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Too much of a good thing? The concave impact of corruption on firm performance

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ABSTRACT

We investigate whether the impact of corruption on firm-level performance exhibits a concave pattern. We measured corruption using a continuous variable of firm-level bribe payments from the World Bank Enterprise Surveys. Our dataset includes 23 327 firms from 140 developing and emerging countries from 2006 to 2020. Using four measures of firm performance and instrumental variables estimation, we find that corruption has a negative linear impact on measures directly linked to market performance but a concave impact on measures focusing on inner processes. Further, larger firms and foreign firms are less negatively impacted by corruption. Importantly, controlling for a concave relationship amplifies the differences across different types of firms.

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Introduction

According to Transparency International's definition, 'corruption is the abuse of entrusted power for private gain'[1]. Corrupted and corrupting agencies can be public or private, and the abuse of entrusted power is usually associated with illicit activities, such as bribery or theft (Bahoo et al., 2020). Corruption has been found to not only hinder economic growth and development (Wei, 1999), but to also sap trust in government and other institutions (Bjørnskov, 2011). It is thus unsurprising that corruption should be denounced in strong words, a 'cancer', in those of the former president of the World Bank Group, James Wolfensohn (quoted in Wei, 1999, p. 3f), or 'the ultimate betrayal of public trust' in those of the Secretary-General of the United Nations, António Guterres[2].

More narrowly, there are reasons to believe that corruption negatively impacts firm performance; that is, corruption sands the wheels of business (Martins et al., 2020), *inter alia,* by leading to misallocation of resources and perverse incentive schemes. However, there are also reasons to believe that engaging in corruption might be beneficial for individual firms, that is, that corruption greases the wheels of business, especially in certain institutional setups, in a second-best manner (Krammer, 2019; Mendoza et al., 2015). Corruption may be used, for instance, to overcome bureaucratic obstacles in getting things done. True to this, extant empirical literature has also pointed in these two seemingly opposite directions. Thus, there is currently no theoretical or empirical reason to expect a categorical answer to the question of whether corruption sands or greases the wheels of business.

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Furthermore, the relationship between corruption and firm performance is multifaceted. It has been widely estimated that different types of firms, such as large versus small firms, are differently impacted by corruption; thus, segmentation is crucial when seeking to measure its impact on performance (Martins et al, 2020). We also know that corruption is an umbrella term encompassing motley phenomena with potentially different impacts on performance (Teixeira, 2015). A one-off payment to a corrupt bureaucrat is likely to have a much less negative, if not positive, impact on the performance of an individual firm than recurrent payments (Seck, 2020). Further, a positive impact of corruption on the performance of individual firms in specific institutional environments may coexist with a negative association between corruption and the overall or average performance of firms in the community (Hanousek et al., 2019; Krammer, 2019).

This study contributes to the literature by investigating whether the impact of corruption on firm-level performance shows a concave pattern. A concave relationship between corruption and performance has been argued, both theoretically and empirically, in the macroeconomics literature, using country-level measures of corruption and performance (Acemoglu and Verdier, 1998; Maria et al., 2022; Méndez & Sepúlveda, 2006). Although recent literature has investigated the heterogeneous impact of corruption on firm performance (e.g. Seck, 2020; Chen et al., 2023), to the best of our knowledge, a concave relation has not yet been explicitly modelled and investigated in the literature on the impact of corruption on firm-level performance. We speculate that one major reason for this is that most of the available firm-level measures of corruption are binary. However, it is plausible that when corruption greases the wheels of individual businesses, it should only do so up to a certain threshold, after which any further corruption becomes a burden beyond any benefit. This is a hypothesis we test in this study.

To do so, we rely on a continuous measure of firm-level bribe payments. Our data, derived from the World Bank Enterprise Surveys (WBES) database, include information for the period from 2006 to 2020 on 23 327 firms from 140 developing and emerging countries. We used four measures of firm-level performance: sales growth, employment growth, productivity growth, and innovation. We find that corruption has a negative linear impact on sales and productivity growth. However, we also find that its impact on employment growth and innovation is positive up to a point; that is, that there is a concave relation in these cases. These results reinforce the conclusion that a categorical answer to the question of whether corruption sands or greases the wheels of business is simplistic, by gathering evidence that the relationship between corruption and firm-level performance may depend on the level of corrupting activity.

Since the literature has found that several firm characteristics modulate the impact of corruption on firm-level performance, we also test whether the performance of larger firms is differently impacted by corruption than that of smaller firms and the performance of foreign firms than that of domestic firms. We find that larger firms and foreign firms are less negatively impacted or, depending on the measure of performance used, more positively impacted by corruption. Importantly, we also find that controlling for a concave relationship amplifies the differences across different types of firms in terms of the impact of corruption on performance. This indicates that previous studies may have underestimated the importance of segregation by firm characteristics.

The remainder of this paper is organized as follows. In the next section, we provide an overview of the relevant literature, formulate our main hypotheses, and outline the underlying conceptual framework. Section 2 describes our empirical strategy. Section 3 presents and discusses the main results. Finally, Section 4 concludes the study.

Literature overview, main hypotheses and conceptual framework

Corruption has been denounced for its dire political and social consequences. Here, we focus on the impact on firm performance. There are several theoretical reasons for the belief that corruption sands the wheels of business. Corruption can distort resource allocation by incentivizing corruption-related non-productive activities (Baumol, 1990). Similarly, it could also divert entrepreneurial talent from the pursuit of greater productivity, innovation and on-the-job training (Boikos et al., 2023; Boudreaux et al., 2018; Murphy et al., 1993). Further, corruption can hinder competition if incumbents leverage it to create barriers to entry (De Rosa, Gooroochurn and Görg, 2015). This could also affect the path of technological progress, as firms are incentivized to adopt technologies that protect them from the arbitrariness of

corrupt officials (Svensson 2005). A corrupt environment is often one with insecure property rights (De Rosa et al., 2015). This could discourage foreign direct investment (FDI), especially its greenfield variety, with foreign firms hedging their risks by pursuing less-committed strategies, such as joint ventures (Bahoo et al., 2020; Cuervo-Cazurra, 2006). Finally, corruption usually involves transactions that are costly to firms (Fisman and Svensson, 2007; Kauffman and Wei, 2000).

Many empirical studies have concluded that firms in more corrupt environments display lower performance. For instance, Hanousek et al. (2019) find a negative association between average perceptions of corruption and firm efficiency in 14 Central and Eastern European economies, Paunov (2016) between the average percentage of firms reporting payments or gifts to obtain an operating license and investments for innovation in 48 developing and emerging economies, and Thakur et al. (2021) between country-level perceptions of corruption and firm value in 16 emerging market economies. Additionally, Demir et al. (2022) show that Chinese firms in cities with higher corruption indices display lower total factor productivity, while Yang et al. (2021) conclude that foreign firms operating in Chinese provinces with higher corruption have a worse financial performance.

This said, especially in less robust institutional environments, corruption might actually grease the wheels of individual businesses (Krammer, 2019; Mendoza et al., 2015). Indeed, corruption could help firms overcome unreasonable bureaucratic and regulatory obstacles, thus facilitating their operational and investment activities, as well as reducing costs (Lui, 1985; Méon and Weill, 2010). It could also help firms hedge against political risks by reinforcing their links to the established bureaucracy, as well as help them access decision-making networks (Krammer, 2019). Similarly, a bribe might also expand and improve the set of public services the firm can access, as well as facilitate or even create opportunities for lucrative public contracts (Hanousek et al., 2019).

Many empirical studies have also found a positive relationship between corruption and firm performance. For instance, Krammer (2019) finds a positive association between firm-level bribe payments and the introduction of new products in 30 emerging markets; Williams and Kedir (2016) find a positive association between firm-level reports of the proportion of annual sales necessary to pay or gift to get things done and firms' employment and productivity growth in 40 African countries; Williams et al. (2016) find a positive association between the same measure of corruption and firms' sales and productivity growth in 132 developing countries, while Cerdeira and Lourenço (2022) offer evidence that corruption is positively associated with innovation in domestic firms.

Cutting across virtually all studies surveyed is the claim that the impact of corruption on firm performance differs greatly depending on the institutional context. In communities with less robust institutional setups, corruption is usually found to be the most greasing. Such is found by Krammer (2019), Mendoza et al. (2015) or Williams and Kedir (2016). However, De Rosa et al. (2015), for instance, found that bribery is especially sanding in communities with weaker institutions.

This summary overview of the theoretical and empirical literature on the impact of corruption on firm performance indicates, as remarked by many (e.g. Martins et al., 2020), that extant works point in two seemingly opposite directions regarding whether corruption sands or greases the wheels of business. Several reasons may be adduced to explain this. First, it is important to distinguish between the impact of the community-level phenomenon of corruption on firm performance and the impact that firm-level corrupt behavior has on its own performance (Hanousek et al., 2019; Krammer, 2019). Communities with high levels of corruption may be associated with lower firm performance, but those firms in the community that do engage in corruption may have better performance than similar firms that do not. Corruption would offer a leg-up, as it were, in an environment that does not foster firm performance.

Second, what is called corruption refers to manifold phenomena, and therefore, studies with apparently contradictory results may simply not be measuring the same thing. Political or grand corruption is rather different from petty or bureaucratic corruption (Teixeira, 2015). Moreover, a one-time payment to, say, obtain a permit, is different from recurrent payments to, say, tax officials (Seck, 2020). There is no reason to expect their impacts on firm performance to be the same. Indeed, Seck (2020), when studying firms in 69 developing countries, finds evidence that one-time payments grease the wheels of business, especially of infant or expanding firms, but recurrent payments harm firm performance. Nur-tegin and Jakee (2020) also found that different types of corruption have different impacts on firm performance.

They (p. 20) 'go so far as to say that the "greases-versus-sands" question is fundamentally unanswerable if corruption is measured too broadly or too vaguely.' [3]

Furthermore, firms themselves are heterogeneous. Firm's 'ability to pay' and 'refusal power', in Svensson's (2003) words, affect both the likelihood and size of bribe payments. In particular, firm size seems to matter, as empirical studies have found that corruption impacts large and small firms differently, with smaller firms usually at a disadvantage (Moumbark and Koudalo, 2023; Paunov, 2016; Zhou and Peng, 2012). Something similar could be said for domestic and foreign firms (Cerdeira and Lourenço, 2022; Hanousek et al., 2019; Paunov, 2016). There is also evidence that firms are affected differently by corruption, depending on the stage of their life cycle (Seck, 2020), industry (Paunov, 2016; Svensson, 2005), the competitiveness of their markets (Ades and Di Tella, 1999; Martins et al., 2020; Treisman, 2000), and region (Asiedu and Freeman, 2009). Regarding the latter, firms in less competitive environments are often found to be less negatively or even positively affected by corruption (Sahakyan and Stiegert, 2012). In summary, segregation should be considered seriously. We thus hypothesize that

H1: The impact of corruption on firm-level performance is not the same for small and large firms.

H2: The impact of corruption on firm-level performance is not the same for domestic and foreign firms.

Third, the empirical observation of both a positive and negative impact of corruption on performance suggests that the relationship in question may be nonlinear (De Rosa et al., 2015). In the macroeconomics literature, corruption is often found to have a negative impact on performance, whether measured by aggregate productivity, stock of human capital, or rate of growth (Abdulla, 2021; Lambsdorff, 2003; Pellegrini and Gerlagh, 2004). However, there are both theoretical and empirical reasons to expect nonlinearities. In addition to the argument that low levels of corruption may be a helpful grease, Acemoglu and Verdier (1998), for instance, develop a model that shows that if fighting corruption is costly, then there is a greater than zero optimal level of corruption. This seems to be buttressed by empirical evidence. Méndez and Sepúlveda (2006) gathered evidence that in countries with freedom, as measured by an index made available by Freedom House International, there is a positive, albeit small, level of corruption that maximizes the rate of growth. However, higher levels are detrimental to growth. Swaleheen (2007) also found a nonlinear relationship between the efficiency of investment and a perceptual measure of corruption, and Abu and Karim (2021) found a relationship between corruption and the level of domestic investment in Nigeria. Something qualitatively similar could be the case at the firm-level. If so, when corruption greases the wheels of business, it does so only up to a certain threshold, after which the costs of further corrupt activities would be greater than any advantage it brought to the firm. We thus hypothesize that

H3: There is a concave relationship between corruption and firm-level performance.

These reflections are summarized in the conceptual framework shown in Figure 1. Corruption refers to motley phenomena, here grouped into petty versus grand and, within each, one-time versus recurrent (Seck, 2020; Teixeira, 2015). Several crucial firm characteristics mediate the impact of corruption on individual firm performance. In line with the literature survey, we emphasize size and foreign ownership. Performance is obviously multidimensional, and given the well-known fact that they are usually poorly correlated (Siepel and Dejardin, 2020), there is no reason to expect all dimensions to be equally impacted by any form of corruption. Finally, and crucially, the distinction between sand vs. wheels is subsumed in the hypothesized concave relation(s) between corruption and performance measures. We also notice that all interrelations are modulated by the institutional background.

Data and methods

The dataset

Our dataset includes cross-sectional information on 23 327 firms from 140 developing or emerging countries for all the available years between 2006 and 2020[4]. It is derived from the World Bank Enterprise Surveys (WBES) database, which compiles data from firm-level surveys of representative samples of private firms from several countries.

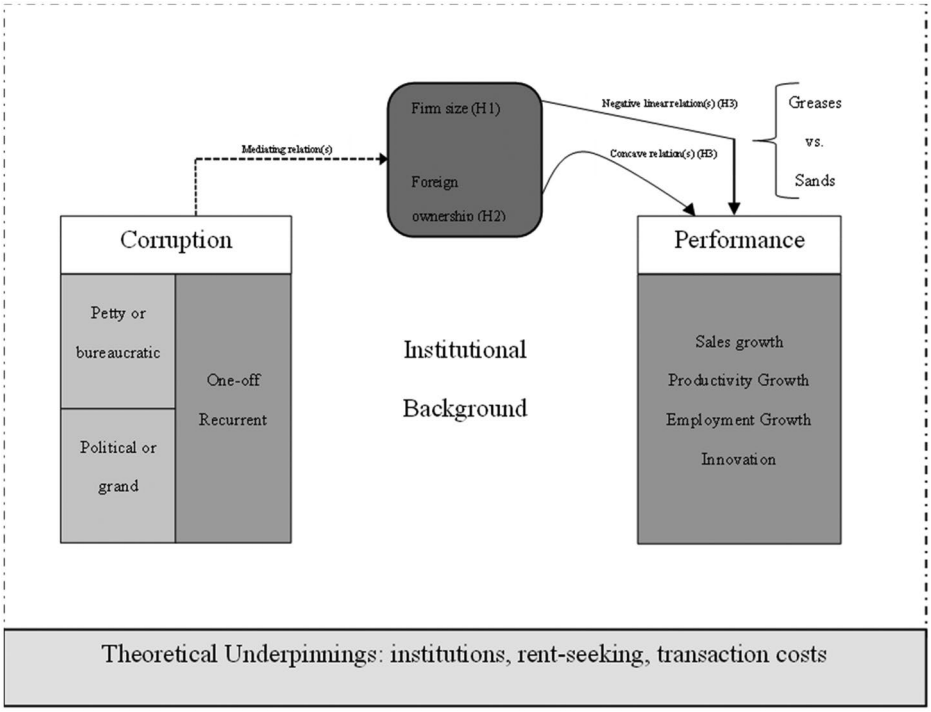

Figure 1. Conceptual framework.

The dependent variable

Our main goal was to measure the impact of corruption on firm performance. We measure the four dimensions of firm performance using four available indicators: the rate of real sales growth, the rate of employment growth, the rate of labor productivity growth, and innovation, that is, whether the firm introduced a new product or innovative process within the fiscal year. All of these measures of performance have been previously used in the literature on the impact of corruption[5]. While some studies used only one measure (e.g. Beltrán, 2016; Paunov, 2016), others used several (Martins et al., 2020; Seck, 2020). The former contributions are usually concerned with estimating the impact of corruption on a specific dimension of performance, whereas the latter, as in our case, is concerned with its impact on performance more generally understood.

As shown in Table 1, the average real annual sales growth is 1.29%, and the mean values for annual employment growth and annual productivity growth are 5.12% and -3.21%, respectively. While these mean values are low, with negative average productivity growth, it is noteworthy that the standard deviations of these dependent variables are high in comparison with the corresponding mean, suggesting significant variability across firms in our data. Regarding innovation, 72% of the firms introduced a new product or process innovation.

Our performance measures show small correlations, except for the rates of sales and productivity growth (0.85). Furthermore, the rate of productivity growth is (weakly) negatively correlated with employment growth and innovation (-0.27 and -0.02, respectively). The measures of sales and productivity growth reflect a firm's ability to market its products. On the other hand, employment growth and innovation are more dependent on internal processes and decisions and are therefore only mediately dependent on the firm's present market performance.

Independent variables and controls

As independent variables, we included a continuous measure of firm-level bribe payments. This measure of recurrent corruption, potentially both petty and grand, has been used in a few previous studies (e.g. Krammer, 2019; Nur-tegin and Jakee, 2020; Williams and Kedir, 2016)[6]. As noted above, recurrent corruption has been found to be more sanding than one-time corruption (Seck, 2020). To test *H3,* we introduced the same variable squared.

Table 1. Descriptive statistics.

	Variables	Description	Mean	St. Dev	Min	Max
Dependent variables	Sales growth	Real annual sales growth (%)	1.287	27.804	−100	100
	Employment growth	Annual employment growth (%)	5.118	17.205	−100	100
	Productivity growth	Annual labor productivity growth (%)	−3.206	28.112	−100	100
	Innovation	Dichotomous variable equal to one if the firm introduced a new product or a process innovation; zero otherwise	0.720	0.449	0	1
Main independent variables	Corruption	Value of gift expected to secure government contract (% of the contract)	1.604	4.645	0	100
	Foreign ownership	Proportion of private foreign ownership in the firm (%)	7.815	24.620	0	100
	Size of the firm	Number of employees	115.952	467.457	1	21000
Firm/manager characteristics	Exporter	Dichotomous variable equal to one if firm exports directly or indirectly; zero otherwise	0.257	0.437	0	1
	Age	Age of the firm	20.160	16.720	0	195
	Manager experience	Years of the top manager's experience working in the firm's sector	18.742	11.463	0	60
	Training	Dichotomous variable equal to one if the firm offers formal training to its employees; zero otherwise	46.264	49.861	0	1
Obstacles	Access to financing	Dichotomous variable equal to one if this is perceived as the biggest obstacle to firm's activities; zero otherwise	0.157	0.364	0	1
	Political instability	Dichotomous variable equal to one if this is perceived as the biggest obstacle to firm's activities; zero otherwise	0.099	0.299	0	1
	Tax rates	Dichotomous variable equal to one if this is perceived as the biggest obstacle to firm's activities; zero otherwise	0.109	0.311	0	1

On average, firms expect to pay 1.6% of the value of a government contract to secure it, with significant variability; the standard deviation of our measure of corruption is approximately 4.65. The median is positive but very close to zero, while almost 15% of firms expect to pay at least 5% of the contract to obtain it. Thus, the distribution is positively skewed. It should be emphasized that this measure is a proportion: a small percentage may still be associated with a sizable bribe payment.

Our other two independent variables measure firm size and whether the firm is foreign or domestic. The former is measured by the number of employees, whereas the latter is measured by the proportion of foreign ownership of the firm's capital. 78% of the firms in our sample are small or medium-sized firms, that is, with fewer than 100 employees, whereas 22% are large firms. About 89% are domestic firms, while 11% are foreign firms; that is, they have at least 10% of the capital owned by private foreigners.

Substantial variability exists in firm size, foreign ownership, and size. On average, a firm has around 116 employees, and 7.82% of the value of its capital is owned by private foreigners, and the standard deviation of each measure is more than three times the corresponding mean.

We also control for whether the firm is an exporter or not, the firm's age (both linearly and squared), the years of experience of top management in the firm's sector, whether the firm offers training to employees, and typical obstacles to the firm's activity, such as access to financing, political instability, and tax rates.

On average, 25.7% of firms export directly or indirectly, and firms are, on average, relatively experienced in the market, as the average age of the firm is approximately 20 years. Top managers also reveal significant experience, as the mean number of years of experience working in the firm sector is approximately 19. The percentage of firms that offered formal training to employees was 46.26%. As for the biggest obstacle to their activity, 15.7% of firms report access to financing, 10.9% report tax rates, and 9.9% report political instability.

The model

To test the hypotheses discussed in Section 2, we estimate the following equation for each of the four performance measures:

$$Y_i = \alpha + \beta C_i + \gamma C_i^2 + \delta \boldsymbol{X}_i + u_i \quad (1)$$

Here, Y_i is the dependent variable (the performance measure), C_i is corruption, C_i^2 is the corruption variable squared, $\boldsymbol{X}_i$ is the set of other independent variables (see Table 1), and u_i is a zero-mean error term. The linear model is the most commonly used model in the literature (Martins et al., 2020). It is a general model that locally approximates any other model with a different specification, and, further, it is the workhorse model for dealing with endogeneity issues.

Indeed, the estimation of equation (1) using Ordinary Least Squares (OLS) is plagued by endogeneity issues. Endogeneity occurs when a regressor is correlated with the error term, leading to inconsistent estimates. There are several potential sources of endogeneity in our case. For instance, it is well known that firms may not be willing to disclose their illegal activities. Also, there could be unobserved, omitted variables impacting both firms' decision to engage in corruptive behavior and their performance (see, e.g. Martins et al., 2020; Seck, 2020; Williams and Kedir, 2016). A Durbin-Wu-Hausman test for endogeneity indeed rejects the exogeneity of our measure of corruption.

To avoid falling prey to endogeneity issues, we resort to instrumental variables (IV) estimation. We use the industry-location averages of corruption and its square as the instruments. They form good instruments insofar as corruption in the sector depends on sector-endogenous but firm-exogenous factors such as sector-specific technology, rents, or demand (Fisman and Svensson, 2007). They are widely used in the literature (Fisman and Svensson, 2007; Ha et al, 2021; Martins et al., 2020).

In addition to estimating equation (1) for the entire dataset (Table 2), we obtain results for four subsamples: small/medium-sized firms and large firms as well as for foreign firms and domestic firms. In so doing, we aim to assess the moderating role of firm size and FDI on the relationship between corruption and firm performance (see Tables 3 and 4). Clustered-robust standard errors at the industry location level were considered in all the regressions[7].

Results and discussion

Regarding the full sample (Table 2), in the case of sales and labor productivity growths, we find an unequivocally negative linear impact of corruption on these measures of performance. This bolsters the results in the previous literature (e.g. Martins et al., 2020; Seck, 2020), which does not consider the possibility of a

Table 2. Corruption and firm performance: Instrumental Variables results.

Variables	Sales growth	Employment growth	Productivity growth	Innovation
Corruption	−1.570**	0.700***	−2.358***	0.067***
	(0.775)	(0.196)	(0.796)	(0.010)
Corruption^2	0.029	−0.011**	0.056	−0.001***
	(0.042)	(0.005)	(0.040)	(0.000)
Size of the firm	0.002***	0.003***	−0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
Foreign ownership	0.013	−0.008	0.020*	0.001***
	(0.010)	(0.006)	(0.011)	(0.000)
Exporter	1.280**	0.380	0.687	0.057***
	(0.648)	(0.314)	(0.612)	(0.012)
Age	−0.223***	−0.329***	0.038	−0.001
	(0.039)	(0.024)	(0.038)	(0.001)
Age^2	0.001***	0.002***	−0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Manager experience	0.035	−0.049***	0.081***	−0.001*
	(0.024)	(0.012)	(0.024)	(0.000)
Training	0.019***	0.015***	0.002	0.001***
	(0.005)	(0.003)	(0.005)	(0.000)
Access to financing	−0.756	−0.440	−0.208	−0.021*
	(0.728)	(0.409)	(0.775)	(0.011)
Political instability	−3.339***	−2.180***	−1.194	−0.083***
	(0.886)	(0.437)	(0.868)	(0.016)
Tax rates	−0.251	−0.294	−0.197	−0.099***
	(0.767)	(0.348)	(0.720)	(0.018)
Constant	5.033***	9.636***	−3.046***	0.599***
	(1.193)	(0.606)	(1.052)	(0.026)
Wald χ^2-test	101.40***	532.56***	58.67***	382.05***
Observations	18,396	21,389	17,877	23,275

Notes: *** (**) [*] is statistically significant at the 1% level (5%) [10%].

concave relationship. The marginal effect of a one percentage point increase in bribe payments, taking into consideration both C_i and C_i^2, is associated with a decrease of 1.48 and 2.18 percentage points in sales and productivity growths, respectively. These marginal effects are significant at a p-value of 0.05.

As for employment growth and innovation, the evidence points in the direction of a concave relationship, as hypothesized in *H3*. We find evidence of a positive impact of corruption on these measures of performance up to a level of the measure of corruption, after which further increases are associated with lower performance. This finding provides empirical support for the hypothesized non-linear effect of corruption on performance, an effect overlooked in previous literature. It thus helps us better grasp how corruption can initially act as a 'grease' before becoming a 'sand' in the wheels of firm performance. The maximum impact is reached at bribe payments of approximately 31.82% and 33.5% of the government contract in the case of employment growth and innovation, respectively.

In other words, the two performance measures directly linked to market performance (i.e. sales and productivity growths) are negatively impacted by expected bribe payments, whereas the two measures that turn on inner processes and decisions, that is, employment growth and innovation, display a positive relationship, even if only up to a point. This suggests, although only tentatively, that corruption may foster the non-market performance while hurting the market performance of these firms. This suggestion is reinforced by the negative association found in the literature between competitive environments and the impact of corruption on firm performance (Sahakyan and Stiegert, 2012). Indeed, a less competitive environment may not generate the necessary incentives for firms to align their inner processes and decisions with market outcomes. As John Hicks (1935, p. 8) famously put it, 'the best of all monopoly profits is the quiet life', an idea supported by recent evidence (Koetter et al., 2012)

This regression gives evidence that firm size and foreign ownership are associated with slightly larger measures of performance. As for controls, being an exporter is associated with higher levels of performance, especially as measured by sales growth and innovation, whereas the opposite seems to be the case for firm age, a proxy for firm experience. Firms that offer training show higher levels of performance, whereas managers' experience presents mixed results. Finally, political instability was the perceived obstacle with the greatest, and negative, impact on performance in our sample. Except for innovation, neither difficulties in accessing financing nor tax rates have noteworthy effects.

The results for the subsamples segregated by firm size (Table 3) are qualitatively similar to the foregoing in what concerns *H3*. Further, they show that in measures of performance related to inner processes and decisions, corruption has a more negative or lower positive impact on the performance of smaller and medium-sized firms. In other words, we find evidence for *H1,* i.e. that the size of firms matters when measuring the impact of corruption on firm-level performance[8]. In particular, in the case of employment growth and innovation, for which the impact of corruption on performance is concave, the marginal effects are 0.65 and 0.06 for small-medium size firms, and 1.56 and 0.07 for large firms, respectively[9]. As for sales and productivity growths, the effects are -1.45 and -2.15 for small-medium size firms and -1.18 and -2.02 for large firms, respectively, but the differences are not statistically significant. According to some authors, larger firms are less affected by corruption because, for them, whether to participate in corrupt activities may be an option, as opposed to an imposition (Martins et al., 2020; Zhou and Peng, 2012). Furthermore, a proportionally equal bribe payment (e.g. 10% of the contract) may be much more significant for a smaller firm (Paunov, 2016).

When segregating by foreign ownership (Table 4), the results for domestic firms are also qualitatively similar to the foregoing with respect to *H3*. However, this is not so in the case of foreign firms insofar as, except for innovation, we find no significant impact of corruption on performance measures[10]. This contrast is significant because it indicates that FDI may mitigate the impact of corruption on firm-level performance. It also offers evidence for *H2,* i.e. that foreign ownership matters when measuring the impact of corruption on firm-level performance. This better performance of foreign firms may result from privileged relationships with institutions and officials (Paunov, 2016)[11].

To further study the linear and concave impact of corruption on performance, we estimate equation (1) without C_i^2 for the four subsamples: small and medium domestic and foreign firms, and large domestic and foreign firms. In all cases, the results were qualitatively identical[12], but we found evidence that the introduction of C_i^2 increases the differences among the subsamples. We explored this result by narrowing in on the two extreme cases of medium-small domestic firms versus large foreign firms (Tables A2 vs. A3

Table 3. Corruption and firm performance by Size: Instrumental Variables results.

	Small and Medium firms				Large firms			
Variables	Sales growth	Employment growth	Productivity growth	Innovation	Sales growth	Employment growth	Productivity growth	Innovation
Corruption	−1.545*	0.677***	−2.337**	0.067***	−1.235	1.650***	−2.136**	0.076***
	(0.887)	(0.205)	(0.936)	(0.008)	(1.008)	(0.523)	(0.975)	(0.025)
Corruption^2	0.027	−0.009*	0.052	−0.001***	0.026	−0.047**	0.059	−0.003**
	(0.050)	(0.005)	(0.050)	(0.000)	(0.037)	(0.018)	(0.037)	(0.001)
Size of the firm	0.027**	0.057***	−0.024**	0.000	0.001*	0.002***	−0.001	0.000
	(0.012)	(0.007)	(0.012)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Foreign ownership	0.005	−0.017**	0.014	0.001***	0.015	−0.007	0.030**	0.001***
	(0.013)	(0.007)	(0.013)	(0.000)	(0.013)	(0.008)	(0.015)	(0.000)
Exporter	1.167	0.010	1.195	0.060***	0.556	−0.154	0.012	0.046***
	(0.847)	(0.389)	(0.787)	(0.014)	(0.896)	(0.515)	(0.914)	(0.017)
Age	−0.291***	−0.423***	0.058	−0.001	−0.157***	−0.221***	0.027	0.001
	(0.052)	(0.029)	(0.051)	(0.001)	(0.051)	(0.031)	(0.052)	(0.001)
Age^2	0.002***	0.003***	−0.000	0.000**	0.001*	0.001***	−0.000	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manager experience	0.042	−0.056***	0.083***	−0.001	0.033	−0.009	0.070*	−0.001
	(0.028)	(0.015)	(0.028)	(0.000)	(0.039)	(0.021)	(0.040)	(0.001)
Training	0.013**	0.009**	0.002	0.001***	0.030***	0.014**	0.013	0.002***
	(0.006)	(0.004)	(0.006)	(0.000)	(0.010)	(0.006)	(0.011)	(0.000)
Access to financing	0.015	−0.022	0.156	−0.018	−4.076***	−2.022**	−2.061	−0.035
	(0.816)	(0.446)	(0.848)	(0.012)	(1.427)	(0.825)	(1.527)	(0.023)
Political instability	−2.933***	−2.492***	−0.518	−0.085***	−4.691***	−1.474*	−3.121**	−0.073***
	(1.075)	(0.526)	(1.029)	(0.017)	(1.283)	(0.814)	(1.431)	(0.024)
Tax rates	0.108	−0.160	0.234	−0.102***	−1.518	−0.832	−1.529	−0.081***
	(0.891)	(0.414)	(0.847)	(0.021)	(1.240)	(0.642)	(1.224)	(0.024)
Constant	5.032***	9.589***	−2.831**	0.599***	5.006***	8.570***	−3.029*	0.557***
	(1.396)	(0.620)	(1.303)	(0.028)	(1.744)	(1.100)	(1.755)	(0.036)
Wald χ^2-test	85.67***	508.27***	57.02***	368.18***	48.56***	164.3***	25.45**	154.58***
Observations	14,353	16,876	14,098	18,245	4,043	4,513	3,779	5,030

Notes: *** (**) [*] is statistically significant at the 1% (5%) [10%] level.

Table 4. Corruption and firm performance by Foreign Ownership: Instrumental Variables results.

	Foreign firms				Domestic firms			
Variables	Sales growth	Employment growth	Productivity growth	Innovation	Sales growth	Employment growth	Productivity growth	Innovation
Corruption	−1.244	0.334	−1.014	0.064***	−1.542*	0.723***	−2.515***	0.069***
	(0.955)	(0.491)	(1.050)	(0.016)	(0.829)	(0.200)	(0.833)	(0.010)
Corruption^2	0.042	0.002	0.024	−0.002***	0.021	−0.011***	0.058	−0.001***
	(0.046)	(0.023)	(0.054)	(0.001)	(0.046)	(0.004)	(0.043)	(0.000)
Size of the firm	0.002**	0.002***	0.001	−0.000	0.002**	0.003***	−0.002	0.000
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Foreign ownership	−0.016	−0.005	−0.019	0.001***	−1.427	−0.545	−0.703	0.003
	(0.026)	(0.014)	(0.030)	(0.000)	(0.948)	(0.404)	(1.050)	(0.010)
Exporter	3.278*	0.978	2.341	0.023	0.793	0.285	0.320	0.067***
	(1.831)	(0.868)	(1.895)	(0.020)	(0.595)	(0.336)	(0.549)	(0.013)
Age	−0.192**	−0.230***	−0.043	0.000	−0.240***	−0.353***	0.051	−0.001
	(0.081)	(0.049)	(0.084)	(0.001)	(0.044)	(0.026)	(0.043)	(0.001)
Age^2	0.001*	0.001***	0.000	0.000	0.002***	0.003***	−0.000	0.000**
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manager experience	−0.015	−0.045	0.021	−0.000	0.043	−0.047***	0.087***	−0.001*
	(0.070)	(0.032)	(0.073)	(0.001)	(0.026)	(0.013)	(0.026)	(0.000)
Training	0.016	0.009	0.009	0.001***	0.020***	0.016***	0.002	0.002***
	(0.017)	(0.008)	(0.017)	(0.000)	(0.005)	(0.003)	(0.005)	(0.000)
Access to financing	−4.998**	0.846	−6.136***	−0.031	−0.318	−0.566	0.354	−0.022*
	(2.295)	(1.279)	(2.197)	(0.030)	(0.785)	(0.435)	(0.808)	(0.012)
Political instability	−5.530*	−0.626	−4.030	−0.082**	−3.004***	−2.393***	−0.765	−0.087***
	(3.084)	(1.354)	(3.037)	(0.033)	(0.872)	(0.456)	(0.860)	(0.017)
Tax rates	−2.272	−1.252	−2.274	−0.037	−0.014	−0.202	0.001	−0.105***
	(2.314)	(1.595)	(2.308)	(0.029)	(0.827)	(0.379)	(0.765)	(0.019)
Constant	7.109**	8.189***	0.710	0.639***	5.144***	9.891***	−3.195***	0.593***
	(3.426)	(1.845)	(3.665)	(0.042)	(1.220)	(0.645)	(1.069)	(0.027)
Wald χ^2-test	38.99***	50.93***	17.51	76.57***	90.06***	536.02***	64.64***	365.85***
Observations	1,988	2,249	1,875	2,550	16,408	19,140	16,002	20,725

Notes: *** (**) [*] is statistically significant at the 1% (5%) [10%] level.

in Appendix A). We found much greater differences in the impact of corruption when C_i^2 was introduced. This suggests that the differential impact of corruption on the performance of different types of firms may be greater than that found in previous studies that did not consider a concave relation.

Conclusion

In this study, we use a sample of firms from 140 developing and emerging countries to investigate the impact of bribe payments on four firm performance measures. We make several contributions to the literature. First, we offer evidence of a negative linear impact of corruption on measures directly linked to market performance, namely sales and productivity growths. Second, we also find that the impact of corruption on measures focusing on inner processes, that is, employment growth and innovation, is positive only up to a point. This highlights that corruption can initially facilitate performance up to a threshold beyond which it becomes detrimental. If, ideally, corruption should be eliminated, anti-corruption strategies could benefit from a nuanced approach that considers its varying impacts at different levels of corruption.

As noted, a categorical answer to the question of whether corruption sands or greases the wheels of business has been found to be simplistic, given that corruption refers to motley phenomena and firm performance is multidimensional. We add to this conclusion by gathering evidence that the relationship between corruption and firm-level performance may depend on the level of corruption activity. This also helps reconcile some of the apparent contradictions in the literature among studies showing that corruption hurts performance, and those concluding the opposite. Still, our measure of corruption is limited to bribery associated with securing government contracts and does not capture other forms of corruption, which are also critical to understanding the full impact of corruption on firm performance. This limitation should be considered when interpreting our findings.

We also investigated the moderating role of firm size and foreign ownership on the relationship between corruption and firm performance. We found that corruption has a more negative or lower positive impact on the performance of smaller and medium-sized firms. This is concerning, given that these firms are not only the vast majority of firms but also typically concentrate a great share of employment in these countries. These results also reinforce that the connection between corruption and performance is mediated by the characteristics of firms, with size being an important factor. Consequently, measures to fight corruption should be designed by considering the specificities of smaller firms.

Regarding foreign ownership, we find that, in general, corruption has no significant impact on the performance measures of foreign firms. This finding indicates that FDI may mitigate the impact of corruption on firm-level performance. If so, measures of policy-fostering FDI, such as easing access to credit, investing in infrastructure and human capital, or promoting economic and political stability, might also mitigate the negative impact of corruption on firm-level performance.

Finally, we draw attention to the noteworthy result that explicitly modelling a concave relation between corruption and performance amplifies the moderating roles of both firm size and foreign ownership.

This study can be extended in several ways. First, given data availability constraints, we used only one measure of corruption. Therefore, further studies are necessary to investigate whether using other measures would lead to similar results. In addition, if panel data are available for a large number of countries and firms, a dynamic perspective could be adopted to uncover possible effects over time and over the life cycle of individual firms.

Notes

1. https://www.transparency.org/en/what-is-corruption#.
2. https://www.un.org/pt/node/104930.
3. Given the well-known difficulties in reliably measuring corruption, it is unsurprising to find studies differing significantly in the measures used. Some use perceptions, which has the advantage of being relatively easy to obtain and widely available. But it has known difficulties. Olken and Pande (2012), for instance, notice a small correlation of perceptions with objective measures of corruption, and notice that perceptions are biased. A similar conclusion is reached by Donchev and Ujhelyi (2014). In several studies, corruption is measured in binary form (e.g. De Rosa et al., 2015; Martins et al., 2020). This said, most studies use several measures in their robustness checks, and report little qualitative differences.

4. Table A1 in Appendix A lists the countries and years included in our dataset. Each firm is categorized into one of the following regions: Africa, East Asia and Pacific, East Europe and Central Asia, Latin America and Caribbean, the Middle East and North Africa, South Asia. The WBES offers information on the sector/industry of each firm. We distinguish the following 15 sectors: chemicals, plastics and rubber; construction; electronics and communication equipment; food; furniture and wood; machinery, equipment and vehicles; metal; non-metallic mineral products; petroleum products; retail trade; textiles, leather and garments; tourism, hotels and restaurants; transports and communication; other manufacturing; other services.
5. The rate of sales growth is used, e.g. by Fisman and Svensson (2007); the rate of employment growth by Beltran (2016); the rate of productivity growth by Martins et al. (2020); and a similar measure of innovation by Paunov (2016).
6. As an anonymous reviewer points out, the measure used does not account for other corrupt practices such as payments for obtaining permits, counter favors, nepotism, or business-to-business corruption. These other forms of corruption can also significantly affect firm performance, but data limitations preclude us from including them in our analysis.
7. For robustness, all estimates of (1) were repeated with sector-specific dummies, and with country-specific dummies. The point estimates of the regression coefficients showed no noteworthy differences. The regressions with country-specific dummies are in Appendix B.
8. For robustness, we have also estimated equation (1), segregated by firm size, without C_i^2. The results are qualitatively the same.
9. In the case of employment, the differences in the coefficients between small and medium-sized firms and large firms associated with C_ia C_i^2 were significant, both with p-values less than 0.0001. Regarding innovation, the difference in the coefficients associated with C_i had a p-value of 0.260, while the difference between the coefficients associated with C_i^2 had a p-value of less than 0.0001.
10. For robustness, we have also estimated equation (1), segregated by foreign ownership, without C_i^2. The results are qualitatively mostly the same. The coefficient for the impact of corruption on employment growth in foreign firms is of similar magnitude, but now significant at 10%.
11. For robustness, we have also estimated Table 3 segregated by foreign ownership, and Table 4 by size. The results are qualitatively the same.
12. With the minor exception of the coefficient for the impact of corruption on employment growth in foreign firms, which becomes significant at 10%.

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Author contributions

Diogo Lourenço contributed to the conception and design of the study, the literature review and conceptual framework, the methodology, the analysis and interpretation of the data, the drafting of the paper, and its revision. Jorge Cerdeira contributed to the conception and design of the study, the literature review and conceptual framework, the methodology, the analysis and interpretation of the data, the drafting of the paper, and its revision. Diogo Lourenço and Jorge Cerdeira approved the version to be published and agreed to be accountable for all aspects of the work.

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Data availability statement

The data that support the findings of this study are openly available from Enterprise Surveys, The World Bank, http://www.enterprisesurveys.org.

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Appendix A

Table A1. Countries and years included in the analysis.

Afghanistan	2008; 2014	Colombia	2006; 2010; 2017	Honduras	2006; 2010; 2016	Morocco	2013; 2019	St Kitts And Nevis	2010
Albania	2007; 2013; 2019	Congo	2009	Hungary	2009; 2013; 2019	Mozambique	2007; 2018	St Lucia	2010
Angola	2006; 2010	Costa Rica	2010	India	2014	Myanmar	2014; 2016	St Vincent and Grenadines	2010
Antigua and Barbuda	2010	Croatia	2007; 2013; 2019	Indonesia	2009; 2015	Namibia	2006; 2014	Sudan	2014
Argentina	2006; 2010; 2017	Cyprus	2019	Iraq	2011	Nepal	2009; 2013	Suriname	2010; 2018
Armenia	2009; 2013; 2020	Czech Republic	2009; 2013; 2019	Israel	2013	Nicaragua	2006; 2010; 2016	Tajikistan	2008; 2013; 2019
Azerbaijan	2009; 2013; 2019	Cote d'Ivoire	2009; 2016	Jamaica	2010	Niger	2009; 2017	Tanzania	2006; 2013
Bahamas	2010	Democratic Republic of the Congo	2006; 2010; 2013	Jordan	2013; 2019	Nigeria	2007; 2014	Thailand	2016
Bangladesh	2013	Djibouti	2013	Kazakhstan	2009; 2013; 2019	North Macedonia	2009; 2013; 2019	Timor-Leste	2009; 2015
Barbados	2010	Dominica	2010	Kenya	2013; 2018	Pakistan	2007; 2013	Togo	2009; 2016
Belarus	2008; 2013; 2018	Dominican Republic	2010; 2016	Kosovo	2009; 2013; 2019	Panama	2006; 2010	Tonga	2009
Belize	2010	Ecuador	2006; 2010; 2017	Kyrgyz Republic	2009; 2013; 2019	Paraguay	2006; 2010; 2017	Trinidad and Tobago	2010
Benin	2009	Egypt	2013; 2016; 2020	Lao	2009; 2012; 2016; 2018	Peru	2006; 2010; 2017	Tunisia	2013; 2020
Bhutan	2009; 2015	El Salvador	2006; 2010; 2016	Latvia	2009; 2013; 2019	Philippines	2009; 2015	Turkey	2008; 2013; 2019
Bolivia	2006; 2010; 2017	Eritrea	2009	Lebanon	2013; 2019	Poland	2009; 2013; 2019	Uganda	2006; 2013
Bosnia and Herzegovina	2009; 2013; 2019	Estonia	2009; 2013; 2019	Lesotho	2009; 2016	Romania	2009; 2013; 2019	Ukraine	2008; 2013; 2019
Botswana	2006; 2010	Eswatini	2006; 2016	Liberia	2009; 2017	Russia	2009; 2012; 2019	Uruguay	2006; 2010; 2017
Brazil	2009	Ethiopia	2011; 2015	Lithuania	2009; 2013; 2019	Rwanda	2006; 2011; 2019	Uzbekistan	2008; 2013; 2019
Bulgaria	2007; 2009; 2013; 2019	Fiji	2009	Madagascar	2009; 2013	Samoa	2009	Vanuatu	2009
Burkina Faso	2009	Gabon	2009	Malawi	2009; 2014	Senegal	2007; 2014	Venezuela	2010
Burundi	2006; 2014	Gambia	2006; 2018	Malaysia	2015	Serbia	2009; 2013; 2019	Vietnam	2009; 2015
Cambodia	2016	Georgia	2008; 2013; 2019	Mali	2007; 2010; 2016	Sierra Leone	2009; 2017	West Bank and Gaza	2013; 2019
Cameroon	2009; 2016	Ghana	2007; 2013	Mauritania	2006; 2014	Slovakia	2009; 2013; 2019	Yemen	2010; 2013
Cape Verde	2009	Grenada	2010	Mauritius	2009	Slovenia	2009; 2013; 2019	Zambia	2007; 2013; 2019
Central African Republic	2011	Guatemala	2006; 2010; 2017	Mexico	2006; 2010	Solomon Islands	2015	Zimbabwe	2011; 2016
Chad	2009; 2018	Guinea	2006; 2016	Moldova	2009; 2013; 2019	South Africa	2007; 2020		
Chile	2006; 2010	Guinea Bissau	2006	Mongolia	2009; 2013; 2019	South Sudan	2014		
China	2012	Guyana	2010	Montenegro	2009; 2013; 2019	Sri Lanka	2011		

Table A2. Corruption and firm performance for two extreme cases: Instrumental Variables results for model with . C_i^2

	Small and Medium Domestic firms				Large Foreign firms			
Variables	Sales growth	Employment growth	Productivity growth	Innovation	Sales growth	Employment growth	Productivity growth	Innovation
Corruption	−1.495	0.742***	−2.527**	0.070***	−0.242	1.987***	−1.278	0.120***
	(0.949)	(0.203)	(0.983)	(0.009)	(1.672)	(0.698)	(1.798)	(0.033)
Corruption^2	0.022	−0.010**	0.058	−0.001***	0.018	−0.057**	0.044	−0.005***
	(0.054)	(0.004)	(0.052)	(0.000)	(0.072)	(0.027)	(0.075)	(0.002)
Size of the firm	0.037***	0.060***	−0.018	0.000	0.002*	0.002**	0.001	0.000
	(0.013)	(0.008)	(0.012)	(0.000)	(0.001)	(0.001)	(0.002)	(0.000)
Foreign ownership	−2.537	−0.214	−2.032	0.002	0.001	0.010	0.002	0.001**
	(1.719)	(0.887)	(1.953)	(0.018)	(0.029)	(0.016)	(0.034)	(0.001)
Exporter	0.646	−0.203	0.893	0.068***	2.564	−0.295	2.282	0.017
	(0.751)	(0.418)	(0.691)	(0.015)	(1.993)	(1.007)	(2.168)	(0.029)
Age	−0.288***	−0.430***	0.076	−0.001	−0.154*	−0.150**	−0.026	0.001
	(0.051)	(0.032)	(0.052)	(0.001)	(0.082)	(0.062)	(0.089)	(0.001)
Age^2	0.002***	0.004***	−0.001	0.000*	0.001	0.001*	0.000	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Manager experience	0.044	−0.054***	0.085***	−0.001	−0.012	−0.005	0.001	0.000
	(0.030)	(0.015)	(0.030)	(0.001)	(0.091)	(0.044)	(0.105)	(0.001)
Training	0.014**	0.009**	0.001	0.001***	0.036	0.017	0.022	0.001***
	(0.006)	(0.004)	(0.006)	(0.000)	(0.023)	(0.011)	(0.023)	(0.000)
Access to financing	0.296	−0.170	0.604	−0.019	−9.330***	−1.558	−6.928**	−0.060
	(0.860)	(0.481)	(0.872)	(0.012)	(2.754)	(2.186)	(3.059)	(0.058)
Political instability	−2.365**	−2.599***	−0.090	−0.088***	−1.268	0.282	−2.277	−0.104**
	(1.009)	(0.532)	(0.996)	(0.018)	(2.659)	(1.993)	(3.326)	(0.045)
Tax rates	0.229	−0.152	0.345	−0.103***	−3.239	−2.470	−2.607	0.014
	(0.939)	(0.437)	(0.868)	(0.022)	(2.653)	(1.576)	(2.548)	(0.043)
Constant	4.643***	9.522***	−3.166**	0.591***	3.931	4.881**	−1.095	0.532***
	(1.382)	(0.651)	(1.277)	(0.028)	(3.970)	(2.394)	(4.551)	(0.073)
Wald χ^2-test	83.73***	500.61***	60.2***	337.83***	26.04**	40.07***	10.32	47.10***
Observations	13,242	15,591	13,021	16,806	877	964	798	1,111

Table A3. Corruption and firm performance for two extreme cases: Instrumental Variables results for model without . C_i^2

	Small and Medium Domestic firms				Large Foreign firms			
Variables	Sales growth	Employment growth	Productivity growth	Innovation	Sales growth	Employment growth	Productivity growth	Innovation
Corruption	−1.094***	0.535***	−1.479***	0.043***	0.167	0.753***	−0.286	0.011
	(0.304)	(0.145)	(0.320)	(0.006)	(0.460)	(0.266)	(0.597)	(0.011)
Size of the firm	0.038***	0.060***	−0.017	0.000	0.002**	0.002**	0.001	−0.000
	(0.012)	(0.008)	(0.012)	(0.000)	(0.001)	(0.001)	(0.002)	(0.000)
Foreign ownership	−2.466	−0.231	−1.834	−0.001	0.002	0.010	0.004	0.001***
	(1.763)	(0.878)	(2.084)	(0.019)	(0.029)	(0.016)	(0.034)	(0.001)
Exporter	0.667	−0.215	0.950	0.066***	2.603	−0.421	2.324	0.000
	(0.742)	(0.418)	(0.683)	(0.015)	(1.976)	(0.996)	(2.171)	(0.029)
Age	−0.286***	−0.433***	0.083	−0.002*	−0.148*	−0.161***	−0.014	0.001
	(0.050)	(0.031)	(0.050)	(0.001)	(0.081)	(0.059)	(0.089)	(0.001)
Age^2	0.002***	0.004***	−0.001	0.000**	0.001	0.001**	−0.000	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Manager experience	0.044	−0.055***	0.084***	−0.001	−0.014	−0.001	−0.001	0.000
	(0.030)	(0.015)	(0.030)	(0.001)	(0.091)	(0.044)	(0.105)	(0.001)
Training	0.014**	0.009**	0.002	0.001***	0.035	0.019*	0.021	0.001***
	(0.006)	(0.004)	(0.006)	(0.000)	(0.023)	(0.011)	(0.023)	(0.000)
Access to financing	0.341	−0.176	0.724	−0.020	−9.356***	−1.326	−6.951**	−0.027
	(0.844)	(0.480)	(0.857)	(0.013)	(2.767)	(2.179)	(3.070)	(0.056)
Political instability	−2.391**	−2.583***	−0.153	−0.087***	−1.268	0.318	−2.262	−0.097**
	(0.998)	(0.530)	(0.988)	(0.018)	(2.669)	(1.952)	(3.330)	(0.043)
Tax rates	0.294	−0.188	0.505	−0.107***	−3.248	−2.581*	−2.521	0.016
	(0.919)	(0.439)	(0.852)	(0.022)	(2.659)	(1.527)	(2.515)	(0.044)
Constant	4.434***	9.670***	−3.712***	0.611***	3.651	5.530**	−1.893	0.577***
	(1.294)	(0.631)	(1.168)	(0.030)	(3.826)	(2.326)	(4.443)	(0.063)
Wald χ^2-test	79.87***	488.23***	56.64***	311.45***	25.65***	36.36***	9.68	42.29***
Observations	13,242	15,591	13,021	16,806	877	964	798	1,111

Appendix B

To account for country-specific heterogeneity, we estimate the following equation for each of the four performance measures:

$$Y_{i,j} = \alpha_j + \beta C_{i,j} + \gamma C_{i,j}^{\ 2} + \delta \boldsymbol{X}_{i,j} + u_{i,j} \tag{2}$$

Here, $Y_{i,j}$ is the dependent variable (the performance measure of firm in country j), α_j is a country-specific fixed effect, $C_{i,j}$ is corruption, $C_{i,j}^{\ 2}$ is the corruption variable squared, $\boldsymbol{X}_{i,j}$ is the set of other independent variables (see Table 1), and $u_{i,j}$ is a zero-mean error term.

The results are in Table B1.

Table B1. Corruption and firm performance: Instrumental Variables results with country-specific fixed effects.

Variables	Sales Growth	Employment Growth	Productivity Growth	Innovation
Corruption	−1.156	0.209	−2.406**	0.037***
	(0.981)	(0.249)	(1.079)	(0.009)
Corruption^2	0.054*	−0.011**	0.120***	−0.001***
	(0.031)	(0.005)	(0.046)	(0.000)
Size of the firm	0.002***	0.003***	−0.001	0.000***
	(0.001)	(0.001)	(0.001)	(0.000)
Foreign ownership	−0.003	−0.009*	0.005	0.000***
	(0.009)	(0.005)	(0.011)	(0.000)
Exporter	0.561	0.397	−0.165	0.072***
	(0.595)	(0.291)	(0.587)	(0.009)
Age	−0.238***	−0.306***	0.011	−0.001**
	(0.035)	(0.025)	(0.034)	(0.000)
Age^2	0.002***	0.002***	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Manager experience	−0.010	−0.049***	0.037	0.000
	(0.022)	(0.011)	(0.023)	(0.000)
Training	0.011**	0.015***	−0.006	0.001***
	(0.005)	(0.003)	(0.005)	(0.000)
Access to financing	−0.744	−0.296	−0.204	−0.013
	(0.724)	(0.396)	(0.757)	(0.009)
Political instability	−1.577**	−1.483***	−0.276	−0.012
	(0.713)	(0.450)	(0.771)	(0.011)
Tax rates	−0.561	−0.014	−0.844	−0.030***
	(0.743)	(0.363)	(0.737)	(0.011)
Constant	−3.384	12.340***	−12.001	0.835***
	(10.018)	(3.456)	(9.788)	(0.034)
Wald χ^2-test	752,110.7***	329,056.28***	127,172.2***	23,893.43***
Observations	18,396	21,389	17,877	23,275

Notes: *** (**) [*] is statistically significant at the 1% level (5%) [10%].