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Abstract

We study the effects of corruption on firm efficiency using a unique comprehensive dataset of private firms from 14 Central and Eastern European countries for the period from 2000 to 2013. We find that an environment characterized by a high level of corruption has an adverse effect on firm efficiency. This effect is amplified for firms with a lower propensity to behave corruptly, i.e. foreign-controlled firms and firms managed by female CEOs, while domestically-owned firms and firms with male CEOs are not penalized. At the same time, an environment characterized by considerable heterogeneity in perception of corruption is associated with an increase in firm efficiency. This effect is particularly strong for foreign firms from low-corruption countries, while no effect is observed for firms managed by female CEO.

JEL Classification: C33, D24, G32, L60, L80 and M21
Keywords: CEO, corruption, efficiency, Europe, ownership structure, panel data and stochastic frontier

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1. Introduction

Corruption imposes significant costs to many countries, and the international community goes to great lengths to combat it. For example, the United States enacted the Foreign Corrupt Practices Act to prohibit all U.S. persons and certain foreign issuers of securities from making bribery payments to foreign government officials. The OECD's Anti-Bribery Convention criminalizes the bribery of foreign public officials in international business transactions. However, the World Bank Institute estimates that the total amount of money spent globally on bribes in any given year is still in the range of 1 trillion dollars (Rose-Ackerman, 2004).[1]

In this study, we examine how characteristics of a corrupt environment affect firm efficiency, where efficiency is defined as the ability of a firm to produce the most output with a given amount of inputs. Focusing on efficiency is important for several reasons. First, corruption may affect the optimal allocation of resources. It could divert managerial effort away from productive tasks thereby causing firms to use more inputs in the production process (Dal Bo and Rossi, 2007), or to invest in easier-to-relocate general capital instead of more productive specific capital (Henisz, 2000). Second, studying firm performance using accounting data in a corrupt environment is challenging. Firms may not be inclined to reveal their performance accurately or even choose to understate it to reduce tax liability. Thus, internal accounting measures cannot be fully trusted (Demsetz, 1997; Schulze et al., 2001; Barney, 2002) and using alternative performance measures may be desirable.

We examine the influence of two environmental characteristics on the efficiency of firms, the first being the mean level of corruption as perceived by firms operating in that environment. We expect a high level of corruption to reduce firm efficiency because bribes are an additional cost that firms must pay to conduct business (Shleifer and Vishny, 1993; Bertrand, Djankov, Hanna, and Mullainathan, 2007; Harstad and Svensson, 2011). Most importantly, by rewarding firms that are willing to engage in such practices, corruption allows inefficient firms to survive, reduces the rewards that efficient firms can obtain, and more generally attenuates the competitive pressures leading to efficiency.

The second characteristic we examine is the variance in perceptions of corruption within a given environment. Differences in perceptions may be associated with different experiences of corruption (or lack thereof), which in turn may signal the presence of different local "sub-environments." Even in an

[1] The Dow Jones State of Anti-Corruption Survey (2014) reports that 33% of companies claim to have lost business to competitors who won contracts unethically. Loss rates are highest in Europe and among non-finance companies. Among companies losing business, nearly 70% cite non-compliant competitors and almost 60% mention losses to companies not required to comply with anti-corruption regulations.

environment that is very corrupt on average, there might in fact be sectors and geographical zones where firms with a lower propensity to bribe can still operate relatively freely. In these sub-environments, competitive forces may operate to full effect and firm efficiency may be high. Thus, to the extent that achieving high efficiency requires an environment that is nearly corruption-free, greater variance in perceptions of corruption may be associated, on average, with more efficiency.

We expect the intensity of these two (mean and variance) effects to be stronger for firms with a lower propensity to behave corruptly. Honest firms are the most likely to be adversely affected when doing business requires firms to engage in corrupt activities. However, if these firms can choose to work in areas of the economy where bribes are less common, their incentives to raise efficiency may still be high.

We examine two firm attributes that are likely to be associated with a lower propensity to bribe. An extensive literature in international business argues that foreign-controlled firms plausibly exhibit such lower propensity, in part because they are less likely to know whom and how to bribe in the local market (Calhoun, 2002). The lower propensity to bribe may be particularly pronounced for foreign-controlled firms from low-corruption countries, as their behavior is affected by their cultural and legal[2] imprint (Stopford and Strange, 1991; Fisman and Miguel, 2007; Cuervo-Cazurra, 2008). Also, firms run by a female CEO may be reluctant to engage in criminal activities such as bribery (Dollar et al., 2001; Swamy et al., 2001). This could be due to factors including the relative exclusion of women from networks traditionally dominated by men (Goetz, 2007), higherrisk-aversion than men (Charness and Gneezy, 2012), aversion to the risk of getting caught and penalized (Levin, Snyder and Chapman, 1988), higher reciprocity in the context of gift-exchanges (e.g., Buchan, Croson and Solnick, 2008), and higher aversion to competition than men (e.g. Croson and Gneezy, 2009; Buser, Niederle, and Oosterbeek, 2014).

We test our conjectures using a unique panel dataset that combines information on business environment characteristics (and corruption in particular) from the EBRD-World Bank Business Environment and Enterprise Performance Survey (BEEPS)[3] with financial, ownership, and managerial

[2] E.g.,the US Foreign Corrupt Practices Act and the UK Bribery Act

[3] As compared to the country-level proxy indicators of the corruption, which exhibit very little variation over time. The variation in the country-level proxy indicators of corruption in the majority of cases could be captured by country-, region- or industry-specific effects, making it difficult to single out the corruption effect. BEEPS contains the corruption experiences of firm managers and is the most detailed data on corruption available at the firm level (Svensson, 2005).

information available in the Amadeus database maintained by Bureau van Dijk.[4] Our final dataset contains 76,552 firm-level observations and covers 14 countries (Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia and Ukraine) over the period from 2000 to 2013. To our knowledge, it is the largest and most comprehensive firm-level dataset to study the effects of corruption.

We find strong support for most of our hypotheses. Firm efficiency is on average lower in environments characterized by a high level of corruption. A 1% increase in the average level of corruption leads to a 2.04% decrease in average firm efficiency. However, greater variance in corruption perceptions is associated with greater efficiency. A 1% increase in corruption perception variation improves firm efficiency by 0.61%. The effects are stronger for foreign-controlled firms, especially if their headquarters are located in low-corruption countries. For instance, while a 1% increase in the average level of corruption leads to a 3.16% decrease in efficiency of foreign firms, this effect jumps to 4.53% for foreign-controlled firms which come from low-corruption countries. These results are consistent with the idea that foreign firms' propensity to behave corruptly is affected by the cultural norms of the firm's home country, the legal restrictions they are subject to, and their relative lack of local market knowledge. At the same time, foreign firms are able to better exploit the greater variation in perceptions of corruption. They likely self-select themselves into relatively corruption-free sub-environments where competitive forces push them towards the efficiency frontier.[5] Having a female CEO is detrimental to efficiency in high-corruption environments; however, we do not find a significant effect for the variance in corruption perceptions.[6]

Our analysis contributes to a better understanding of how operating in a corrupt environment affects firm behavior. First, it indicates that just looking at average indicators of corruption may be insufficient. We find evidence consistent with the idea that firms self-select the area of the economy where they want to operate, with more "honest" firms choosing to operate in a sub-environment characterized by less

[4] Although the corruption measure provided by BEEPS is superior to country-level corruption measures, firm financial and accounting information, which is also part of the survey, is not fully reliable. Surveyed firms are often reluctant to reveal their financial records. For example, about 40% of firms covered by BEEPS do not report their financial information. All studies that rely on firm financial data from BEEPS suffer from this selection bias.

[5] The associated increase in average efficiency is 1.53% for foreign firms and 4.29% for foreign firms from low-corruption countries for a 1% increase in corruption perception variation.

[6] Interestingly, we do not observe any differences in efficiency between firms managed by male and female CEOs. We only observe a difference when we condition on the local corruption environment. This is consistent with the argument that women are not, on average, different from men in terms of ability, but they differ in their preferences for risk and propensity to abide by the law.

corruption. Thus, just looking at measures such as average level of corruption in an environment, without considering dispersion across sectors or regions, may be misleading.

Second, we find that the effect of perceived corruption on efficiency is conditional on firm characteristics. Our results suggest that firm attributes usually associated with "honesty" (foreign-controlled, from a low-corruption country, managed by a female CEO), are less likely to be beneficial in environments characterized by high corruption, especially when there are no niches relatively free from corruption where honest firms can operate. Studying interactions between firm-level characteristics and environmental factors is a promising direction for future work on corruption. Third and last, the results of this paper also provide some basic direction for policy makers. Countries that experience concentrated corruption in certain sub-environments may enact trade policies to provide incentives for foreign companies, especially those from low-corruption countries, to enter the selected market. The incentives, however, have to be strong enough to offset the unfavorable business environment.

The paper is structured as follows. Section two develops the hypotheses. Section three describes the dataset. Section four outlines the modeling strategy and section five discusses the results. Section six concludes.

2. Hypotheses Development

Conventional wisdom suggests that corruption reduces efficiency by giving an unfair advantage to firms with a higher propensity to behave in a corrupt way and connected to officials willing to accept bribes.[7] Studies focusing on the macroeconomic effects of corruption have found that it has an adverse effect on investment (Mauro, 1995; Mo, 2001), foreign direct investment, and capital inflows (Wei, 2000). Corruption has also been shown to reduce country-level productivity and economic growth (e.g., Mauro, 1995, 1998; Mo, 2001). At the micro level, corruption can also have an adverse effect on firm efficiency as it distorts the efficient allocation of capital (e.g., Shleifer and Vishny, 1993; Bertrand, Djankov, Hanna, and Mullainathan, 2007; Harstad and Svensson, 2011).

There are very few empirical studies examining the effects of corruption on firms' performance from a firm-level perspective, due to the illicit nature of the activity, as well as the data collection difficulties.

[7] The institutional environment, as well as economic and structural policies,, lay the foundation to study the determinants of corruption. For the detailed literature review, see Svensson (2005), Acemoglu, Johnson and Robinson (2005), La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999), and Djankov, Glaeser, La Porta, Lopez-de-Silanes, and Shleifer (2003).

Studies mainly focus on a particular country and there are very few cross-country analyses. For example, using a sample of 243 Ugandan firms, Svensson (2003) finds that the number of corrupt payments is conversely related to the tangibility of assets, because firms adopt inefficient "fly-by-night" production technologies to counter corruption pressures. Further exploring the Ugandan data, Fisman and Svensson (2007) report that both the rate of taxation and bribery rate are negatively related to firm growth. In a cross-country analysis, Bardhan (1997) argues that the inherent uncertainty characterizing illegal agreements creates thewrong incentives for firms. A firm will choose to invest in less productive general capital, and not in more productive specific capital, because the former can easily be relocated (Henisz, 2000). Thus, corruption would affect the quality of investment, causing a decrease in efficiency.

Challenging this conventional wisdom, some scholars argue that corruption may be conducive to greater efficiency. Leff (1964) argues, among others, that corruption gives individuals or firms an opportunity to work around misguided government policies, rigid laws, bureaucratic bottlenecks, and red tape (e.g. Leff, 1964; Lui, 1985; Meon and Weill, 2010). The empirical evidence supportive of a positive effect of corruption on firm performance is mainly limited to certain regions in Asia. Rock and Bonnett (2004) report a significant positive relationship between economic growth and corruption in China and Indonesia. Vial and Hanoteau (2010) focus on the Indonesian manufacturing industry from 1975–1995 and find that plant-level corruption increases output and productivity. The authors argue that the positive effect comes from the long-term relationship between the government and firms that facilitate the ability of firms to overcome red tape and barriers to doing business. Asia and specifically Southeast Asia is a unique region for corruption because those economies are based on relationships: contracts are not well-enforced and capital is scarce (Rajan and Zingales, 1998). Empirical evidence outside of Asia is very limited. Only Fungacova, Kochanova, and Weill (2015) find that bribery aids access to bank credit in Eastern and Central Europe.

For the formulation of hypothesis 1, we follow the conventional view of the effects of corruption on firm performance.

H1: *Corruption has an adverse impact on firm efficiency.*

The variance in perceptions of corruption within a given environment could be caused by firms having different experiences with officials. A large variance in perceptions of corruption may indicate

the existence of sub-environments that are characterized by different degrees of corruption. For example, Rose-Ackerman (1999) argues that corruption in contracting occurs even in low-corruption countries. Similarly, Transparency International's 2002 Bribe Payers' Index names the public works/construction sector to be the most vulnerable sector to corruption in emerging economies worldwide. This could also apply to different geographical areas of the same country. For instance, corruption is considerably higher in Southern Italy than in Northern Italy (Golden and Picci, 2006). This suggests that some sub-environments (certain industries, geographical areas) could be relatively corruption-free even in the most corrupt environments. As firms in these low-corruption sub-environments would be forced to compete with each other relatively fairly, a greater variance in perceptions of corruption may be associated with higher efficiency on average. We therefore hypothesize the following:

H2: *Heterogeneity in corruption perception is positively related to efficiency.*

The effects of corruption on firm efficiency are likely to be more pronounced for relatively "honest" firms. Firms with a lower propensity to bribe are the ones most likely to be adversely affected when corruption is high. They may lose contracts to bribing firms, resulting in capital and possibly labor being severely under-utilized. On the other hand, they should be the first to move their operations to less corrupt sub-environments (e.g., from the South to the North of Italy), thus benefitting the most in terms of efficiency from variance in the corrupt environment.

A key empirical challenge is how to identify firms with a lower propensity to bribe. We propose two observable firm characteristics which we expect to be associated with a lower propensity to bribe: foreign ownership, especially if the headquarters of the firm is based in a low-corruption country, and having a female CEO.

We expect foreign-controlled firms to have a lower propensity to behave corruptly for several reasons. First, cultural norms are an important determinant of corruption. For example, Fisman and Miguel (2007) show that the social behavior of diplomatic leaders abroad is highly correlated with their home country-specific corruption scores. We therefore expect foreign firms from low-corruption countries to have a lower propensity to bribe. Second, foreign firms could be a subject of strict anti-bribery regulation in their home country (e.g., the US Foreign Corrupt Practices Act and the UK Bribery Act). Third, foreign firms are also more concerned about their reputation and tend to follow more

responsible business practices. In fact, many voluntary codes of corporate conduct contain anti-bribery provisions. Multinational firms, even when their headquarters are based in high-corruption countries, often have such codes and enforce them. Fourth, lack of knowledge of the local environment may prevent foreign firms from getting involved in corruption (Zaheer, 1995; Zaheer and Mosakowski, 1997; Calhoun, 2002; Cuervo-Cazurra et al., 2007; Bell et al., 2012). To the extent that the propensity not to bribe can be proxied by foreign ownership, especially for firms whose headquarters are based in low-corruption countries, we suggest that mean and variance effects (*H1* and *H2*) are mediated as follows:

H3: *The adverse impact of corruption on firm efficiency is particularly strong for firms controlled by foreign owners. The effect is strongest for owners based in low-corruption countries.*

H4: *Heterogeneity in corruption perception has particularly strong positive effect on efficiency of firms controlled by foreign owners. The effect is strongest for owners based in low-corruption countries.*

Firm participation in corrupt exchanges is largely influenced by the decisions of firm executives (Collins et al., 2009; Mironov, 2015). Corrupt executives can evade more taxes, bribe to remove obstacles for doing business and obtain more government contracts. We expect that female CEOs are, on average, less tolerant of corruption and less likely to get involved in corruption (Dollar et al., 2001; Swamy et al., 2001). For example, Goetz (2007) suggests that greater female participation in government is associated with lower corruption and is driven by the relative exclusion of women from networks traditionally dominated by men. Women are also found to be more reciprocal in the context of gift-exchanges (Croson and Buchan, 1999; Buchan, Croson, and Solnick, 2008) and less likely to lie when it is costly to the other side (Erat and Gneezy, 2010). Further, as a corrupt transaction carries the possibility of detection and penalty; women are less willing to engage in these activities, since they tend to be more risk-averse than men (e.g., Levin, Snyder, and Chapman, 1988; Charness and Gneezy, 2012). Since female CEOs are likely to have a lower propensity to bribe, we suggest that mean and variance effects (*H1* and *H2*) are mediated as follows:

H5: *Firms that operate in more corrupt environments are less efficient, especially when a firm has a female CEO.*

H6: *Heterogeneity in corruption perception is positively related to efficiency, especially when a firm has a female CEO.*

3. Data

We collect the data on corruption and other business environment characteristics from the Business Environment and Enterprise Performance Survey (BEEPS) conducted by the European Bank for Reconstruction and Development (EBRD) and the World Bank Group (the World Bank). BEEPS is a firm-level anonymous survey of a representative sample of private firms that aims to gain an understanding of firms' perception of their operating environment. It covers a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures. We use four waves of the survey completed in 2002, 2005, 2009, and 2013.[8]

A significant disadvantage of BEEPS data is the missing accounting information for a large number of firms, which could lead to biased inference from the data analysis as the worst-performing firms have an incentive not to report their financial information, but to complain the most about corruption (Jensen et al., 2010). For example, about 40% of firms have missing information on sales and assets.[9] To overcome the problem of missing accounting data we match BEEPS to the Amadeus database maintained by Bureau van Dijk that contains comprehensive financial information on private companies across Europe. We focus on 14 countries in Central and Eastern Europe over the period from 2000 to 2013.[10] The annual panel is constructed by combining multiple updates of the Amadeus database. This strategy helps to eliminate survivorship bias because a firm that stops providing financial statements gets removed from the database after four years. Therefore, using several snapshots of the database allows us to add back observations for firms that are not present in more recent updates. Moreover, as every update contains a snapshot of the currently active population of firms and up to the 10 most recent years of firms' financial data, our approach allows us to extend firms' historical financial data beyond the most recent decade.

The financial data are further combined with the ownership data obtained from Amadeus. It is important to highlight that each edition of the Amadeus database covers only the current ownership structure. Again, we use several snapshots of the database to reconstruct end-of-year ownership

[8] Detailed survey information is available at http://ebrd-beeps.com/about/

[9] While the issue of misreporting or not reporting at all is inherent in survey data, measurement errors are a minor concern in cross-country studies, provided they are not systematically related to the country characteristics (Svensson, 2005).

[10] These countries are Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, and Ukraine.

structures for the period under research. Finally, we add managerial data that became available with the latest Amadeus update. The data contain information on the manager's name, position, gender, nationality, and tenure. In particular, using the appointment dates we are able to match managers to specific firm-financial years.

Most firms in Amadeus report unconsolidated financial statements; consolidated statements are provided when available. In our dataset, we use unconsolidated financial statements to avoid double-counting firms and subsidiaries or operations abroad and exclude firms that only report consolidated statements. We also exclude the financial intermediation sector and insurance industries (NACE codes 64 – 66) since they have a different balance sheet and a specific liability structure.

3.1. Sample Construction

Combining BEEPS and Amadeus data provides us with a unique firm-level dataset that contains proxies for business environment conditions and corruption perception at the firm level. To merge BEEPS data with the Amadeus database we first assign firms to mini-environments or clusters based on their country, industry (2-digit ISIC rev 3.1), size (micro firms with 2–10 employees, small firms with 11–49 employees, medium and large firms with more than 50 employees), size of the urban area in which they are registered (capital, city with a population above 1 million, and city with a population below 1 million) and the corresponding time period (2000–2002, 2003–2005, 2006–2009, and 2010–2013 to match BEEPS waves). The total number of BEEPS observations with non-missing data on corruption for the countries under scrutiny is 22,260. Imposing the constraint of at least 4 observations per cluster further reduces the number of observations to 15,975, with total of 1,529 clusters.

We construct the measure of corruption by extracting the answers to the question "It is common for firms in my line of business to have to pay some irregular 'additional payments or gifts' to get things done with regard to customs, taxes, licenses, regulations, services, etc." and normalizing them to between 0 (never) and 1 (always).[11] Then we compute the average perception of the corruption level (corruption mean) and the dispersion in the perception of the corruption level (corruption standard deviation) in each cluster. We further extract other characteristics of the business environment from BEEPS including access to financing, tax rates, customs and trade regulations, business licensing and permits, labor regulation and the functioning of the judiciary environment. These variables are also

[11] A limitation of BEEPS is that they 'provide a very incomplete measurement of corruption' (Gray, Hellman, and Ryterman 2004, p. 54). It only measures the interactions between firms and public officials.

normalized to between 0 and 1. Then, BEEPS cluster-level characteristics of the business environment are assigned to firms from the Amadeus database that are operating in the same cluster.[12]

As the BEEPS business environment measures and firm efficiency measure are constant over three-year periods, we also average over three years the financial information from Amadeus. This allows a reduction in the measurement error as well as the influence of any potential accounting adjustments. The details on the construction of the firm-level variables are provided in the Firm Efficiency Determinants section (4.2) along with the sample descriptive statistics.

4. Modeling Strategy

To study the effect of a corrupt environment on a firm's efficiency we employ stochastic frontier analysis (SFA). First, we derive a firm's efficiency from the stochastic production possibility frontier and then relate the estimated firm efficiency to firm-specific characteristics, the firm's ownership and managerial structure, and the operating environment.

4.1. Firm Efficiency – Stochastic Frontier Analysis

Firm efficiency is estimated using the stochastic production frontier model. This approach compares companies to the most efficient company (i.e. the one with the "best practices") rather than the average company (e.g., an OLS regression).[13] First, we define the production function as:

$$y_{it} = f(x_{it}; \beta) \cdot TE_{it}. \qquad (1)$$

The first part of the equation relates the output y_t and the inputs x_t through a production function $y_t = f(x_t;\ \beta)$. Technical efficiency TE_i takes into account the efficiency of the use of the input variables. In other words, if $TE_i = 1$ then a company uses its inputs efficiently and thus achieves its maximum feasible outcome while TE_i<1 denotes some kind of inefficiency. Since the output is always positive, TE_i is therefore defined on the interval between (0,1]. Stochastic frontier analysis then makes two assumptions. Technical efficiencies, TE_i, is a stochastic variable that has a distribution that is common to all firms. We therefore denote it as $TE_i = \exp\{-u_{it}\}$.[14] The error term is then denoted as

[12] A similar approach has been used by Commander and Svejnar (2011), Hanousek and Kochanova (2015), and Fungacova et al. (2015).

[13] See Aigner et al. (1977) and Meeusen and van den Broeck (1977) for stochastic frontier analysis and Schmidt and Sickles (1984), Kumbhakar (1990), and Greene (2005) for panel data application to stochastic frontier analysis. Kumbhakar and Lovell (2000) provide a detailed literature survey.

[14] Since the technical efficiency TE_i is defined in the interval, u_{it} is non-negative.

exp(v_{it}) to account for random shocks in production (e.g. machinery breakdown). The stochastic production function model is then rewritten as

$$y_t = f(x_t;\beta) \cdot exp(-u_{it}) \cdot exp(v_{it}) \quad (2)$$

and its logarithm form is

$$lny_{it} = \beta_0 + \sum_{j=1}^{k} \beta_{jit}\, lnx_{it} + v_{it} - u_{it}, \quad (3)$$

where v_{it} is a two-sided normally distributed error term while u_{it} is the technical inefficiency variable. It is non-negative and measures the distance from the efficiency frontier.

Technical efficiency is modeled using the Cobb-Douglas production function where its parameters are interacted with 2-digit NACE industry dummy variables to account for industry idiosyncrasies.[15] We specify the model of the efficiency frontier of I firms (i = 1,…,I) in J two-digit NACE sectors (j=1,…,J) over T time periods (t = 1,…,T) as:

$$lny_{it} = \sum_{j=1,\dots,J} \left[\beta_{0j} + \beta_{1j} lnc_{it} + \beta_{2j} lnl_{it}\right] \cdot ID_{itj} + \phi_t + v_{it} - u_{it}. \quad (4)$$

The corporate output variable y_{it} is sales (i.e. the turnover variable in the Amadeus database). ln c_{it} is log of the capital of each firm I. Capital is proxied by total fixed assets plus working capital, which is defined as current assets minus current liabilities.[16] ln l_{it} is defined as the logarithm of the number of employees. Fundamentally, capital and labor represent inputs in the production to generate output sales. ID_{ijt} stands for a vector of industry (j) dummy variables. All parameters of the production function in model (4) — the constant term and both production inputs (capital and labor) — are interacted with 2-digit NACE industry dummy variables to benefit from a flexible functional form. v_{it} is the random error and u_{it} represents the efficiency of the company. If the company is fully efficient then u_{it} = 0. Any inefficiency is represented through a non-negative u_{it}. The inefficiency component of the model (u_{it}) is not directly observable and has to be calculated according classical assumptions where

$$v_{it} \sim iid\ N(0, \sigma_v^2) \text{ and } u_i \sim iid\ N^+(0, \sigma_u^2).$$

[15] The Cobb-Douglas function is a standard and less restrictive production function. Recently, for example, Chirinko et al. (2010) argue for its robust functionality.

[16] Adding working capital to total fixed assets is a common efficiency measure for several reasons: i) Working capital management is closely related to efficiency because it optimizes the allocation of short-term capital (Kim et al., 1998). ii) Working capital helps to manage the day-to-day operations of the company efficiently and any abundant cash holdings make companies targets for potential acquirers.

The minimum squared error predictor of the technical efficiency of the *i*th firm is then calculated as $E(\exp\{-u_{it}\}\,|\varepsilon_i) = E(\exp\{\beta(t)\cdot u_i\}\,|\varepsilon_i) = \frac{1-\Phi[\sigma_i^* - (\mu_i^*/\sigma_i^*)]}{1-\Phi(-\mu_i^*/\sigma_i^*)} \cdot exp\left\{-\mu_i^* + \frac{1}{2}\sigma_i^{*2}\right\}$,

where $\varepsilon_{it} = \nu_{it} - u_{it}$, $\mu_i^* = \frac{\mu\sigma_\nu^2 - T\varepsilon_i\sigma^2}{\sigma_\nu^2 + T\sigma^2}$ and $\sigma_i^{*2} = \frac{\sigma_\nu^2\sigma^2}{\sigma_\nu^2 + T\sigma^2}$.

Since *u* is identified by the minimum squared error predictor, *v* is the remaining difference ($\varepsilon - u$). Battese and Coelli (1992), Kumbhakar and Lovell (2000), and Greene (2008) provide excellent sources for the details.

Model (4) is estimated in a series of short panels (2000–2002, 2003–2005, 2006–2009, and 2010–2013) to account for time-varying changes in technical efficiencies. As demonstrated by Greene (2005), the short time periods over which the technical efficiency is estimated attenuate any potential bias of the estimated parameters in a fixed-effect stochastic frontier model and also allow a feasible estimation.[17] The estimation is performed country by country to account for the different efficiency levels of each industry between countries. From an econometrics standpoint, this is a preferred method because it is less restrictive than estimating the model with country dummies. Additionally, it is much more operational to estimate. Finally, we also include year dummy variables to account for time-specific effects, which in short panels allow us to capture industry-specific price variation.

4.2. Firm Efficiency Determinants

We further model a firm's efficiency as a function of firm-specific and business environment characteristics to analyze the differences in efficiency from the "best practice" companies. Therefore, we use the distance from the efficiency frontier (estimated from (4)) and analyze it as a function of several factors that influence the firm. We are particularly interested in the role of corruption practices and other business environment characteristics as well as firm ownership and CEO characteristics in facilitating or hindering firm efficiency. The model is formalized as follows.

$$u_{it} = \alpha_0 + \beta X_{it} + \sum_{k=1}^{2}\gamma_k^B Corruption_{rk}^k + \sum_{l=1}^{L}\gamma_l^E BusEnvt_{rt}^l +$$

[17] The estimation done on a series of short panels also takes care of the endogeneity concern that arises from the correlation between unobservable productivity shocks and input levels (see Griliches and Mareisse, 1998 for a detailed discussion). This approach has the advantage of a feasible assumption of constant inefficiency. We also expect that firm-specific, time-invariant heterogeneity would be taken care of by fixed-effect estimation (for example, size of the firm or technology are unlikely to change rapidly). While estimation on short panels carries the advantage of limiting endogeneity concerns, it also carries a risk of a small time dimension. It has been mentioned by several authors that there is a potential bias resulting from a small T (number of periods). However, Greene (2005) demonstrates that the biases in the estimated parameters in fixed-effect stochastic frontier models are actually fairy moderate.

$$+\sum_{m=1}^{M}\gamma\delta_m OwnC_{it}^{m} + \lambda_1 FemaleCEO_{it} + \lambda_2 MissingCEO_{it} +$$

$$+\tau_t + \eta_j + \varphi_s + \theta_c + \omega_f + \varepsilon_{it} \qquad (5)$$

for all i = 1,…, N (firm index); t = 1,…, T (time index); r = 1,…, R (cluster index), c = 1,…, C (country index); j = 1,…, J (double digit industry index); s = 1,…, S (firm size index); f = 1,…, F (urban area size index); b = *1*,…, B (corruption measures); e = 1,…, E (business environment characteristics); and m = 1,…, M (ownership categories).

The variables in (5) are defined as follows. u_{it} is the distance from the efficiency frontier for a firm i at time period t; *Corruption* is represented by corruption mean and corruption standard deviation. *Corruption mean* represents the cost all firms have to incur to conduct business or respond to corruption demand. *Corruption standard deviation* characterizes the differences in the perception of the corruption level in the cluster. The $BusEnvt$ (*Business Environment*) vector contains business environment characteristics that are access to financing, tax rates, customs and trade regulations, business licensing and permits, labor regulation, and functioning of the judiciary. Both the *Corruption* and *Business Environment* variables come from BEEPS and are calculated at the cluster level. Each cluster r contains firms operating in the same country and industry (2-digit ISIC rev 3.1) in the corresponding time period (2000–2002, 2003–2005, 2006–2009, and 2010–2013), and that are also similar by size (micro, small, and medium-large firms) and located in the urban area of comparable size (capital, city with more than 1 million inhabitants, city with less than 1 million inhabitants).

Vector X_{it} contains a set of firm-specific characteristics (size, profitability, leverage, and cash balance) of firm i at time t. The ownership structure ($OwnC_{it}^{m}$) is defined for each firm i in year t. We differentiate between domestic- and foreign-majority-controlled firms, firms without significant minority shareholders present, and dispersed ownership. $FemaleCEO_{it}$ equals 1 if the CEO of the firm i at time t is female. Due to incompleteness of managerial data we also control for cases when CEO gender information is missing by including a $MissingCEO$ dummy. Finally, we include country (θ_c), time period (τ_t), industry (η_j), firm size (φ_s), and urban area size (ω_f) fixed effects that correspond to the BEEPS-Amadeus matching clusters.

The firm-specific characteristics are constructed as follows. *Profitability* is defined as a ratio of operating profit over total assets. *Industry adjusted leverage* is calculated as the firm's leverage minus its industry mean average, where leverage is defined as the ratio of short- and long-term liabilities over total assets. *Cash* is defined as company cash holdings over total assets.

To control for the interference of ownership and CEO gender with the corrupt environment and to properly test hypotheses *H3* and *H5*, we need to further extend model (5). In particular, we add the interactions of foreign-controlled firms (*ForeignC*) and a female CEO dummy (*FemaleCEO*) with the corrupt environment characteristics into the model. The resulting specification has the following form:

$$u_{it} = \alpha_0 + \beta X_{it} + \sum_{k=1}^{2} \gamma_k^B Corruption_{rk}^k + \sum_{l=1}^{L} \gamma_l^E BusEnvt_{rt}^l +$$

$$+ \sum_{m=1}^{M} \delta_m OwnC_{it}^m + \lambda_1 FemaleCEO_{it} + \lambda_2 MissingCEO_{it} +$$

$$+ \upsilon_1 CorruptionMean * ForeinC_{it} + \upsilon_2 CorruptionStDev * ForeinC_{it} +$$

$$+ \mu_1 CorruptionMean * FemaleCEO_{it} + \mu_2 CorruptionStDev * FemaleCEO_{it} +$$

$$+ \tau_t + \eta_j + \varphi_s + \theta_c + \omega_f + \varepsilon_{it}. \qquad (6)$$

Using model (5) and (6), the alternative hypotheses formulated in Section 2 can be expressed in the following way:

H1: *Corruption has an adverse impact on firm efficiency.*

$\gamma_1^B > 0$ (the coefficient on corruption mean is positive)

H2*: Firms that operate in more corrupt environments are less efficient, especially when a firm is foreign-owned.*

$\delta_1^{ForeignC} > 0$ (the coefficient on the foreign-controlled dummy is positive)

$\upsilon_1 > 0$ (the coefficient on *ForeignC*CorruptionMean* is positive)

H3*: Firms that operate in more corrupt environments are less efficient, especially when a firm has a female CEO.*

$\mu_1 > 0$ (the coefficient on *FemaleCEO*CorruptionMean* is positive)

H4: *Heterogeneity in corruption perception is positively related to efficiency.*

$\gamma_2^B < 0$ (the coefficient on corruption standard deviation is negative)

H5: *Heterogeneity in corruption perception is positively related to efficiency, especially when a firm is foreign-owned.*

$\nu_2 < 0$ (the coefficient on *ForeignC*CorruptionStDev* is negative)

H6: *Heterogeneity in corruption perception is positively related to efficiency, especially when a firm has a female CEO.*

$\mu_2 < 0$ (the coefficient on *FemaleCEO*CorruptionStDev* is negative)

4.3. Descriptive Statistics

Our final sample contains 76,552 observations and covers 14 Central and Eastern European countries over the period from 2000 to 2013. The countries are Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, and Ukraine.

The descriptive statistics for all variables are reported in Table 1. The average firm in the sample has USD 7.4 million of total assets, a profitability ratio of 0.076, a leverage ratio slightly lower than its industry mean (-0.0004), and a cash position of 0.10. The average efficiency measure is about 0.70 and quite far from the "best practice" efficiency frontier; efficiency decreases as it moves away from 0 towards the maximum of 0.986 within this sample. The mean level of corruption is about 0.23 and deviates from 0 to 0.8. As for the business environment characteristics, custom and trade regulations are reported the lowest obstacle for operations and growth (0.206), while tax rates are the highest obstacle (0.604) limiting business opportunities. The higher these variables, the higher the perception that these factors are problematic in the cluster. About 15% of firms in the sample are foreign-controlled, while about 23% of the companies have a domestic majority owner. Minority non-controlling ownership represents less than 1% of this sample. Finally, 4.2% of the firms in the sample are managed by female CEOs. No CEO information is available for 62% of the (smaller) companies.

(Insert Table 1)

5. Results

We present our results according to the hypotheses presented in the theoretical background section, in Tables 2 to 5.

5.1. Main Effects: Mean and Variance

Table 2 presents the estimation results for the relationship between corruption and firm efficiency. Our first alternative hypothesis *H1* states that corruption has an adverse impact on firm efficiency. Since the corruption mean variable is positive and highly statistically significant in all regressions (Models 1–8), we reject the null hypothesis in favor of the alternative one. A positive coefficient indicates an increased distance from the efficient production frontier. Thus, high corruption decreases the efficiency of the firm. The estimated coefficient ranges from 0.031 (with standard error 0.006) for Model (1) that contains only corruption variables and firm-specific characteristics to 0.065 (with standard error 0.006) for Model (2) that also includes the full set of business environment characteristics potentially problematic for operation and growth. Put differently, a 1% increase in the average level of corruption leads to 2% decrease in average firm efficiency. This result is consistent with the idea of corruption being an additional cost that distorts optimal allocation of resources.

Next, the alternative hypothesis of *H2* states that heterogeneity in corruption has a positive impact on firm efficiency. Our results reject the null hypothesis in favor of the alternative. The standard deviation stands for the variance in perceptions of corruption in the environment, characterizing its inequality. The negative coefficient signals that the larger variance in perceptions of corruption in the environment is conducive to efficiency for the average firm.[18] The estimated coefficients vary from -0.011 to -0.018 (with standard error 0.007) depending on the model. More specifically, a 1% increase in average corruption perception variation improves firm efficiency by 0.61%. We could speculate that companies with a lower propensity to bribe are the ones improving their efficiency. The pressure put on increasing efficiency has its limits. When these limits are crossed, companies exit the environment. This happened, for example, to Shell Brazil when they sold their Agip service stations in 2000.[19] Disentangling the effect of corruption on efficiency into the first and second moment, i.e. corruption mean and variance, offers new insights into the understanding of company behavior in corrupt environments. When used on its own, the corruption mean is the marginal effect of corruption which contains the combined effect. Thus, differentiating between these effects of corruption on firm efficiency helps to capture a clearer picture of the otherwise obfuscated relationship.

All regressions (Models 1-8) in Table 2 are estimated on the sample of 76,542 firms and have R-squared of about 31%. Estimated coefficients for the firm-specific control variables have expected signs

[18] It certainly might be the case that the cluster is so polarized that the "average" firm in that cluster does not exist.

[19] See the case of Shell Brazil selling its service stations to Agip do Brazil (*Financial Times of London*, February 25, 2000, page 18).

with respect to efficiency and are highly statistically significant (<0.01 p-values). We interpret the coefficients of firm-specific variables reported in Column 1 of Table 2, but estimated coefficients and their interpretations are consistent across all specifications. The estimated coefficient for firm size is 0.019 (with standard error 0.000) indicating that larger firms are less efficient. We also include a squared-sized term to control for a possible non-linear relationship, but the positive relationship holds also for the second moment. The relationship between profitability and firm efficiency is not clear-cut. More profitable firms could be more efficient or less efficient, as higher profitability may not force companies to improve efficiency. Our data show that more profitable firms are, on average, less efficient (estimated coefficient 0.03 with standard error of 0.003). This is not particularly surprising as less profitable firms tend to watch every dollar more closely. For example, during recessions, companies tend to decrease discretionary spending, which forces the company into a "leaner" shape. Further, higher leverage is associated with greater efficiency: the coefficient is negative (-0.048) and statistically significant at the 1% level. Specifically, our adjusted leverage variable measures the difference between the company's leverage and the mean leverage ratio of the industry in the particular year. The larger the difference between firm leverage and the industry mean leverage, the higher the efficiency, provided firm leverage is higher than the industry mean. This is consistent with Jensen (1986), as leverage serves as a disciplining tool and forces managers to improve efficiency. Lastly, consistent with the literature on managerial discipline value (see Faulkender and Wang, 2006; Dittmar and Mahrt-Smith, 2007), firms with higher cash holdings are less efficient.

Models 2–8 in Table 2 also control for business environment characteristics that might shape the efficiency of firms in a particular environment. These business environment factors are: access to financing, tax rates, business licensing and permits, labor regulation, customs and trade regulations, and the functioning of the judiciary system. A priori, these factors may have an effect on firm efficiency in the following ways. On the one hand, companies limited by business obstacles cannot embrace investment opportunities that would be detrimental for their efficiency. On the other hand, high-obstacle business environments may also force companies to maximize the usage of their resources and increase firms' efficiency. While controlling for corruption and firm-specific characteristics, Model 2 reports the effects of all business environment factors on the distance to the efficiency frontier. The results show that limited access to financing, high tax rates, difficulties with business licensing and permits, and inflexible labor regulation do not contribute to greater firm efficiency. Interestingly, customs and trade

regulations and the functioning of the judiciary system have the opposite effects. Columns 3–8 report regression results with each of the business environment characteristics separately.

(Insert Table 2)

5.2. Mediating Effects: Foreign Ownership and Female CEO

As presented in hypotheses 3-6, there are two potential groups of firms for which the effect of corruption on firm efficiency would likely be amplified. We first examine direct effects by including foreign ownership and female CEO indicators in our models. We then analyze the interaction effects between honest firms (foreign ownership, and female CEO) and the characteristics of the corrupt environment.

Table 3 contains estimation results. All regressions include firm-specific controls and business environment characteristics. The estimated coefficients for these characteristics are consistent with the results reported in Table 2.[20] Column 1 reports the effect of company ownership on firm efficiency. Note that majority foreign ownership is associated with lower efficiency compared to dispersed and unknown ownership, while majority domestic ownership and non-controlling minority ownership are not penalized in terms of efficiency. The model reported in column 2 examines the effect of a female CEO on the distance from the efficiency frontier. Firms managed by female CEOs are as efficient as male-managed firms, which is consistent with our prior beliefs. The *FemaleCEO* dummy is not significantly different from zero. Finally, we control simultaneously for both ownership structure and female CEO in Model 3. The estimated coefficients have the same signs and statistical significance. Although there is a notable coefficient change on corruption variables (e.g., the estimated coefficient on corruption mean drops from 0.068 in model 1 to 0.031 and 0.034 in model 2 and 3 respectively), this trend is reversed in subsequent models.

(Insert Table 3)

We proceed with the testing of alternative hypotheses *H3* and *H5* that the negative effect of mean corruption on firm efficiency is particularly pronounced for more honest firms, as proxied by foreign ownership and female CEO. We a also test the alternative hypotheses *H4* and *H6*, that the variance in perceptions of corruption is positively related to firm efficiency, especially for honest firms. To formally test these hypotheses we interact the characteristics of a corrupt environment (mean and variance) with

[20] Detailed results are available upon request.

our honesty proxies. Regressions also include both firm-specific characteristics and characteristics of the business environment, which are not reported because of space considerations.[21] The estimation results are reported in Table 4.

Models 1 and 3 present the estimation results for foreign ownership interacting with a corrupt environment. Consistent with our previous findings, foreign majority ownership is associated with lower efficiency (the estimated coefficient is 0.01 with standard error 0.003). Moreover, foreign-controlled firms are at even higher disadvantage in a high-corruption environment. The coefficient estimate on the interaction term is 0.06 (standard error 0.017), meaning that a 1% increase in the average level of corruption leads to a 3.16% decrease in efficiency of foreign firms. At the same time, greater variance in perceptions of corruption is associated with more efficiency for foreign-controlled firms. When corruption is not widespread (there are corruption-free or low-corruption sub-environments), foreign companies that focus on utilizing their resources improve their efficiency as supported by a negative statistically significant coefficient on the interaction term. We estimate that a 1% increase in variation of corruption perceptions is associated with a 1.53% increase in theefficiency of foreign firms.

Model 2 focuses on the interaction of female CEOs with the corruption environment. We find that female CEOs behave differently in corrupt environments than men. This is consistent with the theoretical literature showing different gender preferences towards illegal activities. A higher corruption level is found to have a greater negative effect on the efficiency of firms managed by female CEOs as compared to those managed by male CEOs. Specifically, a 1% increase in the average level of corruption lowers the efficiency of firms managed by female CEOs by 2.80%. Further, a greater variance in the perceptions of corruption is not translated in higher efficiency for firms lead by female CEOs. Even though the sign on the interaction term between female CEO and the variance in perception of corruption is in line with our expectations, the estimated effect is not significant. Therefore, we conclude that a female CEO, on average, performs worse in a corrupt environment compared to a male CEO. Stated in terms of our alternative hypothesis, we reject the null hypothesis of *H5* and fail to reject the null hypothesis of *H6*. These results complement Mironov (2015), who argues that one should hire a corrupt CEO in a corrupt country. Our results suggest that one should hire a male CEO in high-corruption environments.

Model 3 in Table 4 is the complete model of this study. It contains both foreign ownership and female CEO controls interacted with the corruption environment characteristics. All previously reported

[21] The results are available upon request.

results hold; a corrupt environment is particularly detrimental for firms or those with a lower propensity to bribe.

(Insert Table 4)

As a robustness check, we further split the sample of foreign firms into firms from low-corruption countries and the remaining foreign firms.[22] Then these subcategories are interacted with corruption characteristics of the environment. Estimation results are reported in Table 5. All regressions include both firm-specific characteristics and characteristics of the business environment. Models in columns 3 and 4 also include managerial data (female CEO) and the interactions of female CEO with the corruption environment characteristics. In line with our expectations, foreign firms from low-corruption countries experience a much stronger effect of the corrupt environment on their efficiency. These results are robust across specifications. For example, in column 4, the estimated coefficient of the corruption mean on the efficiency of firms from low-corruption countries is 0.163 (standard error 0.074) compared to only 0.068 (standard error 0.017) for the remaining foreign firms. Put differently, a 1% increase in the average level of corruption leads to a 4.53% decrease in efficiency of foreign-controlled firms that come from low-corruption countries. Also, foreign firms from low-corruption countries better utilize the presence of corruption-free (or low-corruption) sub-environment. Greater variance in perceptions of corruption leads to more efficiency for foreign-controlled firms. This effect is much stronger for foreign firms from low-corruption countries (estimated coefficient is -0.143 with a standard error of 0.078) and represents the average boost in efficiency of 4.29% when the variation of corruption perceptions increases by 1%.

(Insert Table 5)

6. Conclusion

This study offers a systematic analysis of static relationships between a corrupt environment and firm efficiency. We use firm-level data and show that the average level of corruption in the environment

[22] We define low-corruption countries as the Top 25 countries (very clean) in the Corruption Perception Index (CPI) provided by Transparency International.

may be insufficient to fully characterize the corruption effects in that environment. Our findings are consistent with the idea that firms with a lower probability of using bribery are likely to self-select themselves into low-corruption sub-environments. Thus, one should account for the variability in perceptions of corruption in addition to its average level. We also find that "honest" firms (foreign-controlled, from low-corruption countries, managed by female CEOs) experience higher adverse effects on efficiency in high-corruption environments. However, the presence of corruption-free sub-environments where foreign firms could compete relatively fairly is beneficial for their efficiency.

We also acknowledge that the corrupt environment could also have a dynamic effect on society. Being initially a quick fix for bureaucratic bottlenecks and red tape, over time, it may have become a source of problems by itself. Thus the relationship between efficiency and bribery may have a bilateral dimension that can be analyzed over time. As BEEPS contains an insufficient number of waves to capture the dynamic effect of corruption on firms' operations, this issue is left for future research.

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Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variable					
Efficiency	76,552	0.699	0.171	0.0002	0.986
Corrupt environment					
Corruption mean	76,697	0.234	0.141	0	0.8
Corruption std. deviation	76,687	0.223	0.010	0	0.707
Firm-specific financial variables*					
Total Assets ('000,000)	76,630	7.401	36.17	0.0004	966
Size [ln(total assets)]	76,630	-0.647	2.43	-10.21	6.88
Profitability	76,630	0.076	0.213	-1.287	1.113
Industry adjusted leverage	64,315	-0.0004	0.174	-0.272	0.974
Cash	76,630	0.104	0.150	0.0002	0.873
Problematic factors for operation and growth**					
Access to financing***	76,697	0.390	0.160	0	1
Tax rates	76,697	0.604	0.165	0	1
Custom and trade regulations	76,634	0.206	0.161	0	0.875
Business licensing & permits	76,697	0.288	0.165	0	0.938
Labor regulations	76,697	0.268	0.162	0	0.833
Functioning of the judiciary	76,697	0.287	0.193	0	0.917
Ownership control[+]					
Foreign	76,697	0.153	0.360	0	1
Domestic	76,697	0.230	0.421	0	1
Minority - no control	76,697	0.009	0.092	0	1
Managerial data					
Female CEO	76,697	0.042	0.200	0	1
Missing CEO	76,697	0.621	0.486	0	1

Notes on the definitions of variables:

[*] Taken from the BEEPS survey, from the question if it is common to make "additional" irregular payments to get things done (1=never, 2=seldom, 3=sometimes, 4=frequently, 5=usually, 6=always). Transformation applied: (variable-1)/5.

[**] Taken from the BEEPS survey, from the set of questions on the business environment (1=no obstacle, 2=minor obstacle, 3=moderate obstacle, 4=major obstacle). Transformation applied: (factor-1)/3.

[***] E.g., collateral required or financing not available from banks.

The firm-specific variables are constructed as follows. *Profitability* is defined as a ratio of operating profit over total assets. *Industry adjusted leverage* is calculated as the firm's leverage minus its industry mean average; leverage is defined as a ratio of short- and long-term liabilities over total assets. *Cash* is defined as company cash holdings over total assets.

The data cover 14 Central and Eastern European countries: Bosnia and Hercegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, and Ukraine.

Table 2. Firm Efficiency and Business Constraints

Independent Variables	Dependent Variable= Firm Efficiency							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Corrupt environment								
Corruption mean	0.031[a]	0.065[a]	0.031[a]	0.030[a]	0.036[a]	0.032[a]	0.033[a]	0.063[a]
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Corruption std. deviation	-0.013[c]	-0.018[a]	-0.013[c]	-0.013[c]	-0.011	-0.012[c]	-0.012[c]	-0.014[b]
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Firm specific financial variables								
Size [ln (assets)]	0.019[a]	0.020[a]	0.019[a]	0.019[a]	0.020[a]	0.019[a]	0.019[a]	0.020[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size squared	0.001[a]	0.001[a]	0.001[a]	0.001[a]	0.001[a]	0.001[a]	0.001[a]	0.001[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	0.030[a]	0.029[a]	0.030[a]	0.030[a]	0.030[a]	0.030[a]	0.030[a]	0.029[a]
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Missing leverage	0.059[a]	0.053[a]	0.059[a]	0.058[a]	0.058[a]	0.058[a]	0.059[a]	0.057[a]
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Industry adjusted leverage	-0.048[a]	-0.050[a]	-0.048[a]	-0.049[a]	-0.049[a]	-0.049[a]	-0.049[a]	-0.050[a]
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Cash	0.131[a]	0.131[a]	0.131[a]	0.131[a]	0.131[a]	0.131[a]	0.131[a]	0.131[a]
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Problematic factors for operation and growth[+]								
Access to financing[+]		0.010[b]	-0.000					
		(0.005)	(0.004)					
Tax rates		0.033[a]		0.012[a]				
		(0.004)		(0.004)				
Custom and trade regulations		-0.013[a]			-0.021[a]			
		(0.005)			(0.004)			
Business licensing and permits		0.008[c]				-0.008[b]		
		(0.005)				(0.004)		
Labor regulations		0.020[a]					-0.012[a]	
		(0.005)					(0.004)	
Functioning of the judiciary		-0.097[a]						-0.079[a]
		(0.005)						(0.004)
Constant	0.749[a]	0.773[a]	0.750[a]	0.743[a]	0.757[a]	0.756[a]	0.748[a]	0.788[a]
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
R squared	0.310	0.315	0.310	0.310	0.311	0.310	0.310	0.314
N (number of observations)	76,542	76,479	76,542	76,542	76,479	76,542	76,542	76,542

Symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are shown in parentheses.

Table 3. Firm Efficiency, Ownership, and CEO gender

Independent Variables	Dependent Variable= Firm Efficiency		
	(1)	(2)	(3)
Corrupt environment			
Corruption mean	0.068[a]	0.031[a]	0.034[a]
	(0.006)	(0.006)	(0.006)
Corruption std. deviation	-0.020[a]	-0.013[c]	-0.015[b]
	(0.007)	(0.007)	(0.007)
Ownership control[+]			
Foreign	0.014[a]		0.013[a]
	(0.002)		(0.002)
Domestic	0.002		0.002
	(0.002)		(0.002)
Minority - no control	0.006		0.006
	(0.005)		(0.005)
Managerial data			
Female CEO		-0.000	-0.000
		(0.003)	(0.003)
Missing CEO		-0.003	-0.002
		(0.002)	(0.002)
Control variables[++]			
Firm financials	YES	YES	YES
Obstacles to growth	YES	YES	YES
Constant	0.749[a]	0.751[a]	0.750[a]
	(0.014)	(0.014)	(0.014)
R squared	0.310	0.310	0.311
N (number of observations)	76,542	76,542	76,542

[+] An excluded category is dispersed and unknown ownership.
[++] The list of control variables is identical to Table 2. The coefficients are very similar and have an unchanged sign and/or significance. We do not list them here to save space; detailed results are available upon request.
Symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are shown in parentheses.

Table 4. Firm Efficiency, Ownership, and CEO Gender Interacting with a Corrupt Environment

Independent Variables	Dependent Variable= Firm Efficiency		
	(1)	(2)	(3)
Corrupt environment			
Corruption mean	0.028[a]	0.029[a]	0.061[a]
	(0.006)	(0.006)	(0.006)
Corruption std. deviation	-0.013[c]	-0.012[c]	-0.019[b]
	(0.007)	(0.007)	(0.008)
Ownership control[+]			
Foreign	0.010[a]		0.009[a]
	(0.003)		(0.003)
Domestic	0.002		0.002
	(0.002)		(0.002)
Minority - no control	0.005		0.005
	(0.005)		(0.005)
Foreign ownership control interacting with			
Corruption mean	0.068[a]		0.061[a]
	(0.017)		(0.017)
Corruption std. deviation	-0.048[b]		-0.034[c]
	(0.020)		(0.020)
Managerial data			
Female CEO		-0.010	-0.011
		(0.007)	(0.007)
Missing CEO		-0.003	-0.001
		(0.002)	(0.002)
CEO gender interacting with			
Corruption mean		0.071[a]	0.052[b]
		(0.023)	(0.023)
Corruption std. deviation		-0.029	-0.006
		(0.032)	(0.032)
Control variables[++]			
Firm financials	YES	YES	YES
Obstacles to growth	YES	YES	YES
Constant	0.751[a]	0.752[a]	0.777[a]
	(0.014)	(0.014)	(0.014)
R squared	0.311	0.310	0.316
N (number of observations)	76,542	76,542	76,479

[+] An excluded category is dispersed and unknown ownership.

[++] The list of control variables is identical to Table 2. The coefficients are very similar and have an unchanged sign and/or significance. We do not list them here to save space; detailed results are available upon request.

Symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are shown in parentheses.

Table 5. Firm Efficiency, Ownership, and CEO Gender Interacting with a Corrupt Environment

Independent Variables	Dependent Variable= Firm Efficiency			
	(1)	(2)	(3)	(4)
Corrupt environment				
Corruption mean	0.068[a]	0.062[a]	0.066[a]	0.060[a]
	(0.006)	(0.006)	(0.006)	(0.006)
Corruption std. deviation	-0.021[a]	-0.020[a]	-0.021[a]	-0.020[a]
	(0.007)	(0.007)	(0.007)	(0.008)
Ownership control[+]				
Foreign- low corruption countries	0.050[a]	0.052[a]	0.049[a]	0.052[a]
	(0.005)	(0.010)	(0.005)	(0.010)
Foreign- rest	0.011[a]	0.004	0.011[a]	0.004
	(0.002)	(0.003)	(0.002)	(0.003)
Domestic	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Minority - no control	0.007	0.006	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.005)
Foreign ownership control interacting with corruption				
Corruption mean - low corruption countries		0.166[b]		0.163[b]
		(0.074)		(0.074)
Corruption mean - rest		0.072[a]		0.068[a]
		(0.017)		(0.017)
Corruption std. deviation - low corruption countries		-0.145[c]		-0.143[c]
		(0.078)		(0.078)
Corruption std. deviation -rest		-0.036[c]		-0.033
		(0.020)		(0.020)
Control variables[++]				
Managerial data & interactions	NO	NO	YES	YES
Firm financials	YES	YES	YES	YES
Obstacles to growth	YES	YES	YES	YES
Constant	0.774[a]	0.776[a]	0.777[a]	0.778[a]
	(0.014)	(0.014)	(0.014)	(0.014)
R squared	0.316	0.316	0.316	0.316
N (number of observations)	76,479	76,479	76,479	76,479

[+] An excluded category is dispersed and unknown ownership.

[++] The list of control variables is identical to Table 2. The coefficients are very similar and have an unchanged sign and/or significance. We do not list them here to save space; detailed results are available upon request.

Symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively. Standard errors are shown in parentheses.