



# Bribery, regulation and firm performance: evidence from a threshold model

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## Abstract

Firm-level bribery and regulation are two of the many determinants of firm performance. However, most of the existing studies examine the direct and linear effects of bribery and regulation and overlook their indirect effects. Using firm-level data, covering 20,343 firms in 78 developing countries, and employing a threshold model, the effects of firm performance's standard determinants vary based on the bribery and regulation levels. Our findings reveal that the impact of bribery and regulation on firm performance varies significantly depending on corruption and regulation levels. Access to external finance improves firm performance if and only if the firms are exposed to bribes and firm-level regulation is below a given threshold. Furthermore, exports boost the performance of the firms that are exposed to more bribery and spend more time with regulation than those that face lower levels of regulation and bribery. While bribery harms firm performance, our findings reveal that spending time with regulation could improve firm performance if firms are exposed to low levels of bribery. Our findings confirm the 'sand the wheels' hypothesis and limiting firm-level bribery improves firm performance.

**Keywords** Corruption · Regulation · Firm performance · Threshold · Grease the wheels · Sand the wheels

**JEL codes** C24 · D21 · D73 · L51

## 1 Introduction

The negative consequences of corruption on economic growth have been long examined (Mauro 1995; Mo 2001; Lambsdorff 2003; Cieslik and Goczek 2018; Gründler and Potrafke 2019, among many others), yet another strand of literature argues that corruption 'greases the wheels' by overcoming some of the ineffective institutions,

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regulations and bureaucracy (Lui 1985; Acemoglu and Verdier 2000; Meon and Weill 2010). A similar set of findings are observed at the firm level. One stream of literature finds that corruption at the firm level is negatively associated with firm performance (Fisman and Svensson 2007; Faruq et al. 2013; Şeker and Yang, 2014; Hanousek and Kochanova 2016; Yang et al. 2021; Demir et al. 2022), while another finds that bribe payments affect firm performance positively (Vial and Hanoteau 2010; Dreher and Gassebner 2013; Jauregui et al. 2020).

Country-level regulations are usually designed to benefit countries by eliminating market failures caused by monopolies and externalities (e.g., Pigou 1920). For instance, regulations mitigate negative externalities (e.g., air pollution) and enable competition. However, arguably, firm-level regulations increase bureaucracy and could create additional barriers to entrepreneurship activity and firm performance. For instance, Dreher and Gassebner (2013) argue that regulations required to carry out business activities (e.g., the number of procedures required to start a new business, the number of days required to start a new business, the costs of starting a new business, and the minimum capital required to start a new business) deter firms entering the market and corruption could reduce the negative impact of regulations on entrepreneurship activity. Similarly, Jiang and Nie (2014) found that corruption could act as a shortcut to firm-level regulations and bureaucracy and increase profitability. In other words, even though country-level regulations are required to overcome some market failures, the business-related regulations (e.g., number of procedures needed to start a business, minimum capital requirements, time and capital required to carry out regulations related to the taxes, customs, labor regulations, licensing and registration, and so on) may be detrimental for entrepreneurship activity, firm entry and performance.<sup>1</sup> In a recent paper, Amin and Ulku (2019) examined the interrelationship between firm-level corruption and firm performance and found a significant negative relationship between corruption and firm productivity when regulation is high and an insignificant relationship between corruption and firm productivity when regulation is low. However, their paper examines this relationship through an interaction term to capture the nonlinear effect, ignoring the possible heterogeneous impact of other variables (including regulation itself). Other papers in the literature examine the indirect effects of bribery and regulation on different characteristics of the firm. For instance, Wellalage et al. (2020) demonstrate that firms exposed to more bribes tend to face more financial difficulties when applying for credit, while Kitching et al. (2015) provide a theoretical framework that regulation could be a burden or a beneficial factor for firms. Given these interlinkages between regulation, bribery and other firm characteristics, this paper uses a threshold model estimation by using firm-level regulation and corruption as threshold variables to identify the heterogeneous effects of regulation and corruption and other firm characteristics on firm perfor-

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<sup>1</sup> By regulation, we refer to the firm-level regulations to carry out business activities in this paper rather than country-level regulations, which may cover an extensive list of regulations to avoid market failures such as environmental externalities.

mance by splitting the sample endogenously using regulation and bribery as threshold variables.<sup>2</sup>

Using an extensive firm-level data set that covers 20,343 firms in 78 developing countries and a threshold regression methodology, we show that firm-level corruption and regulation play a vital role in the factors affecting firm performance. The existing literature argues that bribery could be helpful if firms face rigid business-related regulations that forces them to pay high bribes to ‘get things done’. We find that bribery intensity affects firm performance negatively, but this effect is higher for firms that are exposed to lower bribe levels, while for the same firms with lower bribe exposure regulation could be beneficial as it could promote firm innovation (e.g., Weiss et al., 2019; Tchorzewska et al. 2022). Our findings confirm that access to external finance improves firm performance if firms are exposed to bribes and firm-level regulation is below a given threshold. While bribery harms firm performance, our findings reveal that spending time with regulation could improve firm performance if firms are exposed to low levels of bribery, confirming the so called ‘sand the wheels’ hypothesis.

The remainder of the paper is organized as follows. Section 2 provides a literature review on the role of regulation and bribe for firm performance and sets the hypotheses of the paper. Section 3 provides the details of the data and the variables used in this paper. Section 4 offers the linear and threshold models, and the results are given in Sect. 5. Finally, Sect. 6 concludes.

## 2 Literature review and hypothesis

There is a large body of literature that has been examining the effect of firm-level corruption on firm performance (Fisman and Svensson 2007; Vial and Hanoteau 2010; Faruq et al. 2013; Dreher and Gassebner 2013; Şeker and Yang, 2014; Hanousek and Kochanova 2016; Williams and Kadir, 2016; Krammer 2019; Jauregui et al. 2020; Qi et al. 2020). The literature provides a mixed set of findings (see Martins et al. (2020) for detailed literature on the effect of firm-level corruption on firm performance). On the one hand, firm-level corruption increases the costs of firms, limits entrepreneurship (see e.g., Dutta and Sobel 2016) and leads to inefficient allocation of resources within firms (Boudreaux et al. 2018), and hence harms the firm performance (e.g., Fisman and Svensson 2007; Faruq et al. 2013; Şeker and Yang, 2014; Hanousek and Kochanova 2016). Some other literature argues that firm-level corruption could overcome excessive business-related regulation and bureaucratic obstacles and improve firm performance (e.g., Dreher and Gassebner 2013; Krammer 2019; Jauregui et al. 2020). For instance, Krammer (2019) demonstrates that bribery is positively associated with the innovative performance of firms (i.e., new product introductions) in emerging markets by overcoming bureaucratic obstacles. Similarly, by using World

<sup>2</sup> We used the terms “corruption” and “bribery” interchangeably throughout the text. However, it should be noted that corruption is a broader concept and covers other types of misconduct beyond “bribery”. Since our paper aims to investigate the effect of bribery on firm performance, the firm-level corruption and corruption referred to in the empirical analysis of this paper is firm-level bribery.

Bank Enterprise Survey data across 40 African countries, Williams and Kedir (2016) show that corruption is positively associated with firm sales, employment and productivity growth rates, while Jauregui et al. (2020) show that corruption leads to an increased formation of new firms in Mexico. Contrary to this literature, Amin and Ulku (2019) find that firm-level corruption affects firm performance negatively if firms face high business-related regulations. Overall, the findings concerning the effect of corruption in high business regulation environments are mixed.

Some studies support the “sand the wheels” hypothesis, and others support the “grease the wheels” hypothesis. With the former hypothesis, corruption hampers firm performance, while corruption could ‘grease the wheels’ in the latter hypothesis and improves firm performance. Nur-tegin and Jakee (2020) examine different types of corruption and find that certain types of corruption may help “grease” business transactions, and some others “sand” the wheels. Similarly, Martins et al. (2020) explore the relationship between firm-level corruption and firm performance in different geographical clusters and show that corruption “greases the wheels” of business for African firms, but it “sands the wheels” for firms in Latin America, the Caribbean, Eastern Europe, Central Asia, and Southern Asia. Furthermore, Sharma and Mitra (2015) show that bribe acts as a tax on the profits of firms and reduces efficiency, but at the same time, increases firms’ exports and product innovation.

Even though most of the existing literature finds that excessive regulation increases corruption and hampers economic growth (e.g., Djankov et al. 2002), recent analyses show that regulation could also improve firm performance (Kitching et al. 2015). For instance, Wu (2019) demonstrates that regulation (i.e., time spent with government officials) increases firms’ innovation capacity and, subsequently, productivity. Similarly, there are also mixed results regarding the role of regulation on the effect of corruption on firm performance (e.g., Dreher and Gassebner 2013; Krammer 2019; Amin and Ulku 2019; Jauregui et al. 2020). Hence, our paper argues that firm-level regulation and bribery may lead to heterogeneous and differential effects on firm performance.

**Hypothesis 1** The effect of bribery and regulation on firm performance may be non-linear based on the bribery and regulation levels.

A growing body of literature examines the role of corruption and regulation on other firm characteristics. For instance, Khwaja and Mian (2005) demonstrate a connection between lending and politically connected firms. Furthermore, in a recent paper, Bircan and Saka (2021) find that credit constraints for firms in opposition areas are relatively higher, which then drops employment and sales of these firms. Using 14 transition economies, Fungáčová et al. (2015) demonstrate that bribery is positively associated with firms’ bank debt ratio suggesting that bribery enables firms to access external finance. On the other hand, Galli et al. (2017) show that small businesses in highly corrupt countries face a greater probability of self-restraint regarding their loan applications compared to small firms located in low-corruption economies. Finally, Wellalage et al. (2020) show that firm-level corruption in India is detrimental to accessing credit and the negative effects vary based on the age and size of the firm.

The literature mentioned above highlights that the impact of external finance on firm performance could vary based on firm-level bribery.

It has been found that human capital (manager experience) is also an essential factor for firm performance (see e.g., Peni 2014; Staniewski 2016; Wu 2019). However, the effect of human capital on performance is less effective in more corrupt environments (see e.g., Ehrlich and Lui 1999; Boikos 2016; Feldmann 2017; Hoa 2020). Ehrlich and Lui (1999) argue that individuals invest more in political capital rather than human capital to improve their negotiation and bureaucratic power in corrupt environments. Boikos (2016) shows that the marginal effect of public expenditure on education on human capital accumulation decreases with the increase in corruption. Hoa (2020) also shows that corruption harms labor quality. Finally, Feldmann (2017) demonstrates that economic freedom increases the return on human capital investment. Even though there is no firm-level study about the potential effect of corruption on human capital effect, the impact of human capital on firm performance may vary based on firm-level corruption and regulation.

Finally, some papers also show that different firm characteristics are related to firm-level corruption. For instance, Sharma and Mitra (2015) show that firm-level corruption increases exports. Similarly, Ha et al. (2021) show that larger firms benefit more from bribes through their improved export performances. De Jong et al. (2012) argue that small- and medium-sized firms are more likely to pay a bribe than their larger counterparts as larger firms have more resources to influence government officials or use these resources to take legal action. Examining the firm performance in Indian firms, Jain (2020) also demonstrate that bribery is more harmful to smaller and older firms than larger and younger ones. Overall, regulation and bribery intensity have varying effects on firms with different characteristics.

**Hypothesis 2** The effect of other firm characteristics on firm performance may differ based on firm-level regulation and corruption.

This paper aims to investigate whether the firm characteristics have heterogeneous effects on firm performance at different regulation and bribery levels. While the threshold model could capture such effects, an interaction term between bribery and regulation would only capture the effect of bribery on firm performance at different regulation levels. Therefore, we employ a threshold regression model to explore the potential heterogeneous effects of firm characteristics on firm performance at different bribery (regulation) levels. The next section provides the data set used in this paper and details of the variables employed in the empirical analysis, and Sect. 4 provides the proposed methodology.

### 3 Data

We employ firm-level data from the World Bank Enterprise Surveys database to estimate the heterogeneous effects of firm characteristics on firm performance at different bribery and regulation levels.<sup>3</sup> This data set covers various firm-level characteristics, allowing us to control for additional factors likely to affect firm performance. Furthermore, given the detailed information regarding the firm's sectoral and geography, we can also construct an instrumental variable (IV) for bribery intensity.

Similar to the previous literature (see e.g., Fisman and Svensson 2007; Şeker and Yang, 2014), we use the real annual sales growth for firm performance.<sup>4</sup> For the level of bribery that firms face, we use the bribery variable (B). The bribery variable measures the percentage of instances in which a firm was either expected or requested to provide a gift or informal payment when conducting six specific business transactions (i.e., gift or informal payment requested during the applications made for i) electricity, ii) water connection, iii) construction-related permit, iv) import license, v) operating license, and vi) during the meetings with tax officials). For regulation, we use the natural logarithm of the percentage of senior management time spent in dealing with requirements of government regulation (REG). The regulation variable measures the time required by managers to deal with the government regulations such as taxes, customs, labor regulations, licensing and registration, including dealings with officials and completing forms (see Appendix Table A1 for detailed measurement of each variable), and therefore, measures the firm-level regulation.

Beyond the main variables of interest, we control for the standard set of variables: the age of the firm (Age), the percentage of exports (Exports), size of the firm (i.e., medium and large dummy variables that are equal to 1 if the firm has 20–99 and has 100 or more full-time workers, respectively), foreign ownership (Foreign), a dummy variable measuring whether a firm is solely owned (Sole ownership), external finance (i.e., percentage of the working capital that was financed by banks, suppliers, or other sources), top manager's experience in the industry (Manager experience), and the percentage of total annual losses are due to crime (CRIME). The detailed construction and description of the variables are presented in Appendix Table A1.

Corruption and bribery are very hard concepts to measure and there are important discussions about their measurement and reliability (see e.g., Reinikka and Svensson 2006; Seligson, 2006; Banerjee et al. 2013; Kraay and Murrell 2016; Boikos et al. 2023). Since bribery is self-reported, it is usually underreported by firms that benefit from it (Banerjee et al. 2013). Furthermore, firm-specific unobserved factors such as a favorable demand forecast could affect a firm's performance and bribery positively, and therefore, the estimate of the bribery may be biased toward zero (Fisman and Svensson, 2007). As discussed by Pounov (2016), Amin and Soh (2022) and Boikos et al. (2023), using average bribery intensity in the country, location, and sectoral cluster reduces the measurement error compared to individual firm-level bribery level. Furthermore, another major concern of the analysis is the potential

<sup>3</sup> The data set could be obtained from <https://www.enterprisesurveys.org/>.

<sup>4</sup> The real annual growth rates of sales are obtained by referring to the sales figures of firms in the current fiscal period and three fiscal years ago.

endogeneity of the bribe variable. To deal with this issue, we construct an IV for the bribe variable by obtaining the average bribery intensity in the country, location, and sectoral cluster (see e.g., Fisman and Svensson (2007), Şeker and Yang (2014), Mendoza et al. (2015) and Wellalage et al. (2020) for the use of a similar IV). Therefore, using an instrumental variable estimation tackles the endogeneity problem and reduces measurement errors. We use three general sectoral groupings: manufacturing (ISIC 15–37), services including retail (ISIC 51–52), and other service sectors like transportation, hotels, and restaurants, and construction services to obtain the instrumental variable and used a minimum of 20 observations in this cluster. Finally, we eliminate the countries that have less than 200 firms in the sample. The final data set consists of 78 developing countries with 20,343 firms. Each country has a different survey period, and we use the final survey year for each country covering the survey period between 2013 and 2017 (see Appendix Table A2 for the list of countries and the survey year).

Table 1 presents the descriptive statistics of the variables used in our analysis. It should be noted that the firm performance (sales growth), bribery, exports, external finance and crime variables are measured as percentages. On the other hand, the natural logarithms of the regulation, firm's age, and manager's experience are taken. Finally, the medium, large, foreign and sole ownership variables are dummy variables. It can be observed that 42%, 36% and 22% of the firms in the sample are classified as small, medium and large (firms that have less than 20, have 20–99 and have 100 or more full-time workers, respectively), respectively. Overall, there is a good variation in the real annual sales growth rates across firms, ranging between –100 and 100%. Furthermore, we also observe a good level of variation in bribe and regulation variables.

Figures 1, 2 and 3 offer average real annual sales growth, bribery and regulation per firm across countries, respectively (see Table A3 for details for each country). On average, firms in some African, Eastern European and Central Asian countries experienced negative sales growth. For instance, the annual sales growth of an average firm in South Sudan, Tanzania, Uganda, Laos, Ukraine and Kazakhstan decreased by 41%, 32%, 28%, 25%, 15%, and 14%, respectively. On the other hand, an average firm in Tajikistan, Sudan, Uzbekistan, Morocco and Turkey experienced 14%, 13%, 12%, 11%, and 11% increases in their real sales growth rates, respectively. Similarly,

**Table 1** Summary statistics

Variables	Mean	Std. Dev.	Minimum	Maximum
Sales growth	-0.22	29.10	-100.00	100.00
Bribe	18.11	35.92	0.00	100.00
Regulation	1.31	1.30	0.00	4.62
Age	2.75	0.70	0.00	5.20
Exports	8.38	23.17	0.00	100.00
Medium	0.36	0.48	0.00	1.00
Large	0.22	0.41	0.00	1.00
Foreign	0.09	0.29	0.00	1.00
Sole ownership	0.38	0.48	0.00	1.00
External finance	29.88	33.88	0.00	100.00
Manager experience	2.67	0.71	0.00	4.09
Crime	0.65	3.47	0.00	100.00

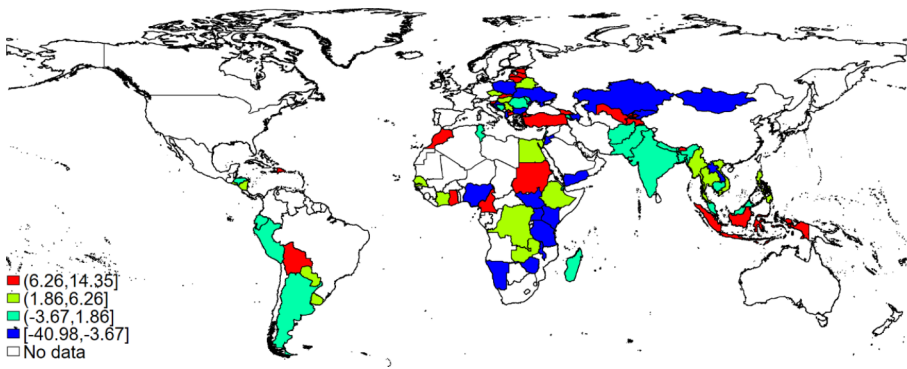


Fig. 1 Average sales growth per firm

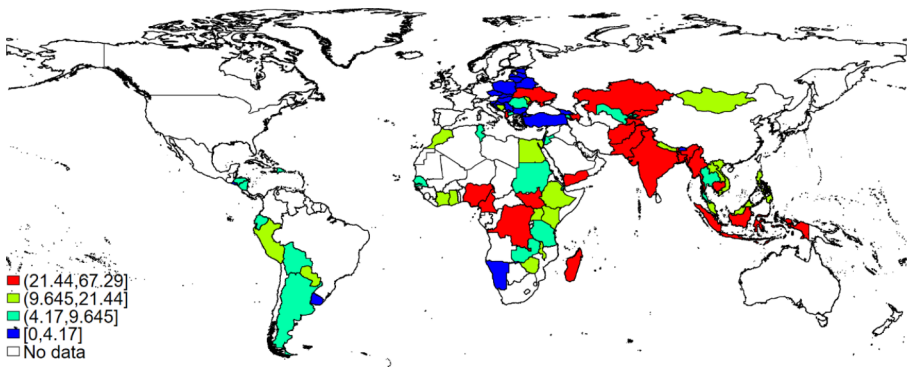


Fig. 2 Average percentage of bribery experienced per firm

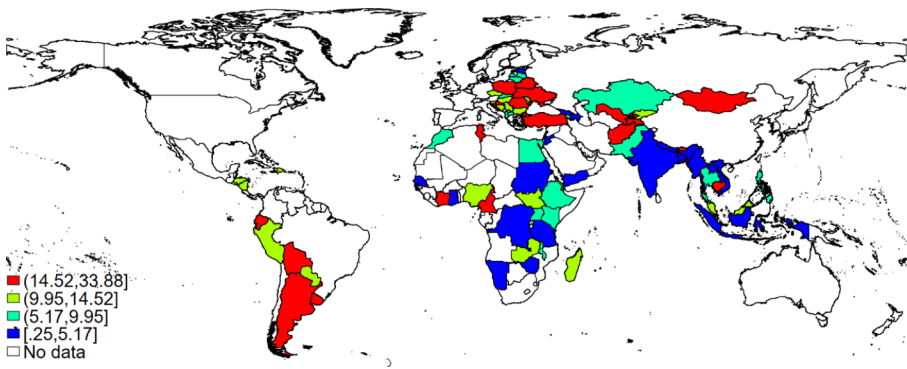


Fig. 3 Average top manager's time spent with regulations per firm



bribery experienced by an average firm shows a significant variation across countries and the presence of bribery is relatively higher in some countries than others (Fig. 2). For instance, an average firm in Yemen, Cambodia, Kyrgyzstan, the Democratic Republic of Congo, Afghanistan, Bangladesh and South Sudan paid bribes for more than 35% of their transactions. On the other hand, firms in Georgia, Latvia and Estonia reported no bribery transactions, and only a limited number of firms in Slovenia, Israel, Bhutan and Slovakia paid bribes. Finally, the amount of time an average firm manager spends with regulations varies across countries (Fig. 3). Contrary to bribery, top managers of the firms in Latin America and Eastern European spent more time dealing with government regulations compared to firms in other regions. For instance, an average firm's top manager in Uzbekistan, Poland, Croatia, Argentina, Tajikistan, Bhutan and Tunisia spent more than 20% of their time dealing with the regulations, while relatively less time is required for regulations in most African and Asian countries. The correlation matrix (Table 2) highlights that bribery (regulation) is negatively (positively) correlated with the annual growth rates, and there is a significant negative correlation between regulation and bribery. In other words, firms exposed to more bribery tend to spend less time dealing with regulations. Specifically, our data reveal that within-country correlations indicate Serbia, Poland, and Croatia display the strongest negative associations between bribery and firm performance. Conversely, Afghanistan, Dominican Republic, and Belarus exhibit the strongest positive correlations between regulation and firm performance. We also find Morocco, Nicaragua, and Czech display the strongest negative correlation between regulation and bribery.

## 4 Methodology

The baseline model used for the empirical estimation is shown in Eq. (1)

$$g_{jt} = \alpha_0 + \alpha_1 B_{jt} + \alpha_2 REG_{jt} + \beta^T X_{jt} + \lambda_t + \eta_s + \epsilon_{jt} \quad (1)$$

where the dependent variable is the real annual sales growth of firm  $j$  at year  $t$ . The variable  $B_{jt}$  is the percentage of bribery;  $REG_{jt}$  is the natural logarithm of the percentage of senior management time spent in dealing with requirements of government regulation. The vector  $X_{jt}$  contains the control variables reflecting firm characteristics that include firm's age, exports, size, ownership, finance status, manager's experience, and vulnerability to crime. The full set of yearly and sectoral dummies are also included. As each country has a different survey period,  $\lambda_t$  is time dummies to account for time-specific factors.  $\eta_s$  is sectoral dummies for manufacturing (ISIC 15–37), services including retail (ISIC 51–52), and other service sectors like transportation, hotels, and restaurants, and construction services.

Following the threshold models of Hansen (2000), Caner and Hansen (2004), Kourtellos et al. (2016) and Seo and Shin (2016), to examine the potential nonlinear impact of firm characteristics on firm performance at different corruption and regulation levels, we extend Eq. (1) to be regime-specific, where the group is determined

**Table 2** Correlation matrix

	Sales growth	Bribery	Regulation	Age	Exports	Medium	Large	Foreign	Sole owner	External finance	Manager experience	Crime	
Sales growth	1												
Bribery	-0.031***	1											
Regulation	0.018**	-0.043***	1										
Age	-0.026***	-0.027***	0.010	1									
Exports	0.044***	-0.010	0.039***	0.064***	1								
Medium	0.024***	0.014**	0.009	0.049***	-0.033***	1							
Large	0.049***	-0.011	-0.005	0.202***	0.270***	-0.395***	1						
Foreign	-0.007	-0.011	0.061***	0.007	0.178***	-0.025***	0.151***	1					
Sole owner	-0.029***	0.065***	-0.135***	-0.129***	-0.125***	-0.082***	-	-	1				
External finance	0.028***	-0.032***	0.066***	0.060***	0.056***	0.043***	0.223***	0.147***	-	1			
Manager experience	0.022***	-0.057***	0.063***	0.410***	0.065***	0.031***	0.069***	-0.003	0.145***	-	1		
Crime	-0.034***	0.047***	0.050***	-0.025***	-0.016**	-0.025***	0.077***	-0.017**	0.137***	0.036***	-	1	
							-	0.039***	0.042***	0.019***	0.019***	-0.017**	1
							0.041***						

Notes: \*\*\*, \*\*, \* represent significance level at the 1%, 5% and 10% levels, respectively.

by the value of the threshold variable. The panel threshold regression model is of the form:

$$g_{jt} = \alpha_0^1 + \alpha_1^1 B_{jt} + \alpha_2^1 REG_{jt} + \beta^1 X_{jt} + \lambda_t + \eta_s + \epsilon_{jt}, q_{jt} \leq \gamma_0, \quad (2)$$

$$g_{jt} = \alpha_0^2 + \alpha_1^2 B_{jt} + \alpha_2^2 REG_{jt} + \beta^2 X_{jt} + \lambda_t + \eta_s + \epsilon_{jt}, q_{jt} > \gamma_0, \quad (3)$$

where  $\gamma_0$  is the true threshold level and  $q_{jt}$  is the threshold variable.

We consider the threshold variable to be bribery variable (B) and senior management time spent in dealing with requirements of government regulation (REG). Note that we can integrate (2) and (3) to have a compact form of the threshold model as follows:

$$g_{jt} = \gamma^T \Omega_{jt} + \delta^T \Omega_{jt} I(q_{jt} \leq \gamma_0) + \lambda_t + \eta_s + \epsilon_{jt}, \quad (4)$$

where  $\gamma = [\alpha_0^2, \alpha_1^2, \alpha_2^2, \beta^{2T}]^T$ ,  $\Omega_{jt} = [1, B_{jt}, REG_{jt}, X_{jt}^T]^T$ ,  $\delta = [\alpha_0^1 - \alpha_0^2, \alpha_1^1 - \alpha_1^2, \alpha_2^1 - \alpha_2^2, (\beta^1 - \beta^2)^T]^T$ , and  $I(\cdot)$  is the indicator function.

To control for endogeneity resulting from the bidirectional causality between  $g_{jt}$  and  $B_{jt}$ , we use a generalized method of moment (GMM), see Caner and Hansen (2004) and Seo and Shin (2016), to estimate (1) and (4) with the moment condition being given by  $E(z_{jt}\epsilon_{jt}) = 0$  where  $z_{jt}$  is the instrument vector. We instrument  $B_{jt}$  using the percentage of the sectoral-location-country average of the bribery variable.

## 5 Results

### 5.1 Baseline estimations

We start our analysis with the linear specification by using Eq. (1) and the results are presented in Table 3. Columns (1), (2) and (3) of Table 3 provide the results when we include the bribery intensity without regulation variable, regulation variable without bribery indicator, and bribery with regulation variable, alongside the standard control variables, respectively. Based on the results reported in column (3) of Table 3, we find that bribery hampers firm performance significantly at the 1% level. A standard deviation increase in bribery (i.e., 35.95) would lead to a 4.9% points reduction in annual sales growth level. On the other hand, we found that firm regulation has no significant impact on annual sales growth levels at the conventional levels, which aligns with the findings of Fisman and Svensson (2007), and Şeker and Yang (2014). Regarding the control variables, younger firms, firms that export more, relatively larger firms, firms that are owned by nationals, firms that are externally financed, firms with more experienced managers, and firms that are less subject to crime experienced higher annual sales growth. Most of the findings concerning the control variables are in line with the results of previous studies.

**Table 3** Linear Pooled Panel Regression Results

Variables	(1)	(2)	(3)
Bribe	-0.1385*** (0.0130)		-0.1373*** (0.0130)
Regulation		0.2153 (0.1847)	0.1837 (0.1857)
Age	-2.8244*** (0.3378)	-2.8239*** (0.3342)	-2.8229*** (0.3376)
Exports	0.0296*** (0.0098)	0.0302*** (0.0096)	0.0292*** (0.0098)
Medium	2.9239*** (0.4987)	2.6994*** (0.4940)	2.9181*** (0.4985)
Large	4.1647*** (0.6033)	3.9855*** (0.5962)	4.1745*** (0.6035)
Foreign	-2.6119*** (0.8408)	-2.6513*** (0.8316)	-2.6442*** (0.8406)
Sole ownership	-0.2269 (0.4675)	-0.6129 (0.4689)	-0.1721 (0.4755)
External finance	0.0153** (0.0064)	0.0184*** (0.0064)	0.0148** (0.0064)
Manager experience	0.9638*** (0.3435)	1.1490*** (0.3389)	0.9610*** (0.3434)
Crime	-0.1607 (0.0997)	-0.2309** (0.0988)	-0.1656* (0.0994)
Observations	20,343	20,343	20,343

This table provides estimations of the linear pooled panel model using GMM method. Standard errors are provided in brackets. \*\*\*, \*\*, \* represent significance level at the 1%, 5% and 10% levels, respectively. Sector-specific and yearly fixed effects, and constant are included but not reported.

The findings presented in Table 3 assume that the effects of standard determinants of firm performance are linear and do not vary based on the different characteristics of the firm. However, as discussed earlier, we argue that the effects of the standard determinants of firm performance may show variation based on firm-level regulation and bribery. Henceforth, we conduct our analysis with the threshold model specified in Eq. (4) when we use bribe and regulation variables as threshold variables. Table 4 presents the results. Firstly, we found significant nonlinear relationships between firm characteristics and firm performance when bribery and regulation are used as threshold variables since the bootstrapping p-values of the SupWald test statistic are 0.000 for all the cases. In other words, the relationships between firm characteristics and firm performance vary if the regulation and bribery are below and above the identified thresholds, which could be considered as low and high regimes, respectively.

The findings suggest that an increase in bribery would lead to a decrease in sales growth proportionately more for the firms that experience bribery less than 40% compared to ones that pay bribery more than 40% of the transactions. In other words, the harmful effect of bribery on annual sales drops if firms are exposed to relatively higher bribery. For instance, based on our estimation results, a 1% point increase in bribery in the low (high) regime leads to a 2.8% points (0.5% points) reduction in annual sales growth. While the regulation was found to be insignificant with the

**Table 4** Panel Threshold Regression Results

Threshold variable	BRIBE		REGULATION	
Threshold	40***		2.8904***	
Regime	Low	High	Low	High
Bribe	-2.8512*** (0.4225)	-0.5109*** (0.1077)	-0.1364*** (0.0134)	-0.1431*** (0.0432)
Regulation	0.8339*** (0.2382)	-0.7675 (0.4834)	0.1339 (0.2510)	2.7962** (1.3099)
Age	-4.0664*** (0.4300)	1.1304 (0.8134)	-2.5859*** (0.3560)	-3.9953*** (0.9505)
Exports	0.0212* (0.0121)	0.0687*** (0.0254)	0.0186* (0.0106)	0.0787*** (0.0242)
Medium	2.4000*** (0.6113)	5.8416*** (1.1822)	2.8075*** (0.5287)	3.5313** (1.3749)
Large	4.7737*** (0.7979)	6.1111*** (1.5297)	3.9105*** (0.6483)	5.8468*** (1.5485)
Foreign	-1.8698* (1.0570)	-1.6930 (2.0838)	-1.5156 (0.9302)	-6.8929*** (1.9199)
Sole ownership	-0.7600 (0.5903)	1.6121 (1.0962)	-0.1257 (0.4894)	-0.7242 (1.6908)
External finance	0.0153* (0.0080)	0.0125 (0.0162)	0.0187*** (0.0069)	0.0006 (0.0163)
Manager experience	0.9648** (0.4105)	0.0576 (0.8308)	0.9798*** (0.3609)	0.8468 (0.9667)
Crime	-0.0627 (0.1403)	-0.0818 (0.1836)	-0.2128** (0.1008)	-0.0232 (0.2428)
SupWald <i>P</i> value	0.0000		0.0000	
SupWald Statistic	113.5306		45.4492	
Observations	16,275	17,061	17,061	4433

Notes: This table provides estimations of the panel threshold model using GMM method. Standard errors are provided in brackets. \*\*\*, \*\*, \* represent significance level at the 1%, 5% and 10% levels, respectively. Sector-specific and yearly fixed effects, and constant are included but not reported.

linear model, we found that regulation positively affects firm performance in a low bribery regime. In other words, if firms face lower levels of bribery requests, time spent with the regulations could improve firm performance. Another interesting finding is that the effect of exports on a firm's performance seems to be relatively higher when firms face higher bribes above the specified threshold. This finding aligns with the findings of Sharma and Mitra (2015) and Ha et al. (2021), where firms benefit from bribes through increased exports. Similarly, we also find that the magnitude of the coefficients on the medium and large dummy variables are relatively higher when firms pay bribery for more than 40% of the transactions compared to the same coefficients when firms pay bribes for less than 40% of the transactions. This suggests that relatively larger firms are more capable of tackling bribery than smaller firms as they may have more power or resources to deal with the bribery than smaller firms (De Jong et al. 2012; Jain 2020).

When we use the regulation variable as a threshold variable, we find that the negative effect of bribery is relatively higher for firms that have a regulation above a

given threshold. This finding is in line with the findings of Amin and Ulku (2019), where the magnitude of the bribe coefficient is higher for firms facing higher regulation. However, unlike Amin and Ulku (2019), we find that the effect of bribery on firm performance is still significant and negative for firms with lower regulation levels. Furthermore, our findings are contrary to the literature that argues that corruption ‘greases the wheels’ in highly regulated markets (see e.g., Jiang and Nie 2014). Another important finding is that even though the percentage of senior management time spent dealing with government regulation requirements is not significant with the linear model, based on our estimates, we find spending time with regulation improves firm performance if managers devote more time to regulations above a given threshold. Our finding aligns with the suggestions of Kitching et al. (2015) that different types of regulations act as a dynamic force and enable firm performance. In other words, contrary to the literature that argues that business-related regulation is an obstacle (e.g., Dreher and Gassebner 2013; Jiang and Nie 2014), our findings highlight that regulation could promote firm performance in low corruption regime. The finding aligns with the recent literature that firm-level regulation could encourage innovation and improve performance (e.g., Weiss et al., 2019; Tchorzewska et al. 2022). On the other hand, when we examine the effect of exports on firm performance in low and high regulation regimes (i.e., regulation levels below and above the threshold level), we find that for firms that spent more time in government regulations above a given threshold, the effect of exports on firm performance is relatively higher. Hence, our results suggest that spending more time with regulations could improve export returns. Finally, similar to the case of bribery, we also find that relatively larger firms tend to perform better if the time spent with regulations is above a given threshold (i.e., the magnitude of coefficients of medium and large dummies are relatively higher in high-regime than the ones in low-regime). Overall, relatively larger firms have more resources to deal with the regulations than smaller firms. Therefore, the magnitude of the performance difference between smaller and larger firms is larger in the high regime compared to the low regime. Finally, our findings highlight that foreign-owned firms were hurt more if their managers spent more time dealing with regulations.

We also find the coefficients estimates of the top manager’s experience and external finance variables are only significant and positive for firms that are less subject to bribery (i.e., less than 40%) and have lower levels of regulation (i.e., REG is lower than 2.8904). In other words, our results infer when senior management spends more time on regulation and the firm is subjected to higher bribe requests, then the manager’s experience becomes an insignificant factor in firm performance. This finding is in line with the literature highlighting the fact that the effect of human capital on performance is less effective in more corrupt environments (see e.g., Ehrlich and Lui 1999; Boikos 2016; Feldmann 2017; Hoa 2020). Even though spending more time with regulation increases firm performance, the manager’s experience is not significant for firm performance in the high regulation regime. Even though dealing with government regulations (e.g., taxes, customs, labor regulations, licensing and registration) enables the firm to carry out their activities and improve firm performance, allocating more of manager’s time to deal with regulations reduces their ability to carry out their regular activities in the firm (see e.g., Boudreaux et al. 2018). Finally,

we also find that firms exposed to more bribes and regulation face higher constraints in accessing external finance and limiting their firm performance (Galli et al. 2017; Wellalage et al., 2020).

## 5.2 Robustness analysis

The countries included in this study differ widely in terms of economic and institutional environments. For example, some countries have better institutional quality than others. Similarly, the countries may also differ in terms of tax structure and credit environments. As our study is cross-sectional, we include country dummies to control for country-specific factors such as institutional quality, tax structure and credit environments. Table 5 provides the results when we use bribery and regulation as threshold variables, and we include country and sectoral dummies in our estimations. Firstly, the p-values of the SupWald test statistics suggest that the threshold values of bribery and regulation intensity variables are significant at the 1% level.

**Table 5** Panel threshold regression results with country fixed effects

Threshold	Bribe		Regulation	
	Low	High	Low	High
Regime	33.33***		3.2189***	
Bribe	-1.4754*** (0.3713)	-0.4334*** (0.1230)	-0.0980*** (0.0164)	-0.0354 (0.0619)
Regulation	1.8736** (0.4574)	0.1146 (0.4564)	0.0399 (0.2313)	3.0359* (1.8162)
Age	-4.0579*** (0.3781)	-0.5114 (0.7529)	-3.1420*** (0.3323)	-5.0675*** (1.1442)
Exports	0.0181* (0.0109)	0.0678*** (0.0243)	0.0227** (0.0100)	0.0758** (0.0301)
Medium	0.8021 (0.5503)	3.2631*** (1.1465)	0.8955* (0.4963)	5.4320*** (1.7070)
Large	2.8240*** (0.6818)	2.8650* (1.4972)	2.2030*** (0.6025)	6.5381*** (1.8474)
Foreign	-0.5360 (0.9453)	2.7384 (1.9844)	0.8171 (0.8903)	-5.0781** (2.1635)
Sole ownership	0.6282 (0.5678)	1.8839* (1.0615)	0.4644 (0.4827)	1.0832 (1.9966)
External finance	0.0103 (0.0074)	0.0093 (0.0156)	0.0194*** (0.0067)	-0.0151 (0.0194)
Manager experience	0.0964 (0.3739)	-1.0753 (0.7843)	0.2667 (0.3465)	-1.9177 (1.5497)
Crime	-0.0174 (0.1220)	0.1194 (0.1748)	-0.0196 (0.0927)	0.1606 (0.2857)
SupWald <i>P</i> value	0.0000		0.0000	
SupWald Statistic	57.5825		29.8993	
Observations	16,253	4090	18,199	2144

Notes: This table provides estimations of the panel threshold model using GMM method. Standard errors are provided in brackets. \*\*\*, \*\*, \* represent significance level at the 1%, 5% and 10% levels, respectively. Sectoral and country fixed effects, and constant are controlled but not reported.

The threshold level for bribery is 33.33% and the threshold regulation level is 3.2189 (i.e., 25% of senior management time spent in dealing with requirements of government regulation) when we account for the country-specific factors.

Overall, the findings when we control for country-fixed effects (Table 5) align with those when country-fixed effects are not controlled for (Table 4). The magnitude of the negative effect of bribery on the firm performance is higher in the low bribery regime than in the high bribery regime. Similar to the case when we do not control for country-fixed effects, we found that the time spent with the regulations improves firm performance in the low bribery regime. Furthermore, if managers of firms spend more time with the regulations above a given threshold, their performance significantly improves. Moreover, the magnitude of the positive effect of exports on firm performance is relatively larger for firms that pay high bribes and spend more time with regulation compared to the low regime scenarios. Similarly, firms with foreign ownership are hurt if their managers spend relatively more time with regulations. Finally, if managers spend less time with the regulations, external finance is positively associated with the firm performance, but the effect of external finance is not significant in the high regulation regime. Overall, these findings align with those when we did not control for the country-fixed effects.

Few of the findings in Table 4 change when we account for the country-fixed effects. Firstly, once we account for the country-fixed effects, we find that corruption is no longer harmful in the high regulation regime. Secondly, a manager's experience is no longer significant in low or high bribery and regulation regimes once the country-specific factors are accounted for. Since we control for the country-specific factors, it is possible that the manager's experience is closely associated with the country-specific factors and that after accounting for country dummies, the manager's experience is no longer a significant factor affecting the firm performance. Finally, we found that the magnitude of the negative effect of corruption on firm performance is relatively lower when we account for country-fixed effects compared to the case when we do not. On the other hand, the positive effect of regulation on firm performance is relatively higher in low bribery and high regulation regimes once the country-fixed effects are controlled for. For instance, our estimates show a percentage increase in regulation in high regulation regime leads to a 3% points increase in annual growth sales when we control for country-fixed effects compared to a 2.8% points increase in annual sales growth rates when we do not.

We used annual sales growth rates as a proxy for firm performance. To test the robustness of the findings, we use annual labor productivity growth rates as a proxy for firm performance in line with the existing literature (e.g., Martins et al. 2020; Seck 2020; Williams et al. 2016). Labor productivity is obtained by dividing the real sales by full-time permanent workers. We then obtained the annual labor productivity growth using the change in labor productivity reported in the current and previous fiscal periods. Using labor productivity growth as a dependent variable, we re-estimate findings when we control for country-fixed effects. In other words, we carry out the same re-estimation as Table 5 but use annual labor productivity growth rates as a dependent variable. The results are presented in Table 6.

When labor productivity growth is used as a proxy for firm performance, we still found significant threshold effects where the effects of the firm characteristics on firm



**Table 6** Robustness checks. Dependent variable is labour productivity growth

Threshold variable	BRIBE		REGULATION	
	Low	High	Low	High
Threshold	33.33***		2.7726***	
BRIBE	-1.5955*** (0.4043)	-0.3739*** (0.1142)	-0.1030*** (0.0175)	-0.0475 (0.0484)
REG1	0.4048* (0.2408)	-0.4976 (0.4750)	-0.1066 (0.2629)	1.5838 (1.3325)
Age	-1.1101*** (0.3941)	1.8693** (0.7976)	-0.4483 (0.3589)	-1.0552 (0.9337)
Exports	0.0236** (0.0111)	0.0618*** (0.0239)	0.0212** (0.0105)	0.0762*** (0.0239)
Medium	-1.8657*** (0.5687)	0.5443 (1.1647)	-1.6471*** (0.5307)	-0.2127 (1.3703)
Large	-1.7010** (0.7075)	-0.7688 (1.4361)	-2.1632*** (0.6370)	-0.3374 (1.5568)
Foreign	0.4699 (0.9764)	2.3361 (2.0377)	1.5746* (0.9404)	-3.0103 (1.8775)
Sole ownership	-1.0648* (0.5663)	0.3413 (1.0723)	-1.0023* (0.5121)	0.1307 (1.6626)
External finance	0.0133* (0.0075)	0.0069 (0.0161)	0.0169** (0.0071)	0.0041 (0.0162)
Manager experience	0.6217 (0.3867)	-1.1364 (0.8094)	0.4398 (0.3653)	0.5537 (0.9290)
Crime	0.0876 (0.1266)	0.2584 (0.1644)	0.1090 (0.0972)	0.1114 (0.2320)
SupWald <i>P</i> value	0.0000		0.0000	
SupWald Statistic	43.6563		35.6710	
Observations	15,835	15,835	15,508	4312

Notes: This table provides estimations of the panel threshold model using GMM method. Standard errors are provided in brackets. \*\*\*, \*\*, \* represent significance level at the 1%, 5% and 10% levels, respectively. Sectoral and country fixed effects and constant are controlled but not reported.

performance vary if the bribery and regulation are below or above given bribery and regulation levels. Most of the findings align with the results when the annual sales growth rates are used as a proxy for firm performance. Firstly, the negative effect of bribery on labor productivity is higher in the low bribery regime compared to the high bribery regime. Secondly, business-related regulations positively affect labor productivity in the low bribery regime. The recent literature found that the regulation could enhance the innovation capacity of the firms and improve firm performance (see e.g., Weiss et al., 2019; Tchorzewska et al. 2022). Similarly, an increase in exports improves firm performance more if firms pay relatively higher bribes and spend more time with regulation than the low bribery and regulation regimes. Ha et al. (2021) demonstrate that bribery and regulations increase firms' likelihood of exporting more. Therefore, if firms face high bribery and regulation, they tend to specialize in exporting their products and a percentage increase in exports leads to a higher magnitude increase in firm performance. For instance, a percentage point increase in exports in low bribery and regulation regimes leads to a 0.02% point increase in

labor productivity growth. However, a percentage point increase in exports in high bribery and regulation regimens lead to 0.06% point and 0.07% point increase in labor productivity growth, respectively. Finally, external finance does not have any significant effect on labor productivity in high corruption and regulation regimes, but external finance boosts the firm performance in low bribery and regulation scenarios. The finding is in line with the existing literature that finds that the firms have limited access to external finance if they face high bribery and regulation (Galli et al. 2017; Wellalage et al., 2020), and therefore, external finance is not a significant determinant of firm performance if firms face high bribery and regulation. Some of the findings also show variation when we use labor productivity growth as a proxy of firm performance. For instance, while medium- and large-sized firms have higher annual sales growth rates in high bribery and regulation regimes compared to the low regimes, our findings highlight that labor productivity is lower in medium- and large-sized firms compared to the smaller-sized firms.

## 6 Conclusions

Most of the existing literature on the determinants of firm performance examines the direct linear effects of the standard set of variables and ignores the possible complex relationships among firm characteristics. In this paper, using extensive firm-level data and a threshold regression methodology, we show that firm-level corruption and regulation play a vital role in the factors affecting firm performance. We demonstrate that bribery intensity affects firm performance negatively, but this effect is higher for firms that are exposed to lower bribe levels. On the other hand, we found that the regulation could improve firm performance if firms are exposed to lower levels of bribery. The existing literature argues that bribery could be helpful to ‘get things done’ if firms face rigid business-related regulations and therefore spending more time with regulations could be counter-productive if firms pay high bribes to ‘get things done’. However, if the firms are exposed to low levels of bribery, then business-related regulation could promote firm performance since regulation could promote firm innovation (e.g., Weiss et al., 2019; Tchorzewska et al. 2022).

We also find that regulation and bribery intensity are relatively more beneficial for certain types of firms. Firms that pay more bribes and spend more time with government regulations above a given threshold are more export-oriented and exports boost firm performance relatively more if firms spend more time with regulation and pay higher bribes. Our findings reveal that external finance becomes ineffective in improving firm performance if firms are exposed to high levels of corruption and regulation. However, if firms are exposed to lower levels of regulation and corruption, then access to external finance improves the firm performance. Overall, our findings highlight while high business-related regulation and bribery may improve the returns to exports, business-related regulation and access to external finance could boost firm performance if firms pay lower bribes. Our paper shows that the effect of firm characteristics on firm performance displays variation based on business regulation and bribery levels.

The findings of this paper have various policy implications. Firstly, eliminating firm-level bribery improves firm performance and allows firms to benefit from firm-level regulation. Therefore, developing countries should prioritize policies to detect bribery practices by government officials and eliminate such informal practices. Secondly, high bribery boosts firm performance through the increased positive effect of exports on firm performance. Given that bribery has direct and indirect negative implications for firm performance, the governments could increase the efficiency of export-related licensing and registration activities (e.g., improve the time required to carry out these activities) to limit bribery requests.

Overall, even though the previous literature has examined the role of different firm characteristics on firm performance, their complex relationships are harder to capture with linearly specified models. In this paper, we found that beyond their direct effects on firm performance, regulation and bribery intensity could alter the effects of different factors on firm performance. Future research could examine other possible heterogeneous effects of firm characteristics by using different firm characteristics as threshold variables.

## Appendix

**Table A1** Construction of firm-specific variables from World Bank Enterprise Survey

Variable	Relevant survey numbers and questions	Construction of the variable.
Real annual sales growth (%)	D.2. In fiscal year [insert last complete fiscal year], what were this establishment's total annual sales for ALL products and services? N.3. In fiscal year [insert three complete fiscal years ago], three fiscal years ago, what were total annual sales for this establishment?	Real annual sales growth is the change in sales reported in the current fiscal year from a previous period. All values for sales are deflated to 2009 using the country CPI deflator.
Bribery intensity (B)	C.5. In reference to that application for an electrical connection, was an informal gift or payment expected or requested? C.14 In reference to that application for a water connection, was an informal gift or payment expected or requested? G.4 In reference to that application for a construction-related permit, was an informal gift or payment expected or requested? J.12 In reference to that application for an import license, was an informal gift or payment expected or requested? J.15 In reference to that application for an operating license, was an informal gift or payment expected or requested? J.5 In any of these inspections or meetings (with tax officials) was a gift or informal payment expected or requested?	Bribery is the percentage in which a firm was either expected or requested to provide a gift or informal payment when conducting six specific business transactions is listed in relevant survey questions.

**Table A1** Construction of firm-specific variables from World Bank Enterprise Survey

Variable	Relevant survey numbers and questions	Construction of the variable.
Regulation	J.2 In a typical week over the last year, what percentage of total senior management's time was spent on dealing with requirements imposed by government regulations? [By senior management I mean managers, directors, and officers above direct supervisors of production or sales workers. Some examples of government regulations are taxes, customs, labor regulations, licensing and registration, including dealings with officials and completing forms]	The natural logarithm of the percentage of total senior management's time was spent on dealing with requirements imposed by government regulations
Age	B.5. In what year did this establishment begin operations in this country?	The age of the firm is obtained by subtracting the year in which this firm started its operations from the year of the survey.
Exports	D.3. In fiscal year [insert last complete fiscal year], what percentage of this establishment's sales were: (a) National sales, (b) Indirect exports (sold domestically to third party that exports products), (c) Direct exports	Percentage of the firm's total sales that are exported directly indicated in c).
Medium	L.1. At the end of fiscal year [insert last complete fiscal year], how many permanent, full-time individuals worked in this establishment? Please include all employees and managers	Dummy variable equals to 1 if the firm has 20–99 full-time workers, zero otherwise.
Large	L.1. At the end of fiscal year [insert last complete fiscal year], how many permanent, full-time individuals worked in this establishment? Please include all employees and managers	Dummy variable equals to 1 if the firm has 100 or more full-time workers, zero otherwise.
Foreign ownership	B.2. What percent of this firm is owned by each of the following: (a) Private domestic individuals, companies or organizations (b) Private foreign individuals, companies or organizations (c) Government/State (d) Other	Dummy variable equals to 1 if the share of the ownership of the private foreign individuals, companies or organizations is 10% or above.
Sole ownership	B.1. What is this firm's current legal status? (1) Shareholding company with shares trade in the stock market; (2) Shareholding company with non-traded shares or shares traded privately; (3) Sole proprietorship; (4) Partnership; (5) Limited partnership	Dummy variable equals to 1 if firm is registered as a sole proprietorship, and zero otherwise.
External finance	K.3 Over fiscal year [insert last complete fiscal year], please estimate the proportion of this establishment's working capital that was financed from each of the following sources: (1) Internal funds or retained earnings; (2) Borrowed from banks: private and state-owned; (3) Borrowed from non-bank financial institutions which include microfinance institutions, credit cooperatives, credit unions, or finance companies; (4) Purchases on credit from suppliers and advances from customers; (5) Other, moneylenders, friends, relatives, etc.	The percentage of the working capital that was financed by banks, suppliers, or other sources. This is the total of the amounts indicated in 2, 3, 4 and 5.
Top manager experience	B.7 How many years of experience working in this sector does the Top Manager have?	The natural logarithm of the top manager's experience in the sector.

**Table A1** Construction of firm-specific variables from World Bank Enterprise Survey

Variable	Relevant survey numbers and questions	Construction of the variable.
Crime	I.4. In fiscal year [insert last complete fiscal year], what were the estimated losses as a result of theft, robbery, vandalism or arson that occurred on this establishment's premises either as a percentage of total annual sales or as total annual losses?	If total annual losses are offered, then the losses were divided with the total sales to obtain percentage of annual losses due to the theft, robbery, vandalism or arson.

**Table A2** List countries and survey years

Country	Year	Country	Year	Country	Year	Country	Year
Afghanistan	2014	El Salvador	2014	Macedonia, FYR	2013	Slovakia	2013
Albania	2014	Estonia	2014	Madagascar	2013	Slovenia	2013
Argentina	2014	Ethiopia	2014	Malawi	2014	South Sudan	2014
Armenia	2014	Georgia	2014	Malaysia	2015	Sudan	2014
Azerbaijan	2014	Ghana	2014	Moldova	2013	Tajikistan	2013
Bangladesh	2014	Honduras	2014	Mongolia	2013	Tanzania	2013
Belarus	2014	Hungary	2014	Morocco	2013	Thailand	2016
Bhutan	2014	India	2014	Myanmar	2014	Tunisia	2013
Bolivia	2014	Indonesia	2014	Namibia	2014	Turkey	2013
Bosnia and Herzegovina	2014	Israel	2014	Nepal	2013	Uganda	2013
Bulgaria	2014	Ivory Coast	2014	Nicaragua	2016	Ukraine	2013
Cambodia	2014	Jordan	2014	Nigeria	2014	Uruguay	2017
Cameroon	2014	Kazakhstan	2014	Pakistan	2013	Uzbekistan	2013
Congo, Dem. Rep.	2014	Kenya	2014	Paraguay	2017	Vietnam	2015
Croatia	2014	Kosovo	2014	Peru	2017	West Bank and Gaza	2014
Czech Republic	2014	Kyrgyzstan	2014	Philippines	2015	Yemen	2013
Djibouti	2014	Lao PDR	2014	Poland	2013	Zambia	2013
Dominican Republic	2014	Latvia	2014	Romania	2013	Zimbabwe	2016
Ecuador	2014	Lebanon	2014	Senegal	2014		
Egypt	2016	Lithuania	2014	Serbia	2013		

**Table A3** Average sales growth, bribery and regulation across countries for an average firm

Country	Sales growth	Bribery	Regulation
Afghanistan	-2.24	41.26	17.29
Albania	-4.62	23.33	7.74
Argentina	-1.63	5.33	23.09
Armenia	0.41	7.98	9.82
Azerbaijan	-12.55	29.23	0.25
Bangladesh	1.72	37.21	2.75
Belarus	2.83	3.90	15.43
Bhutan	6.31	0.47	31.49
Bolivia	7.00	4.92	18.68

**Table A3** Average sales growth, bribery and regulation across countries for an average firm

Country	Sales growth	Bribery	Regulation
Bosnia and Herzegovina	0.63	9.66	13.26
Bulgaria	-6.46	4.17	14.09
Cambodia	1.64	52.67	15.79
Cameroon	8.50	22.39	18.18
Congo, Democratic Republic	5.28	48.88	4.68
Croatia	-3.67	2.69	21.83
Czech Republic	5.54	2.00	10.55
Djibouti	1.19	6.94	7.19
Dominican Republic	9.98	8.64	12.41
Ecuador	-2.74	4.92	15.08
Egypt	4.38	15.90	7.65
El Salvador	3.85	2.60	11.14
Estonia	9.97	0.00	5.17
Ethiopia	3.22	15.59	7.80
Georgia	7.37	0.00	1.49
Ghana	8.94	13.64	3.57
Honduras	0.54	5.35	10.85
Hungary	6.26	1.61	12.53
India	1.62	22.96	2.46
Indonesia	7.01	27.66	1.96
Israel	3.72	0.36	5.71
Ivory Coast	4.23	16.28	14.61
Jordan	-3.90	7.59	4.45
Kazakhstan	-14.47	27.73	7.35
Kenya	-21.11	19.27	6.86
Kosovo	6.59	1.93	10.08
Kyrgyzstan	-7.60	52.04	13.29
Lao PDR	-24.78	12.35	1.47
Latvia	8.66	0.00	6.18
Lebanon	-0.51	21.42	3.24
Lithuania	6.72	2.94	6.49
Madagascar	-2.71	22.09	13.00
Malawi	-4.96	17.70	5.49
Malaysia	-2.71	21.29	10.30
Moldova	-1.13	21.44	12.92
Mongolia	-14.05	21.33	16.05
Morocco	11.17	16.21	8.25
Myanmar	3.63	22.09	1.20
Namibia	-5.56	2.05	3.14
Nepal	0.90	17.91	3.01
Nicaragua	4.59	6.53	11.64
Nigeria	-9.05	27.98	10.75
North Macedonia	8.84	4.30	9.80
Pakistan	-1.69	30.74	5.39
Paraguay	5.04	9.90	10.95
Peru	1.33	11.58	12.99
Philippines	6.02	15.83	5.49

**Table A3** Average sales growth, bribery and regulation across countries for an average firm

Country	Sales growth	Bribery	Regulation
Poland	-8.35	2.78	21.47
Romania	1.28	7.90	17.49
Senegal	4.64	5.83	4.28
Serbia	5.33	4.16	14.52
Slovakia	8.33	0.83	9.15
Slovenia	8.93	0.22	10.70
South Sudan	-40.98	35.93	12.00
Sudan	13.18	8.86	4.32
Tajikistan	14.35	26.87	23.16
Tanzania	-31.91	9.63	3.86
Thailand	2.81	4.91	5.29
Tunisia	-0.71	6.77	33.88
Turkey	11.00	3.37	19.41
Uganda	-28.41	13.99	5.82
Ukraine	-14.84	31.20	17.18
Uruguay	3.10	2.75	18.34
Uzbekistan	12.39	5.56	20.79
Vietnam	4.33	19.03	2.09
West Bank and Gaza	2.00	4.95	6.79
Yemen	-18.45	67.29	1.93
Zambia	5.77	7.86	11.06
Zimbabwe	-4.84	11.25	4.66

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s00181-023-02456-0>.

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