institutional bearings (Vaal & Ebben 2011).

Anomie describes a normless environment in which ends justify means. Anomie theorists posit that individuals and firms are inherently goal-oriented and, that in absence of regulatory norms they become more likely to use illegal (deviant) means to become successful (Merton 1938). At the societal level, anomie provides a sociological explanation for the effects of institutions on the rates of such deviant behaviors. In its original formulation (Durkheim 1897), anomie is the result of a rapid and radical change that inherently involves economic activities. This inconsistency between economic goals and social means results in strain that fuels anomie in the face of weak or inexistent institutions (Merton 1938). Firms face local anomic pressures (e.g. perceived

financial constraints, competitive peer pressures, etc.) that invest bribing as a prerequisite for success (Martin et al. 2007). As more firms follow, the pressure on other firms to also bribe increases, and corruption becomes the new rule due to the existence of anomie and strain.

Transition economies provide a rich environment for exploring anomie and institutional development. These countries have made a commitment to change radically and rapidly their existing economic and political systems that resulted in a deep shift in terms of societal values and goals. However, such profound changes require new systems, processes and infrastructure in place to match the changing configuration of the society, and require financial resources, which translate into anomic structures and societal strain. In line with the theory, this translates into higher corruption (deviant) behaviors from all society members.

The seminal work of Leff (1964) was first to identify mechanisms through which corruption may enable innovation in anomic environments. He suggests a close and longstanding association between economic and political cliques in this environment, which result in competitive interferences. Under these auspices, "graft may enable an economic innovator to introduce his innovations before he has had time to establish himself politically" (Leff, 1964, p.11). Moreover, corruption may also help firms in dealing with uncertainty and risks stemming from political factors. In emerging markets, the behavior of government is a major potential risk to investors, given the frequency of regime changes and the incoherence of legislation (Acemoglu & Verdier 2000). Consequently, if firms wish to innovate, they are willing to pay for insurance against future harmful interventions in their affairs (Leff 1964). Hence, bribery can be seen as prerequisite of successful innovation in weak institutional environments (De Jong, Tu, & Van Ees 2012). Finally, innovation is a long-term process that starts with an idea, goes through several cycles of investments (i.e. R&D), and concludes with new products and services that

improve market consumers' wellbeing (Rosenberg 2004). The last stage of this lengthy process involves multiple actions from public officials (e.g. approvals, permits, licenses etc.) and in the context of anomic societies bribing provides a unique tool to counter excessive and often ill-conceived regulatory measures (Galang 2012).

Therefore, I hypothesize that corruption will have a positive impact on firm innovation in via two mechanisms: (i) by granting firms access to decision making processes related to approvals of new products and services, thus reducing uncertainty, and (ii) by providing a way to overcome bureaucratic obstacles and sub-par public services (such as licenses, permits) associated with introduction of innovations in the market. Both will improve firm's expected returns on innovation by insuring against discriminatory rulings and speeding the approval process. Hence:

Hypothesis 1: Bribe has a positive effect on firm innovative performance.

Both formal and informal norms influence bribing practice. However, employing a country-level average of these norms may not be indicative of the firm-level bribing heterogeneity (Svensson 2003). For example a small manufacturing firm in a rural environment is likely to experience a very different bribing demand than a large high-tech service firm in the capital city. Therefore, characteristics of the local environments stemming from both the demand and the supply side will affect the relationship between corruption and innovation.

On the demand side, governmental bureaucrats are the gatekeepers for introduction of new products and services to markets. To innovate, firms must acquire complementary licenses from these officials. While, as a whole bureaucrats have a monopoly over these rights, they may organize themselves in a cartel or behave as individual monopolists (Blackburn & Forgues-Puccio 2009). In the first scenario – organized corruption-, bureaucrats act by choosing a level of

bribes that maximizes the demand (income) of all. Agreeing upon an average uniform bribe reduces uncertainty and establishes bribes as an informal "tax" on firm activities. Moreover, it lowers both the variance and the level of local bribes, improving their efficiency. This translates in an additional stream of unused revenues available to innovative activities. Thus, organized local corruption, or lower variance of bribes within a given location and industry, will facilitate firm innovation. In the second scenario -disorganized corruption-, each bureaucrat acts as an independent monopolist and chooses a level of bribe that maximizes his own demand, disregarding the aggregate implications on overall bribing activities in the local economy. Hence, firms are hit with a wide range of bribing demands, pending on their geographic location, industry characteristics (i.e. technological maturity, levels of profits and markups), and specifics of the bureaucrats (i.e. greed, competition, penalties). For example, if a firm requires more permits or licenses, due to the nature of its activity, and is located in a place with disorganized or greedy corrupt officials, it will likely face a greater variance and larger amount in terms of bribes demanded by the officials (Fisman & Svensson 2007). This will translate into fewer resources available for firm long-term strategies such as innovation (Blackburn & Forgues-Puccio 2009). Therefore:

> Hypothesis 2: Heterogeneity of local environment has a negative effect on firm innovative performance.

Furthermore, the supply of individual bribes by firms may vary significantly within local environments and not necessarily matches the demand. Some firms may offer high bribes, while others may opt for smaller amounts, or even refrain at all from bribing. This variance in bribing practices within the local environment is influenced by firms' existing profit margins, value of outside options and degree of informational asymmetry. In homogeneous environments, all firms

are equally involved in bribing activities or do not do it at all. In these cases, bribing is perceived as an additional non-discriminatory tax on economic activities, and one that facilitates innovation. In such homogeneous settings, bureaucratic frictions are efficiently eliminated, and firm performance is determined solely by its capabilities, just like in a corruption-free scenario. However, in heterogeneous environments, there are high-bribing firms as well as ones that do not bribe at all. This heterogeneity takes a toll on all firms regardless: those that decide to bribe will have to pay higher bribes to "grease the wheels", given that they need to compensate for non-bribers to match the local demand. Moreover, those that do not bribe will find it even more difficult to promote their innovations due to excessive red tape and negatively externalties they are likely to face as a result of not bribing. Therefore, those that bribe in these volatile environments will likely receive additional benefits, in the form of a positive discrimination, translated in increases in their innovation levels. Hence:

> Hypothesis 3: The effect of bribe on innovative performance is positively moderated by heterogeneity of local environments.

Finally, there is tremendous heterogeneity in terms of innovation and growth rates, even among countries perceived to be extremely corrupt (two extremes would be the Southeast Asian versus sub-Saharan African nations). This prompts the question of what factors can mitigate the economic effects of corruption. As firm and governmental activities take place within a national institutional framework, a prime candidate for these moderation effects is the structure of formal and informal institutions in a country.

Institutional theory predicts that firms adopt and diffuse business practices to access resources and ensure stakeholder approval (DiMaggio & Powell 1983). Previous research has proposed

that formal and informal aspects of institutions affect firm strategies (Mike et al. 2009) especially in the context of emerging and transition economies (Hitt et al. 2000). Therefore, given the existing heterogeneity in performance among corrupt countries, I expect that the effect of corruption is conditional on the quality of existing institutions. These conjecture is supported by recent empirical evidence examining growth (Mendez & Sepulveda 2006; Aidt 2009), foreign direct investments (Cuervo-Cazurra 2006) and firm strategies (Uhlenbruck et al. 2006).

Institutions are commonly perceived as comprising both formal and informal aspects (Scott 2001). The formal component refers to codified rules (laws, regulations, policies) that govern the interactions between economic agents. Among them, control of corruption is the most salient regulatory aspect that affects both the incidence and the interplay between bribes and firm innovation (Kostova 1999). These laws and regulations are meant to limit the use of public power for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (Kaufmann, Kraay, & Mastruzzi 2009). Low-quality institutional regimes that characteristic to many emerging markets create peer pressure on firms to bribe governmental officials. In such environment, bribes are not perceived as dangerous and illegal activity, but more as an acceptable pathway to success, equally perpetuated by firms and officials (Ufere et al. 2012).

Therefore, in anomic conditions, firms use corruption to hedge against uncertainty and informational asymmetries associated with deployment of new products and services. While formal institutions in these countries appear in disarray, informal alternatives –i.e. bribing- are common practice, functioning as a “tax” on economic (and innovative) activities of firms, with well-established routines (who to pay; when; what to expect) and rates (how much). In such settings, corruption is a second-best option that facilitates innovation faster than the legal

institutional route. However, as the crackdown on corrupt practices increases, the efficiency of bribes is reduced significantly. Slowly, the costs and risks of being caught giving or receiving bribes increases significantly, making it less attractive for innovative entrepreneurs. Thus, control of corruption will have positive effects on overall levels of innovation, reducing the threshold of minimally required profitability such that more innovative opportunities are brought to fruition (Anokhin & Schulze 2009). Bribing will still present advantages in terms of shortening regulatory procedures associated with innovation; however, it will become less attractive in the face of increased risk of being caught and harsher contingent penalties. Therefore, I expect the relationship between corruption and innovation to be negatively moderated by the quality of formal institutions.

The second component of an institutional system is represented by the extent of informal institutions in place (Scott 2001). Corruption remains, at least on paper, illegal almost in all countries. Therefore an important in explaining the role and incidence of corruption is the role of trust between the two parties involved in the acts of corruption (bribes and governmental officials). Previous studies have founded trust to lower transaction-costs and promote collaboration and through it economic performance (La Porta et al. 1997), international partnerships (Parkhe 1998), and growth (Algan & Cahuc 2010).

Concerning the relationship between corruption and the state-building process, trust (based on kinship, affect or ethnic proximity) is known to facilitate the development of relationships to support complex and uncertain activities such as innovation (Anokhin & Schulze 2009). Even in weak-institutional environments with rampart corruption, trust may serve as a substitute for corrupt practice, allowing an implicit quid pro quo mechanism to govern firm-bureaucrats relationships. This mechanism benefits from two desirable features: the lack of any monetary

transfers and the importance of reputation effects within communities and networks. Such networks are more prevalent in small towns, among older and tenured residents of these areas, and exhibiting more homogeneous demographics (Hunt 2004). However, emerging markets, characterized by rapid urbanization, economic growth and high fertility rates are exactly the opposite of ideal "trustful" environments. The lack of societal trust results in an increase in prevalence of corrupt and other deviant practices characteristics of anomic environments (Hunt 2004). Thus, taking advantage of idiosyncratic socio-cultural factors such as trust may present an important non-formal alternative to reduce corruption in emerging markets.

Incorporating all previous conjectures in this subsection, I expect that, as the quality of institutions (formal and informal) improves, the need for bribing to overcome innovation-related obstacles to become lower. Accordingly, we have:

> Hypothesis 4a and 4b: the quality of formal (a) and informal (b) institutions moderates negatively the effect of bribe on innovative performance.

METHOD

Data

To test the predictions developed in the previous section, I use firm-level data on innovation and corruption from the latest Business Environment and Enterprise Performance Survey (BEEPS), a joint initiative of the European Bank for Reconstruction and Development and the World Bank Group. This survey was conducted in 2008 and exhibits a stratified random sample of firms from 29 transition economies (including all countries from Central and Eastern Europe - CEE and the Commonwealth of Independent States - CIS) plus Turkey. The survey comprises 16 sections that cover firm activities, interaction with governmental officials and measures of the business

environment. The respondents are business owners or top managers. The final sample used in this work, after removing missing observations, consists of almost 7,938 firms from 30 countries (CEE, CIS and Turkey). The distribution of observations across countries is given in **Table 6**.

Dependent variable

To capture innovation I employ the Oslo manual guidelines for collecting and interpreting innovation data (OECD 2005). Firm innovative activities are measured using the new products and services developed by a firm within the last three years, therefore focusing on radical innovations. Values are obtained from the following question: "In the last three years, has this establishment introduced new products or services?" The final dependent variable for innovation (ninnov) is binary (1-"yes"; 0-"no") with all missing observations and "don't know" answers being dropped from the dataset. Furthermore, additional measures of innovative activities are employed in the robustness checks section.

Independent variables

With respect to corruption, BEEPS provides a rich set of questions that captures various facets of corruption (i.e. frequency, amounts, sources and to some extent, purposes). For this study, I am interested in the actual intensity of bribing (and not so much its frequency or destination) to capture whether the firm is engaged in corruption and to what degree its resources are reallocated from other activities towards getting its new products out faster. Thus, the main variable measuring corruption at the firm level (bribe) is obtained from the following question: "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, licences, regulations, services etc. On average what percentage 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?" Therefore, the bribe variable measures the percentage of sales devoted to bribing activities. In cases of firms that have provided the annual value of bribes, this was subsequently converted to percentage terms using their total sales value. Moreover, additional measures of corruption will be employed in the robustness checks section.

Despite experiencing similar obstacles, heritage and length of transition, there is great corruption and innovation heterogeneity both between and within these countries (**Table 6**). To capture this environmental heterogeneity across countries, regions and industries, I compute it as the dispersion of bribes within a country-region-sector unit. Lower values of this variable indicate more homogeneous environments.

There are a multitude of factors that make up the institutional environment. For the purpose of this study, I focus on specific issues related to corruption (Kostova 1999). In this case, formal institutional quality is measured using the control of corruption from Kaufmann, Kraay, and Mastruzzi (2009). This indicator measures control of corruption within the interval of -2.5 (low control) to 2.5 (high control of corruption) employing data from polls of experts as well as surveys of managers in a given country. To simplify the interpretation of this variable, I have rescaled the original index by adding 2.5 to it, so that it takes only positive values and higher values indicate greater control of corruption. Informal institutional aspects related to corruption are captured using general measures of trust in the society. My measure of trust comes from a question from the World Value Surveys (Inglehart 2004) that asks: "Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?" (Yes/No). I use the percentage of respondents answering "yes" as my measure of trust

(or informal institutional quality) within a country employing data from the latest WVS wave (2008).

Controls

In order to obtain reliable estimates, I control for several firm and country specifics that are well established in the empirical literature (Lederman 2010). Moreover, to account for any idiosyncratic differences between countries and industrial sectors, I employ fixed effects throughout these regressions.

The first category includes several stylized variables in the innovation literature. Firm size is commonly proposed as an explanation for innovative performance, as bigger firms posses more resources for R&D activities, which result in new products and processes (Cohen & Klepper 1996). I measure it (lnsize) as the number of permanent employees of the firm. Besides mass, experience is also an important driver of firm innovative strategy (Hansen 1992). Age is calculated by subtracting the year when the firm was registered from the year when the survey was collected. Furthermore, governance has been shown to impact firms' value, profitability and strategy (Hitt et al. 1996). This consensus reveals significant differences between private and state owned firms, suggesting that the latter have higher inefficiency levels that translate in a lower rate of innovation (La Porta, Lopez-De-Silanes, & Shleifer 2002). Moreover, foreign participation in both public and privately owned enterprises has positive effects on firm innovation (Girma, Gong, & Görg 2009). To account for these effects I use foreign, a dummy variable that takes a value of 1 a firm has a majority foreign ownership (greater than 50 percent), and 0 otherwise. Recent empirical studies document significant differences both within and between countries in terms of managerial practices, which are strongly correlated with firm productivity, performance and survival (Bloom & Van Reenen 2010) and serve as a source of

value creation and efficiency improvements (Holcomb, Holmes Jr., & Connelly 2009). In this study, I control for managerial experience (manexp) as the number of years the manager has been working in this industry. The link between competition and innovation has been examined numerous times since Schumpeter (1938). While this issue remains virtually unsettled (Aghion et al. 2009), I include a measure of competition to account for these potential effects. The variable measures the pressure from domestic competitors on the decision to develop new products using a Likert scale from 1 ("not at all important") to 4 ("very important"). Moreover, recent findings suggest a strong complementarity between firm innovation and exports (Golovko & Valentini 2011). Therefore, I include a dummy variable (exporter) to control for exporting firms in the data. Starting with the seminal work of Mansfield (1965), economics and management scholars have repeatedly reinforced the tight link between firm R&D investments and its innovative performance using different proxies. Given that the BEEPS survey does not include data on the actual amount spent on R&D, I employ instead a dummy variable (R&D) that distinguishes firms that have performed such activities over the past three years. Finally, firm access to finance is recognized to promote growth and innovation (Ayyagari, Demirgüç-Kunt, & Maksimovic 2011). Finance is a dummy variable that has a value of 1 for firms that have a credit line from a private bank and 0 otherwise.

Estimation strategy and econometric issues

To estimate the impact of corruption on innovation at the firm level, I follow prior literature (Goedhuys 2007; Lederman 2010) and model innovation using a probit model given the binary nature of the dependent variable (ninnov). Thus, I estimate the following equation:

$$ninnov_{fsc} = \Phi\{\alpha_0 + \beta_1 bribe_{fsc} + \beta_2 environhet_{src} + \beta_3 formal_c + \beta_4 informal_c + \beta_5 formal_c * bribe_{fsc} + \beta_5 informal_c * bribe_{fsc} + \beta_6 environhet_{src} * bribe_{fsc} + \alpha_1 controls_{fsc} + \lambda_s + \eta_c + error\}$$

Where ninnov is a dummy that equals 1 for any new products or services introduced in the past three years (radical innovation); Φ denotes the cumulative standard normal distribution; f, s, r, c index firms, industries, regions and countries; controls include all the firm specifics detailed in the previous section; λ_s and η_c are the industry (sector) and respectively country fixed effects.

Estimating the above equation by simple logit or probit regression may lead to biased estimates of the betas, given the endogeneity issue regarding corruption and generic firm performance (Vial & Hanoteau 2010). Corrupt bureaucrats establish taxes, administrative hurdles and delays in order to extort bribes in accordance with the perceived capacity of firm to pay based on its current and future (expected) assets, which includes also profits from new products and services (innovations) waiting to be launched. Thus, innovative firms could be more likely experience bribes given their higher perceived ability to pay (Svensson 2003). Bribe payments and innovative performance are jointly determined by a multitude of factors that are specific to various industries (technological maturity), countries (institutions, wealth) and geographic locations (concentration, habits of local bureaucrats). To correct for this endogeneity bias, I follow (Fisman & Svensson 2007) and instrument our firm-level measure of corruption (bribe) with the average bribe in a given sector-region-country unit (corr = 0.49). The underlying assumption is that sector-region-country bribing rates are uncorrelated with the firm innovative performance, confirmed by the data (corr = 0.01). Moreover, using these average for instrumentation may mitigate also possible measurement errors associated with bribery, given that most corrupt firms may be reluctant to report their bribery payments (Vial and Hanoteau

2010). To assess whether the proposed model of endogeneity was to be employed I perform the Wald exogeneity test for our bribe measure. The null hypothesis that this variable is exogeneous was rejected at 5% (Wald Chi-square = 4.58), suggesting that instrumental variable probit is more appropriate in estimating the effects of bribes on firm innovation. With respect to the other two variables of interest (environmental heterogeneity and quality of institutions), I assume that they are exogeneous given that they are measured at the sector-country, and respectively country level. However, firm level bribes are treated as endogeneous throughout all specifications.

Empirical analysis and results

Table 2 presents correlations between main variables of interest. In most cases these are within acceptable limits. Moreover, I compute variance inflation factors (VIFs) for each model with satisfactory results. Finally, to accommodate for the presence of group-wise heteroskedasticity, as indicated by exploratory plots of residuals against our bribe measure, I employ robust standard errors throughout all estimations. The main results are reported in **Table 3**.

Model 1 presents the benchmark regression that incorporates all controls. The examination of the latter yields some interesting insights on issues that have been the focus of many studies in the area of innovation. Thus, larger, younger, R&D performing firms are prone to innovate. Foreign ownership, access to finance, competition and exporter status are also associated with greater probability to introduce new products, supporting previous claims in the literature.

Model 2 tests Hypothesis 1, namely that the effect of bribe on firm innovative performance, as proxied by introduction of new products and services, will be positive. The coefficient of bribe is positive and significant at 1% and remains within this range throughout the rest of estimations strongly supporting my first hypothesis. Model 3 introduces our measure of environmental

heterogeneity, as the dispersion of bribes within a sector-region-country, and tests its impact on firm innovative performance. The results confirm my second hypothesis, namely that firms are less likely to innovate in more heterogeneous local environments in terms of bribing practices. This result supports the institutional isomorphism theory and confirms an implicit consensus that to be successful one must adhere to the "normal" rules of business, which in this case includes local bribing norms. As firms experience more heterogeneity, due to a sudden increase in the amount of bribes or the number of firms bribing, this additional "tax" will sustain a toll on firms' innovative performance. Next, Model 4 tests my fourth hypothesis, namely that those that bribe in such heterogeneous (bribing) environments are more likely to be successful in introducing their innovations to the market. The coefficient of the interaction is positive, as expected; however, it is not statistically significant. Thus, I do not find empirical support for Hypothesis 3. Finally, Models 5 and 6 test the moderating effect of institutional quality (both formal and informal) on the relationship between bribing and innovation. Since the two institutional variables chosen, control of corruption for formal aspects and average degree of trust between society members for the informal part, are both measured at the country-level due to limitations of the available data, their direct effect on innovation is wiped-out by the use of country fixed effects. Therefore Models 5 and 6 do not report the coefficients for these direct effects, since they are already incorporated in the country fixed-effects, which capture more efficiently unobserved cross-country heterogeneity[1]. The coefficients of these interactions are both negative and significant confirming my fourth twin hypothesis, namely that formal and informal institutional quality makes bribing less effective for successful innovation. These results are

[1] As an additional robustness check, in additional estimations I drop the country fixed effects and run the regressions with the original direct effects. I obtain in both cases (formal and informal) positive and highly statistical significant coefficients, confirming previous findings of a positive effect of institutions on innovative activities.

intuitive: for the formal aspects, as the control of corruption increases (e.g. governments become more proficient in spotting and eradicating this behavior), while it still pays off to speed-up procedures of introducing new products to the market, the risks of being caught are increasing as well. Similarly, distrustful societies and rapidly urbanizing countries with high fertility tend to encourage corruption. A bond of trust allows implicit quid pro quo scenarios to substitute for bribing, therefore reducing the overall corruption. Model 6 confirms this conjecture.

Robustness checks

To test the robustness of my results, I perform several additional estimations which include: (1) additional controls documented in the literature to enable (or hinder) firm innovation, (2) test the hypotheses in various subsamples of the dataset, (3) utilize different measures or proxies for the main variables of interest (innovation and corruption) and (4) explore the effects of corruption on other firm performance measures, which are not directly linked to innovation.

Additional control variables

Previous literature proposes several other variables that impact firm innovative performance. **Table 4** reports additional estimations results against some of these factors. Throughout these estimations the coefficient of our corruption variable (bribe) remains positive and retains a high level of statistical significance, providing additional supports for present findings.

For instance, availability of skilled labor (human capital) is commonly associated with superior economic (Benhabib & Spiegel 1994) and innovative (Krammer 2009) performance. To test this effect, I include an additional variable, adequate labor, which measures the availability of adequate workers for these firms (Model 7). The coefficient is positive and highly significant,

confirming these priors[2]. Scholars have also established a strong link between information technology (IT) infrastructure and the diffusion of technology across borders (Tang & Koveos 2008), with positive effects on innovation and growth in developing and developed nations (Czernich et al. 2011). Therefore I include a dummy variable (internet), which signals the availability of broadband Internet to firms. Its coefficient is positive and significant as expected (Model 8). Naveh & Erez (2004) suggest that quality improvements (QI) and standards have different effects on innovation and attention to details, negative for the former and positive for the latter. However, the existence of QI teams and goals is positively associated with innovative performance. I test the effects of ISO accreditation, and the results suggest that on average, firms with quality standards innovate more (Model 9). Moreover, empirical evidence suggests that firms rely increasingly on external sources for technological progress, often in the form of licensing agreements with foreign partners (Arora, Fosfuri, & Gambardella 2001). I also find this correlation in my dataset, so firms that acquire technologies from external sources have a higher propensity to introduce new products in the market (Model 10). Finally, given that all these firms originate in transition countries, which are highly dependent on public funding of innovative activities (Krammer 2009), I control for both enterprises in which the state has a majority ownership (state-owned), and those that receive any support from the government (subsidies). The results confirm the existing consensus on the lower productivity and innovation levels for state-owned enterprises (Model 12), and the positive effects of subsidies on these activities (Model 11).

Different measures of innovation and corruption

[2] Additionally, I also test this using another variable (*skilled workers*) computed as the percentage of workers with university degrees, and obtain very similar results.

To further examine the strength of our results, I perform additional regressions using different measures (proxies) for our two main variables of interest, namely corruption and innovation (**Table 5**). Following Ayyagari, Demirgüç-Kunt, & Maksimovic (2011), Model 13 employs a rougher proxy of innovation as the dependent variable which equals 1 if a firm has introduced a new product (radical innovation) or upgraded an existing one (incremental innovation) over the past three years. The coefficient of bribe remains positive and significant at 5% levels. However, when focusing only on incremental innovation (product upgrades), the benefic effects of bribing disappear, in accordance with our hypothesis that bribes perform a necessary role of facilitating fast accession of new products to markets though streamlining the existing institutional bureaucracy surrounding these procedures. Finally, examining the effects of bribes on sales from new products and processes using a Tobit model (Model 15) yields similar conclusions. The rest of the estimations in **Table 5** check different proxies for corruption/bribes, namely the percentage of governmental contracts given as payments or graft (Model 17), and the frequency of such payments to insure a smooth relationship with customs (Model 18), courts (Model 19) and tax officers (Model 20). In all these cases, the coefficient for these variables remains positive and statistically significant at 1%, reinforcing our previous results.

Different subsamples

Furthermore, to ensure the robustness of these findings, I run these estimations in different subsamples of the dataset with similar results to those reported in **Table 3**. These results are not reported in the paper due to inherent space constraints but are available upon request. First, I eliminate all seemingly not truthful responses (as judged by the survey administrators) and all non-registered enterprises (in total 88 observations). Second, I account for influential observations using Cook's square distance. Observations for which this distance measure is

greater than 4/N, where N is the number of observations, are marked as outliers and excluded from estimations. Finally, I test these effects across different regions (CIS versus CEE) and firm size classes (small, medium and large) to check for consistent patterns. The results suggest that the positive effects of bribing on innovation are stronger for CIS countries, consistent with our third hypothesis, so that firms in low-quality institutional environments benefit more from bribing as opposed to those from countries with better institutions. In terms of firm size, small and medium size firms (less than 50 employees) appear to gain from bribing, whereas the effects become insignificant for large firms.

Effect of corruption on other performance measures

Finally, prior literature reports mostly negative effects of corruption on firm performance measures other than innovation. To this end, I replicate the main estimations using different proxies for performance, namely sales, labor productivity and profit margins. In the first two cases the coefficient of bribe is positive, while for profit this is negative; however, in none of these regressions bribe has a statistically significant effect on performance, when including the standard battery of controls and the sector-country fixed effects. This reconciles our findings with the majority of previous studies on corruption and firm performance that report similar findings.

DISCUSSION AND IMPLICATIONS

Conclusions

Innovation is accepted as a universal desiderate for economic development and competitiveness (Cameron 1996). While prior research pays attention to various firm- and country-specifics that affect innovative performance of firms and nations (Lederman 2010), the effect of institutional

characteristics has not received significant attention, especially at the level of the firm and in the context of emerging markets (Anokhin & Schulze 2009; Gorodnichenko, Svejnar & Terrell 2010). Corruption is commonly perceived by many scholars to harm economic development and innovative performance (Campos, Dimova, & Saleh 2010). However, many emerging markets with low quality institutional environments tend to perform better in terms of innovation and economic growth despite rampart corruption (Vial & Hanoteau 2010). This work seeks an answer for this puzzle and examines the relationship between firm-level corruption and innovation in 30 transition countries.

Following Martin et al. (2007), I suggest that radical change witnessed in transition economies yields anomic conditions both at the national and local levels which in turn breeds corruption. Fuelled by the lack of strong formal and informal institutions, corruption becomes an accepted second-best solution for firms that seek innovation and market success. Thus, corruption fulfills the role of an informal yet efficient "tax" on economic activities, including innovation. Furthermore, I examine potential moderating effects from institutional frameworks in place and local heterogeneity in terms of bribing practices, under the assumption that lower institutional quality and higher local bribing volatility results in reinforcing the role of corruption as a perpetuator of firm innovation in these markets.

This analysis extends the literature on multiple fronts. I find support for my key hypotheses that shed light on an interesting interplay between corrupt practices as a result of dysfunctional institutional settings and firm innovation in transition economies. In doing so, I advance the literature on bribery (Uhlenbruck et al. 2006; Collins, Uhlenbruck, & Rodriguez 2009) by examining its effects on firm innovation in the context of heterogeneous local and institutional settings (Kostova 1999). Few if any systematic explorations exist of how firms react to

corruption under different institutional regimes present in different countries. Furthermore, the introduction of heterogeneous local environments is supported by Svensson (2003) and Fisman & Svensson (2007) who suggest that firms react to both peer pressures from competitors and the structure of local demand for bribes from local officials (Blackburn & Forgues-Puccio 2009). Thus, "organized" corruption reduces the heterogeneity of bribe supply (firms' willingness to pay), the overall burden on all firms in the market, and facilitates firm innovation. Oppositely, "disorganized" corruption results in a volatile environment that impedes innovation, and increases discrimination between top bribers and the rest of firms. Finally, weak formal institutions (i.e. corruption control policies) entice firms to use bribery as a tool to reduce uncertainty, informal asymmetries and bureaucratic hurdles associated with introduction of innovations to the market. Similarly, corruption substitutes for informal aspects (i.e. trust) in anomic settings due to rapid growth and existing institutional vacuum.

Managerial implications

These findings inform both firms and policy makers on multiple fronts. Weaker formal institutions and socio-cultural norms are found to perpetuate the effects of corruption as an efficient "greasing" substitute for achieving success. Therefore, better control of corruption and trust in the governmental apparatus will decrease the effectiveness of bribery. Moreover, these results may inform foreign companies in (or entering) these countries about what can be expected of them in terms of corrupt practices, and potentially use this information to gain competitive advantage. This research emphasizes also the importance of the supply side of bribery. It finds that greater local heterogeneity in terms of bribing practices is detrimental to most firms. However, those that increase bribing in such environment appear to benefit more. This finding emphasizes both the need to pay attention on competitors' and local bureaucrats'

expectations in terms of bribes. Being "off the mark" of what is commonly expected could translate into unexpected penalties for a firm.

Limitations and future studies

While this work provides some interesting insights and ideas for future work in this strain, it has some limitations. First, transition countries may not be representative of all emerging markets given their strong institutional idiosyncrasies. Second, capturing accurately the scope of illegal activities through self-reports remains questionable. The BEEPS includes a rich set of questions about firms' performance, activities, obstacles, and business environment, however, in some cases, it exhibits numerous missing observations. To meet these shortcomings, I test successfully the sensitivity of my results across a range of possible biases. Nonetheless, further inquiries into firm level bribing practices are needed to generalize and develop these findings for all emerging markets.

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Variable	Description	Obs	Mean	St. dev.
ninnov	New product innovation (0/1)	7,938	0.55	0.50
bribe	Bribes as a percentage of annual sales of the firm	7,938	0.92	3.76
environhet	Environmental heterogeneity - st. dev. of bribes within a country-region-sector	7,888	0.28	0.77
formal	Formal institutions - Control of corruption standardized (Kaufmann et al., 2009)	7,707	1.68	0.58
informal	Informal institutions - Average level of trust (World Value Surveys 2005)	6,368	40.15	17.31
lnsize	Logarithm of the number of employees	7,938	3.48	1.44
age	Firm age (2009 - year of establishment)	7,938	14.39	13.64
foreign	Majority foreign owned firms (0/1)	7,938	0.07	0.26
managexp	Managerial experience (years)	7,938	16.93	10.35
competition	Intensity of competition in domestic markets (0-4)	7,938	2.71	1.05
exporter	Exporting firms (0/1)	7,938	0.23	0.42
R&D	R&D performing firms (0/1)	7,938	0.25	0.44
finance	Existing finance from banks or lines of credit (0/1)	7,938	0.49	0.50
adequate labor	Lack of adequate labor force as an obstacle (0-4)	7,819	1.65	1.39
internet	High-speed internet available (0/1)	2,507	0.60	0.49
ISO	ISO certification (0/1)	7,890	0.26	0.44
techlicense	Technology licensing (0/1)	3,322	0.23	0.42
subsidies	Subsidies (0/1)	7,886	0.09	0.29
stateowned	Majority state-owned firms (0/1)	7,938	0.02	0.12
innov	New or upgraded products and services (0/1)	7,899	0.79	0.41
upgrade	Upgraded products and services (0/1)	7,884	0.74	0.44
innovsale	Percentage of firm's sales from new products and services	4,175	27.59	25.04
bribegov	Bribe as a % of governmental contracts obtained	1,605	2.35	7.40
bribecustoms	Frequency payments to deal with customs (0-6)	6,988	1.59	1.16
bribecourts	Frequency payments to deal with courts (0-6)	6,974	1.51	1.06
bribetax	Frequency payments to deal with tax officers (0-6)	7,328	1.73	1.18

Table 1: Descriptive statistics - all variables

No	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	ninnov	1.00												
2	bribe	0.03	1.00											
3	lnsize	0.12	-0.04	1.00										
4	age	0.04	-0.04	0.28	1.00									
5	foreign	0.07	-0.02	0.18	-0.02	1.00								
6	managexp	-0.01	-0.03	0.07	0.21	-0.06	1.00							
7	competition	0.08	-0.01	-0.01	0.05	-0.04	0.01	1.00						
8	exporter	0.15	-0.05	0.30	0.16	0.15	0.08	-0.04	1.00					
9	R&D	0.30	0.00	0.23	0.11	0.04	0.05	0.01	0.21	1.00				
10	finance	0.15	-0.03	0.24	0.09	0.00	0.04	0.06	0.20	0.16	1.00			
11	environhet	0.01	0.77	-0.02	-0.04	-0.01	-0.04	-0.02	-0.05	-0.01	-0.04	1.00		
12	formal	0.06	-0.16	0.00	0.11	0.08	0.14	0.11	0.21	0.07	0.17	-0.22	1.00	
13	informal	0.10	0.03	-0.01	-0.06	0.04	-0.21	0.04	-0.12	-0.01	-0.11	0.03	-0.25	1.00

Table 2: Paired correlations - main variables

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
bribe		0.088***	0.161***	0.154***	0.188**	0.267***
		[0.029]	[0.059]	[0.056]	[0.074]	[0.081]
environhet			-0.243**	-0.293**		
			[0.107]	[0.137]		
bribe * environhet				0.006		
				[0.004]		
bribe * formal					-0.080**	
					[0.040]	
bribe * informal						-0.003***
						[0.001]
lnsize	0.053***	0.058***	0.063***	0.067***	0.057***	0.055***
	[0.013]	[0.013]	[0.013]	[0.014]	[0.013]	[0.014]
age	-0.003**	-0.003**	-0.002+	-0.002+	-0.003**	-0.002+
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
foreign	0.208***	0.210***	0.207***	0.211***	0.189***	0.227***
	[0.063]	[0.062]	[0.063]	[0.063]	[0.064]	[0.071]
managexp	0.002	0.002	0.002	0.002	0.002	0.000
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
competition	0.103***	0.102***	0.100***	0.100***	0.102***	0.112***
	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.017]
exporter	0.258***	0.258***	0.254***	0.252***	0.253***	0.257***
	[0.044]	[0.044]	[0.044]	[0.045]	[0.044]	[0.048]
R&D	0.847***	0.835***	0.826***	0.815***	0.843***	0.853***
	[0.040]	[0.040]	[0.041]	[0.042]	[0.040]	[0.044]
finance	0.204***	0.198***	0.200***	0.196***	0.192***	0.183***
	[0.033]	[0.033]	[0.033]	[0.034]	[0.034]	[0.037]
constant	0.185	-0.248	-0.037	-0.119	-0.981***	-0.366
	[0.266]	[0.240]	[0.258]	[0.253]	[0.255]	[0.247]
Industry fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
N	7,938	7,938	7,888	7,888	7,707	6,274
LR Chi Square	1287.87	1338.02	1307.00	1302.41	1320.15	1034.74

Table 3: Innovation and Corruption: the impact of environmental heterogeneity and institutional quality

Notes: The dependent variable (ninnov) equals 1 if a firm has introduced a new product or service in the past three years, 0 otherwise; Model 1 is estimated with a regular probit, while Models 2 through 6 employ an IV probit estimator; +, ** and *** indicate variables that are significant at the 10%, 5% and respectively 1%.

Variables	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
bribe	0.038***	0.089***	0.039***	0.036**	0.037***	0.039***
	[0.010]	[0.021]	[0.010]	[0.016]	[0.010]	[0.010]
adequate labor	0.081***					
	[0.012]					
internet		0.327***				
		[0.068]				
ISO			0.104**			
			[0.041]			
techlicense				0.166***		
				[0.060]		
subsidies					0.147***	
					[0.057]	
stateowned						-0.186
						[0.127]
lnsize	0.051***	0.092***	0.049***	0.007	0.057***	0.059***
	[0.013]	[0.024]	[0.013]	[0.021]	[0.013]	[0.013]
age	-0.003**	-0.003	-0.002+	-0.001	-0.003**	-0.003**
	[0.001]	[0.003]	[0.001]	[0.002]	[0.001]	[0.001]
foreign	0.206***	0.500***	0.202***	0.000	0.216***	0.206***
	[0.063]	[0.130]	[0.064]	[0.092]	[0.062]	[0.062]
managexp	0.002	0.001	0.002	0.002	0.002	0.002
	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
competition	0.095***	0.103***	0.100***	0.086***	0.104***	0.101***
	[0.015]	[0.028]	[0.015]	[0.023]	[0.015]	[0.015]
exporter	0.250***	0.447***	0.245***	0.276***	0.250***	0.257***
	[0.044]	[0.112]	[0.045]	[0.060]	[0.044]	[0.044]
R&D	0.825***	0.803***	0.824***	0.878***	0.834***	0.835***
	[0.040]	[0.084]	[0.041]	[0.059]	[0.040]	[0.040]
finance	0.187***	0.269***	0.190***	0.222***	0.194***	0.198***
	[0.033]	[0.061]	[0.033]	[0.052]	[0.033]	[0.033]
constant	0.106	5.151***	-1.246***	4.871***	-1.241***	-0.251
	[0.259]	[0.866]	[0.227]	[0.730]	[0.224]	[0.240]
Industry fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
N	7,819	2,501	7,731	3,316	7,886	7,938
LR Chi Square	1363.67	875.18	1289.80	6853.69	1338.61	1338.69

Table 4: Innovation and Corruption: additional controls

Notes: The dependent variable (ninnov) equals 1 if a firm has introduced a new product or service in the past three years, 0 otherwise; All models employ an IV probit estimator; +, ** and *** indicate variables that are significant at the 10%, 5% and respectively 1%.

Variables / DV	Model 13 *innov*	Model 14 *upgrade*	Model 15 *innovsale*	Model 17 *ninnov*	Model 18 *ninnov*	Model 19 *ninnov*	Model 20 *ninnov*
bribe	0.030**	0.007	0.227**				
	[0.012]	[0.011]	[0.099]				
bribegov				0.129***			
				[0.042]			
bribecustoms					0.448***		
					[0.129]		
bribecourts						0.644***	
						[0.175]	
bribetax							0.400***
							[0.111]
lnsize	0.070***	0.068***	-0.878***	0.103**	0.045***	0.054***	0.055***
	[0.015]	[0.014]	[0.321]	[0.043]	[0.014]	[0.015]	[0.014]
age	-0.001	-0.002	-0.144***	-0.005	-0.002	-0.002	-0.002+
	[0.002]	[0.001]	[0.030]	[0.003]	[0.001]	[0.001]	[0.001]
foreign	0.201***	0.191***	1.414	0.051	0.180**	0.247***	0.203***
	[0.077]	[0.071]	[1.448]	[0.211]	[0.070]	[0.073]	[0.067]
managexp	0.001	0.002	-0.065	0.001	0.004**	0.003	0.003+
	[0.002]	[0.002]	[0.042]	[0.005]	[0.002]	[0.002]	[0.002]
competition	0.090***	0.096***	0.070***	0.005	0.070***	0.033	0.050**
	[0.017]	[0.016]	[0.021]	[0.046]	[0.021]	[0.025]	[0.022]
exporter	0.263***	0.207***	0.529	0.393***	0.169***	0.234***	0.224***
	[0.053]	[0.049]	[1.040]	[0.127]	[0.054]	[0.051]	[0.047]
R&D	0.901***	0.804***	2.530***	0.579***	0.794***	0.767***	0.793***
	[0.055]	[0.048]	[0.885]	[0.111]	[0.046]	[0.048]	[0.044]
finance	0.171***	0.149***	0.645	0.206**	0.178***	0.190***	0.196***
	[0.038]	[0.036]	[0.857]	[0.094]	[0.037]	[0.039]	[0.036]
constant	0.769**	-0.273	42.012***	-0.111	-1.540***	-0.698**	-0.472+
	[0.337]	[0.254]	[5.356]	[0.698]	[0.329]	[0.313]	[0.272]
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
N	7,899	7,884	4,175	1,596	6,988	6,974	7,328
LR Chi Square	996.185	1062.069	-	250.45	1113.167	1008.292	1156.262

Table 5: Innovation and Corruption: different proxies

Notes: For Model 13 the DV equals 1 if a firm has introduced a new product/service or upgraded one (innov); In Model 14 DV equals 1 if firm has upgraded existing products (upgrade); In Model 15 the DV is the percentage of firm's sales from new products or services (innovsale). Models 17 through 20 the dependent variable equals 1 if a firm has introduced a new product or service in the past three years (ninnov); Given the nature of the DV, Model 15 employs a tobit estimator, while all other models employ an IV probit estimator; +, ** and *** indicate variables that are significant at the 10%, 5% and respectively 1%.

Country	Obs.	ninnov	upgrade	innovsale	bribe	environhet	formal	informal	bribegov	bribecustoms	bribecourts	bribetax
Albania	78	0.36	0.71	21.33	2.09	1.26	1.34	51.2	10.58	1.76	1.47	1.84
Armenia	259	0.59	0.76	32.09	0.68	0.27	1.36	51.8	0.58	1.90	1.65	2.11
Azerbaijan	231	0.49	0.77	29.51	0.92	0.38	.	.	3.00	2.03	1.80	2.31
Belarus	177	0.76	0.90	25.70	0.30	0.15	1.18	85.2	1.66	1.24	1.18	1.35
Bosnia and Herzegovina	241	0.62	0.81	29.77	0.37	0.12	1.67	32.4	0.37	1.68	1.63	1.56
Bulgaria	151	0.41	0.58	23.05	0.41	0.16	1.87	50.9	0.08	1.46	1.50	1.68
Croatia	125	0.66	0.78	24.09	0.18	0.09	1.99	38.7	0.36	1.25	1.14	1.16
Czech Republic	169	0.61	0.76	25.41	0.34	0.15	2.46	48.8	0.94	1.12	1.14	1.25
Estonia	222	0.63	0.80	22.21	0.07	0.02	2.78	48.4	0.14	1.25	1.12	1.14
FYR Macedonia	275	0.60	0.77	31.67	0.41	0.16	1.54	29.5	0.03	1.44	1.68	1.31
Georgia	190	0.35	0.74	28.68	0.12	0.04	1.41	38.2	0.00	1.35	1.27	1.47
Hungary	267	0.42	0.76	18.00	0.32	0.11	2.64	44.8	0.71	1.09	1.17	1.93
Kazakhstan	332	0.45	0.72	28.08	1.56	0.52	0.99	.	4.47	1.72	1.54	1.98
Kosovo	186	0.59	0.86	20.22	0.30	0.09	2.15	.	1.67	1.13	1.16	1.19
Kyrgyz Republic	144	0.43	0.69	30.55	3.03	1.27	1.07	33.7	6.50	2.26	1.94	2.95
Latvia	187	0.63	0.90	23.27	0.57	0.21	2.15	35.9	3.19	1.23	1.36	1.41
Lithuania	209	0.73	0.91	26.06	0.16	0.11	2.22	52.8	0.85	1.11	1.22	1.22
Moldova	268	0.55	0.68	32.43	0.58	0.17	1.35	36.7	2.62	1.71	1.59	1.69
Mongolia	330	0.67	0.84	25.86	0.94	0.30	1.66	21.4	3.95	2.15	1.94	1.82
Montenegro	69	0.75	0.77	30.70	0.45	0.26	2.15	.	1.22	1.32	1.19	1.20
Poland	302	0.63	0.68	22.65	0.19	0.06	2.45	40.9	0.57	1.21	1.18	1.16
Romania	244	0.47	0.53	32.25	0.58	0.24	1.81	43.6	0.94	1.52	1.62	1.61
Russia	726	0.66	0.88	27.28	1.50	0.32	1.09	55.4	5.24	1.72	1.65	1.97
Serbia	294	0.64	0.75	24.53	0.95	0.29	1.41	.	1.26	1.72	1.93	1.87
Slovak Republic	157	0.54	0.73	29.19	0.43	0.18	2.39	33.4	1.73	1.20	1.14	1.23
Slovenia	245	0.75	0.91	25.86	0.12	0.05	3.05	38.6	0.03	1.05	1.08	1.06
Tajikistan	238	0.51	0.79	34.82	4.19	1.28	0.84	.	2.91	1.87	1.64	2.37
Turkey	892	0.44	0.59	30.64	0.65	0.17	1.87	10.2	2.52	1.59	1.28	1.43
Ukraine	416	0.59	0.77	31.15	1.65	0.39	1.12	60.0	3.24	1.87	1.89	2.26
Uzbekistan	314	0.24	0.37	27.81	2.08	0.42	0.95	.	3.73	2.34	2.28	2.89

Table 6: Distribution of observations and mean values of variables by country