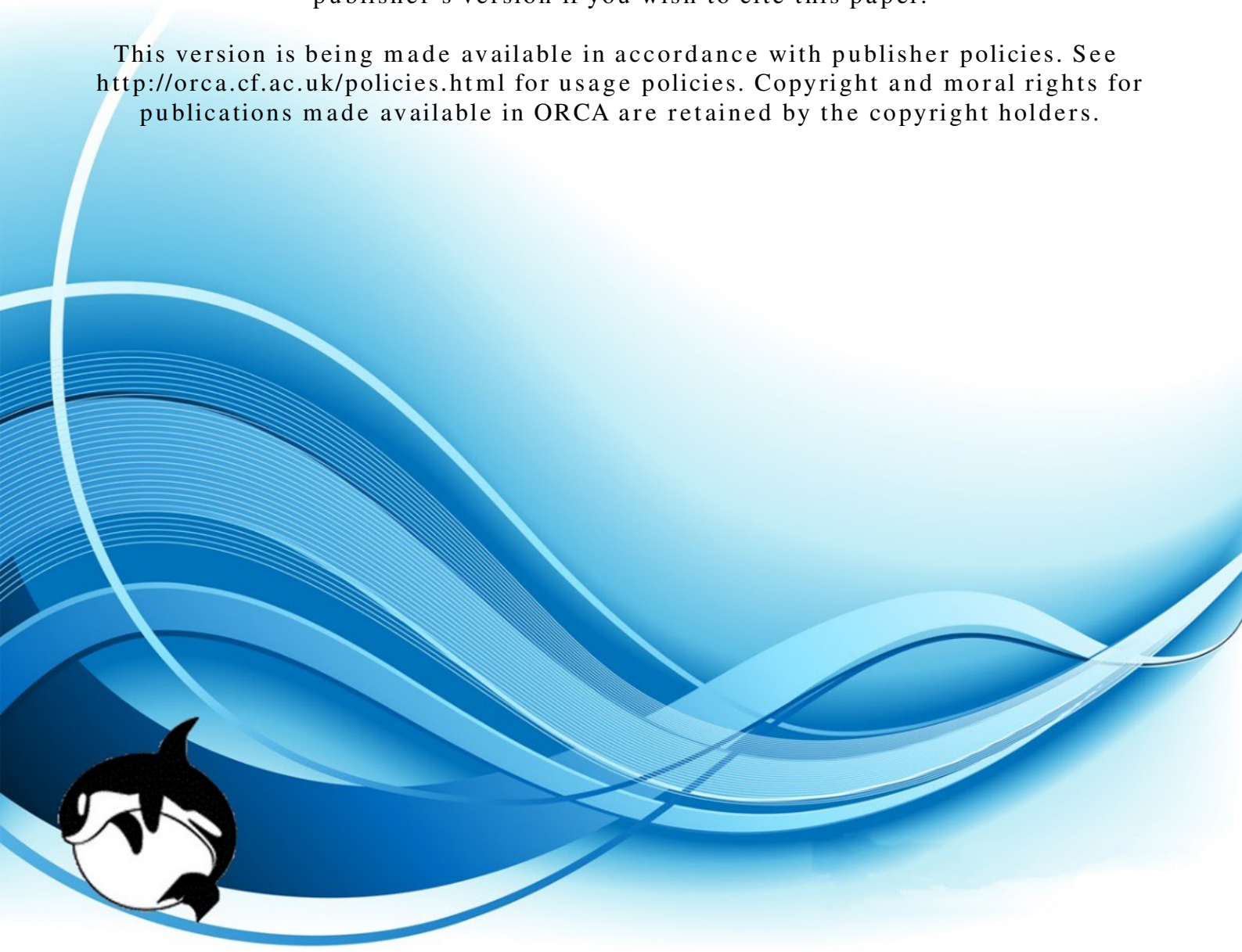

Bribery Environments and Firm Performance: Evidence from CEE Countries

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Abstract

We examine the relation between bureaucratic corruption and firm performance in CEE countries. We show that divergent consequences of corruption found in previous studies can be explained by the specifics of the local bribery environment in which firms operate. A higher mean bribery is associated with lower firm performance, while higher dispersion of individual firm bribes appears to facilitate it. We also conduct a detailed analysis by firm sector and size, and countries' institutional environments.

Keywords: Bureaucratic Corruption; Firm Performance, CEE Countries.
JEL classifications: D22, D73, O12, P37.

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1. Introduction

In countries with weak policies and legal systems corruption is considered a strong constraint on growth and development. The existing literature on the effects of corruption on firm performance is, however, divided. One branch considers corruption a 'grease the wheels' instrument that helps overcome cumbersome bureaucratic constraints, inefficient provision of public services, and rigid laws (Huntington, 1968; Lui, 1985; Lein, 1986), especially when countries' institutions are weak and function poorly (Acemoglu and Verdier, 2000; Meon and Weill, 2010; De Vaal and Ebben, 2011). Another branch argues that corruption reduces economic performance due to rent seeking, increase of transaction costs and uncertainty, inefficient investments, and misallocation of production factors (Murphy et al., 1991; Shleifer and Vishny, 1993; Rose-Ackerman, 1997; Kaufmann and Wei, 2000). Empirical evidence at the firm-level is also ambiguous: some papers find that bribery is harmful (McArthur and Teal, 2004; Fisman and Svensson, 2007; De Rosa et al., 2015), while others find a positive effect (Vial and Hanoteau, 2010). Overall the evidence remains scarce due to the lack of available data.

In this paper we contribute to the firm-level empirical research on bureaucratic corruption and firm performance, and explain the divergent effects of corruption found in previous studies. We employ a rich firm-level panel dataset with a widely-accepted measure of bureaucratic corruption (bribery) that allows us to alleviate some of the methodological concerns of existing research. We focus on a group of countries from Central and Eastern Europe (CEE), as they have a similar history of transition to a market economy, but are still institutionally diverse.

Our approach is to combine the information on firm bribery practices, measured as the frequency of bribing public officials to 'get things done,' from BEEPS[1] and firm

[1] BEEPS (Business Environment and Enterprise Performance Survey) is a part of the global WBES (World Bank Enterprise Survey)

financial data from the Amadeus database. This gives us a large firm-level panel data for 14 CEE, which have more accurate and detailed information on firms' economic activity and bribery than BEEPS alone. Previous studies that use firm bribery practices and performance from anonymous surveys such as BEEPS or WBES suffer from missing data, as firms are often reluctant to reveal their financial records (Gaviria, 2002; McArthur and Teal, 2004; Fisman and Svensson 2007; De Rosa et al., 2015).[2] Those studies also deal with cross-sectional data, while we are able to exploit the panel structure of our dataset. In the regression analysis we control for firm fixed effects, which eliminate time-invariant factors that could simultaneously cause bribery, and firm performance. This is an important step to diminish the endogeneity of the bribery measure, given the recognized difficulties in finding exogenous variation to explain corruption.

To combine two datasets we introduce 'local bribery environments.' We define 'local markets,' in which firms operate, as clusters jointly formed by survey wave, country, double-digit industry, firm size, and location size. This is relevant, since bureaucratic corruption might be a local phenomenon that depends not only on country, but industry, firm and markets size. We then analyze how the 'local bribery environments' – characterized by the means and dispersions of individual firm bribes – influence the economic performance of firms. We compute the mean and standard deviation of the bribery measure from BEEPS for all local markets. For firms from Amadeus we can also identify those markets, and thereby each firm is assigned characteristics of the local bribery environment. Economically, the bribery mean approximates the equilibrium level of bribery in a local market. The bribery dispersion, meanwhile, represents the pervasiveness of bureaucratic corruption, and the availability of opportunities for some firms to extract benefits from bribery.

[2] For example, in the widely-used BEEPS and WBES databases about 40 to 50% of firms do not report their performance indicators.

The use of the notion of local bribery environments is another step to reduce the endogeneity of bribery measures, since an individual firm's performance less likely affects the bribery environment than its own bribing behavior. The joint use of two independent data sources also alleviates this concern, because different firms report financial statements and bribery. Our approach thus provides more accurate estimates of the effect of bribery on firm performance than those obtained from previous studies.

Similar to many papers (Gaviria, 2002; Beck et al., 2005; Fisman and Svensson, 2007; Vial and Hanoteau, 2010) we measure firms' performance as sales and labor productivity growth of firms, as these enhance wealth and employment creation, and stimulate economic development. The results of the empirical analysis, identified from within-firm variation, show that the ambiguous consequences of corruption found in previous studies can be explained by the different effects of the mean and dispersion of bureaucratic corruption in the local environment. In particular, a higher bribery mean impedes both the real sales and the labor productivity growth of firms. This is generally consistent with the existing firm- and macro-level empirical research. In contrast, a higher dispersion of individual firm bribes facilitates firm performance. Moreover, firms are more likely to increase their growth rates in the environments with both a higher bribery mean and higher dispersion. We also find that these impacts are more pronounced in the case of labor productivity growth. These results are robust to various specification checks.

Our results suggest that in more dispersed local bribery environments at least some firms that bribe receive preferential treatments from public officials, and non-bribing firms are likely to be efficient in production and growth. The existence of a certain number of bribing firms in a local market, therefore, stimulates aggregate firm performance. This finding is in line with Acemoglu and Verdier (2000), as positive effects from bribery dispersion can overshoot negative effects from the bribery mean. The chance to receive benefits from bribery for particular firms may be one reason why corruption does not

vanish, in spite of its overall growth restraining effect (Mauro, 1995; Aidt et al., 2009). In addition, we find that our results vary for different types of firms. Smaller firms are least affected by bribery, while service firms are able to gain most in environments with higher corruption dispersion. We also observe that in countries with stronger institutions, the effects of bribery mean and dispersion are more pronounced.

The reminder of the paper is structured as follows. Section 2 introduces the notion of 'local bribery environments' and discusses its relation to firm performance. Section 3 describes the data and explains the merging of the financial information and the bribery practices of firms. Section 4 outlines the empirical methodology. Section 5 presents the results and robustness checks, and section 6 concludes.

2. Local Bribery Environments and Firm Performance

The institutional environment of a country largely determines its level of economic development, overall corruption, and the behavior and performance of firms (Acemoglu, 2003). However, a country may consist of many narrow local markets that can be heterogeneous with respect to economic conditions as well as bribery practices. A small furniture company located in a rural area, for instance, may face a different demand for, and provide a different supply of bribes than a large retail firm located in a capital city.

In this paper we focus on local markets that are comprised of firms sharing a similar size, area of economic activity (industry), and location size. We characterize these local markets by the levels of bribery mean and dispersion of individual firm bribes, which we term the 'local bribery environments.'[3] The bribery mean can be viewed as an equilibrium level of corruption in a local market, defined by the demand from public officials and

[3] The notion of the 'local bribery environment' is aligned with the arguments of Svensson (2003) and Fisman and Svensson (2007) that bribery is industry- and region-specific. They suggest that a firm depends more on public officials, and therefore might have to pay higher bribes (or pay bribes more often) if it requires more permits and licenses due to specifics of its economic activity or location. Del Monte and Papagni (2007) and Ledyaeva et al. (2013) demonstrate the variation of corruption across regions in Italy and in Russia, respectively. However, it is unlikely that all firms in a local market always bribe equally.

supply by firms. Bribery dispersion reflects firms' willingness to bribe (Bliss and Tella, 1997; Svensson, 2003; Luo and Han, 2008), the discretionary power of public officials and uncertainty in a local market. We outline possible links between firm growth and local bribery environments below.

Higher bribes or frequency of bribing can alter firms' incentives to grow, such that they prefer to remain small and less visible to public officials (Gauthier and Goyette, 2014). Bribery can also restrain firms from obtaining licenses and permissions, which undermines innovations and investment (O'Toole and Tarp, 2014), and can limit exporting and importing activities essential for firm growth. In the same vein, if public officials demand bribes repetitively, firms may chose inefficient technology and lower investments, as Choi and Thum (2004) show. Bribery can also cause longer delays in public services provision, and thereby project interruptions, if bureaucrats tend to increase red tape in order to extract more bribes (Kaufmann and Wei, 2000). Finally, higher bribes can provoke reallocation of talent from production to rent-seeking (Murphy et al., 1991, Dal Bo and Rossi, 2007). In this case, one would expect a negative relationship between bribery mean and firm performance. Some empirical research finds either an insignificant or negative impact of bribery on the sales growth or productivity of firms (for example, Gaviria, 2002; McArthur and Teal, 2004; Fisman and Svensson, 2007). For CEE and the former Soviet Union countries, De Rosa et al. (2015) show that bribery more negatively affects firm productivity in non-EU countries and in those with weaker institutions.

However, if bribery works as a 'grease the wheels' instrument, it can help overcome some bureaucratic constraints and inefficient public services provision. This would create a positive relationship between bribery mean and firm performance (Huntington, 1968; Lui, 1985; Lein, 1986; and Vial and Hanoteau, 2010, present empirical evidence for Indonesia).

The relationship between dispersion of individual firm bribes and firm performance is less straightforward. Given a positive level of bribery mean, in an environment with low

bribery dispersion, all firms bribe in the same way. Corruption is pervasive and can be seen as a tax or an additional fee for public services provision. This should not create distortions other than those connected to the bribery mean.

In an environment with higher bribery dispersion the variation of frequency of bribing is high. This possibility is well documented in the empirical literature (e.g., Svensson, 2003; Luo and Han, 2008). However, theoretical research does not provide clear guidance on the effects of bribery dispersion on firm performance. We thus highlight a few outcomes.

In order for higher bribery dispersion to facilitate joint firm performance in a local market, bribery should benefit all, or the majority of bribing firms. This situation could happen when bribing firms are able to exploit favorable opportunities from bribery, and are efficient in giving bribes. At the same time public officials are able to discriminate between firms to extract more bribes in a local market.[4] Non-bribing firms must be efficient in complying with bureaucratic regulations, and benefit from better allocation of their production recourses, as otherwise bribing firms would crowd out those that do not bribe.[5] This does not imply, however, that bribing firms must always be less efficient in production. Such an outcome would be in line with Acemoglu and Verdier (2000), showing that when the government intervenes to correct market failures, a small amount of corruption may exist as part of an optimal allocation of resources. Infante and Smirnova (2009) demonstrate that in weaker institutional environments, rent-seeking bureaucrats can help improve the productivity of entrepreneurs. Similarly, De Vaal and Ebben (2011) suggest that when the initial quality of institutions is below a certain threshold, bureaucratic corruption facilitates economic performance, as it takes on the role of institutions. These papers, however, discuss

[4] Diaby and Sylwester (2014), for instance, show that bribes are higher when bureaucracy is decentralized.
[5] Hanousek and Palda (2009), for example, find that in an uneven environment, efficient non-tax-evading firms are crowded out by inefficient tax-evading firms.

beneficial effects of corruption for social welfare, while we focus on the effects for aggregate firm performance in local markets.

In contrast, if bribery helps only a minority of bribing firms, creates negative externalities (Kaufmann and Wei, 2000), and does not incentivize non-bribing firms to perform better, then in a more dispersed local bribery environment firm performance can deteriorate. This could happen, for example, when public officials target the most productive firms, which in response degrade their technology and investment (Choi and Thum, 2004). Such an outcome is in line with Mauro (1995), Aidt et al. (2009) and O'Toole and Tarp, (2014).

Finally, a higher bribery dispersion can be perceived as a higher uncertainty in a local market, which can lead to negative outcomes (Shleifer and Vishny, 1993; Choi and Thum, 2004). Given the disagreement on the effects of bribery on firm performance in the literature, and missing theoretical predictions regarding the possible impact of bribery dispersion, we have a strong incentive to analyze the relationship between the characteristics of the local bribery environment and firm performance.[6] In the next section we describe our data, the definitions of local bribery environments and other variables, prior to empirical analysis.

3. Data

3.1. Data Sources

The bribery measure is taken from BEEPS, an anonymous survey of a stratified random sample of firms from CEE and former Soviet Union countries.[7] It consists of a rich set of questions about firms' activity, market orientation, financial performance and employment,

[6] The analysis of the specific channels through which bribery can impact firm growth is, however, beyond the scope of this paper.

[7] BEEPS is collected jointly by the World Bank and the European Bank for Reconstruction and Development. The data are available online at https://www.enterprisesurveys.org and at http://ebrd-beeps.com/data/. Data for this paper was downloaded from the first source.

as well as infrastructural, criminal, corruption and legal environments. A disadvantage of BEEPS is missing data for questions related to accounting information (40–50% missing data on sales, assets, costs, etc.), which can imply a biased inference from the data analysis. For instance, the worst-performing firms may not report their accounting information and complain more about corruption (Jensen et al., 2010). Each wave of BEEPS covers the three preceding years; we use the three waves completed in 2002, 2005, and 2008.

The financial data comes from the Amadeus database. It contains detailed balance sheet and income statement data, as well as industry codes and the exact identification of European firms.[8] Because non-active (unresponsive or exiting from the market) firms are excluded from the database after a certain period, we have merged several editions of Amadeus (2003, 2007, and 2010).

For the analysis we chose 14 CEE countries that are well covered in both Amadeus and BEEPS: Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, and Ukraine. These countries are similar in that they started the transition to a market economy at approximately the same time. They are, however, quite different in overall corruption levels, as Figure A.1 in Appendix A shows for the Control of Corruption indicator from the Worldwide Governance Indicators (WGI) database compiled by the World Bank.

Both the BEEPS and Amadeus databases tend to understate very small firms, and Amadeus tends to overstate large firms (Klapper et al., 2006). In addition, during data cleaning of Amadeus we removed firms with less than two employees that potentially could have been created for purposes of tax evasion (Klapper et al., 2006).[9] Due to these facts, we conduct analysis for different subsamples of firms, in particular, for firms of different sizes and industrial sectors.

[8] Details about the Amadeus database can be found at http://www.bvdep.com.

[9] The data cleaning procedure as well as a detailed comparison of firm distributions in BEEPS and Amadeus with the whole population of firms retrieved from OECD.STAN for eight OECD countries is available in the Online Appendix.

3.2. Combining Information from the BEEPS and Amadeus Databases

The joint use of the BEEPS and Amadeus databases provides a good opportunity to study the effects of local bribery environments on firm performance. To combine bribery practices with firm financial information we define clusters that represent local markets, using the following criteria: i. country; ii. time period (1999–2001, 2002–2004, and 2005–2007, corresponding to the waves of BEEPS); iii. industry (two-digit ISIC rev 3.1 industry code), 4) firm size (micro firms with 2–10 employees, small firms with 11–49 employees, and medium and large firms with more than 50 employees); and iv. location size (capital, city with population above 1 million, and city with population below 1 million). A resulting cluster combines all criteria: country, time, industry, firm size and location size.[10]

It is straightforward to identify clusters in both databases. In both BEEPS and Amadeus firms report industry and employment data. In BEEPS firms record the size of location. In Amadeus firms report the address of registration, which we use to identify capitals and cities with a population above 1 million (these are only in Russia and Ukraine) to construct a location size variable.

The criteria defining clusters explain 40% of the total variation of the bribery measure in BEEPS.[11] We require each cluster to have at least 4 firms, which reduces sample size to 10,097 firms (67% of the original sample), available for use in BEEPS, and we obtain 1,137 clusters in total. The average number of firms in a cluster is 8.87 and the median is 6. For each cluster we compute the mean and standard deviation of individual firm bribes and assign them to every firm in the Amadeus database operating in the same

[10] We cannot utilize 'regions' in the criteria defining local markets, as would be in accordance with Svensson (2003) and Fisman and Svensson (2007), since regions are not consistently defined in BEEPS. In the robustness check, therefore, we show that the results of this study remain the same for the subsample of firms located in the capital cities only and for the case when size of location is omitted from the criteria defining clusters.

[11] This result is R^2 obtained from the analysis-of-variance (ANOVA) with the bribery measure as a dependent variable and all interactions between country, year, industry, firm size, and location size as independent variables.

cluster. Given the structure of the data, the mean and standard deviation of the bribery measure are a good way to describe the bureaucratic corruption environment in the local market. They represent an equilibrium bribery level and the dispersion of individual firm bribes.[12]

The initial sample size available for use in Amadeus is around 1,450,000. When combining two datasets, only two clusters computed using BEEPS have no counterparts in Amadeus. About 48% of observations from Amadeus got assigned characteristics of the local bribery environments,[13] which yields around 700,000 firm-year observations useful for analysis.

Our final dataset results in unbalanced firm-level panel data for 1999–2007 where the bribery measures vary across clusters and remain constant over three-year periods. For the regression analysis we reduce the time span to three time periods to match the variation of bribery measures. Besides the availability of high quality firm-level financial data, the advantage of our dataset is the alleviation of the endogeneity between firm performance and bribery, which we discuss in detail in Section 4. Another advantage is the reduction of measurement error and firm-specific perceptions (due to managers' optimism or pessimism) in the bribery mean measure, by averaging them out.

[12] Anos-Casero and Udomsaph (2009) and Commander and Svejnar (2011) also attempt to combine two datasets using the 2002 and 2005 waves of BEEPS for 7 – 8 CEE countries. Our main departure from these papers is that we separate micro firms with fewer than 10 employees from small firms with 11-49 employees. This is motivated by the fact that originally nearly 45% of firms in BEEPS and 40% of firms in Amadeus are micro firms. Clearly, micro firms might be exempted from some bureaucratic regulations and taxes (World Bank, 2004; European Commission, 2011), and consequently they may encounter demands from public officials less often. Anos-Casero and Udomsaph (2009) and Commander and Svejnar (2011) study how business constraints impact TFP and efficiency to generate revenue. A recent paper by Fungacova et al. (2015) uses exactly the same criteria in defining clusters as we do. It studies whether bribery affects firm-level bank debt. None of these papers, however, examine the dispersion of individual firm bribes or business constraints within clusters.

[13] 48% of observations from Amadeus merged with BEEPS is a large number, since a complete number of clusters in the roster would be 8100=14(country)*3(wave)*2(3 for Russia and Ukraine, location size)*3(firm size)*30(industry). But because BEEPS does not cover all firms, industries, etc. combinations, and we disregard clusters with less than 4 firms, we have only 1,137 clusters (14%).
Additional summary statistics are available in the Online Appendix. For example, after merging, around half of the sample belongs to Russia and Ukraine, while in BEEPS these countries represent only 30%. This redistribution across countries, however, does not affect our results, as we show in the robustness check.

3.3. Definitions of Variables

The bribery measure is obtained from answers to the following BEEPS question:

Thinking about officials, would you say the following statement is always, usually, frequently, sometimes, seldom, or never true: "It is common for firms in my line of business to have to pay some irregular "additional payments/gifts" to get things done with regard to customs, taxes, licenses, regulations, services, etc.?[14]

Amongst the questions about corruption, this one is the most neutral, and virtually the only one that occurs consistently across all three waves. The variable is categorical and takes values from 1 to 6. Higher values stand for higher frequency of bribing. For convenience we rescale it to a variable that varies from 0 to 1 by subtracting 1 from the original value and dividing the result by 5. Figure A.2 in Appendix A offers a country-time variation of this measure. It is heterogeneous across countries and decreases overall with time.

The dependent and control firm-level variables come from the Amadeus dataset. For performance variables we consider real sales growth and real labor productivity growth, as used in previous studies (Gaviria, 2002; Beck et al., 2005; Fisman and Svensson, 2007; Vial and Hanoteau, 2010).[15] Real sales are approximated by the firm operational revenue in 2000 prices, and labor productivity is real sales per employee. We take the first differences of the logarithms of these measures to derive yearly growth rates. Further, we average these growth rates over three-year periods in order to match the variation of bribery mean and dispersion. Essentially, we moved from the nine-year time span to the three-period time span for the regression analysis.

[14] The framing 'in my line of business' or 'typical firm like yours' is a common approach to provide more confidence to respondents and at the same time to elicit their own experience.

[15] We do not measure productivity as TFP (total factor productivity) or value-added per employee, because Amadeus has many missing values in the intermediate material and staff cost variables for CEE countries; Russia, Latvia, and Lithuania do not report them at all. We use a simplified version of productivity that allows firms' capital and intermediate costs to be flexible.

We expect that a local bribery environment may have somewhat different effects on these performance measures. We opt for the analysis of sales, as company turnover is not directly affected by corporate income taxes and transfers. On the other hand, labor productivity should reflect changes in employment structure, and therefore reveal firm performance potential in a longer horizon. The dynamics of these firm characteristics are important for development as they enhance economic welfare and employment creation.

For controls we employ the usual set of variables used in the firm-level financial studies. To proxy firm size we use the logarithms of total assets and number of employees, as well as their squares, to control for possible non-linearity.[16] Market share is the ratio of sales of a firm to total sales in an industry defined at the four-digit level. Firm profitability is defined as EBIT (earnings before interest and taxes) over total assets. Leverage equates to book leverage ratio – total debt over total assets, and cash flow is the reported cash flow scaled by total assets. All control variables are from 1999, 2002, and 2005 to control for initial conditions, as we move to the three-period panel data.

Our control variables can correlate with bribery measures and reduce the omitted-variable bias. Firms with lower market shares, for instance, can be more engaged in bribery in order to survive on the market. Luo and Han (2008) report such a correlation in a study of the determinants of bribery and graft using WBES for several developing countries. More profitable firms may have a higher willingness to pay and can pay larger bribes and/or more frequently (Bliss and Tella, 1997; Svensson, 2003). Firm leverage can also correlate with bribery if unofficial payments are needed to obtain external financing (Beck et al., 2005; Fungacova et al., 2015). The availability of cash can also open greater opportunities for bribe payments. In addition, the control variables restrict the sample to those firms that report all essential financial information, making it more homogeneous across countries.

[16] Inclusion of initial levels of sales or labor productivity, as well as their squares, in addition to or instead of initial levels of total assets and employment does not change our main results. These additional results are available upon request.

Finally, to proxy for the strength of country-level institutions, we use the rule of law indicator, which we obtain from the Worldwide Governance Indicators (WGI) database compiled by the World Bank. We rescale this indicator to a variable that ranges from 0 to 1, where higher values stand for a stronger rule of law. Appendix B details definitions of all employed variables. Summary statistics of variables and their pairwise correlations are in Tables 1 and 2.

Table 1: Summary statistics

	Mean	Median	SD	Min	Max
Sales growth	0.05	0.04	0.52	-3.92	4.53
Productivity growth	-0.03	-0.03	0.47	-3.58	4.55
Total Assets	4.14	4.05	2.04	-4.14	14.75
Employees	2.61	2.40	1.36	0.18	11.34
Profitability	0.11	0.07	0.33	-5.96	33.71
Market Share	0.00	0.00	0.02	0.00	1.00
Leverage	0.67	0.67	0.47	0.00	24.83
Cash Flow	0.06	0.03	0.36	-16.81	137.31
Bribery Mean	0.30	0.29	0.14	0.00	0.80
Bribery Dispersion	0.27	0.28	0.09	0.00	0.58
Rule of Law	0.32	0.17	0.26	0.00	1.00

Note: The Table reports summary statistics of all used variables. The definitions of the variables are in the text and Appendix B. Number of observations is 678,381, non-missing for all variables.

Table 2: Pairwise correlations

		1	2	3	4	7	8	9	10	11	12
1	Sales growth										
2	Productivity growth	0.60 [a]									
3	Total Assets	-0.03 [a]	0.04 [a]								
4	Employees	-0.08 [a]	0.07 [a]	0.67 [a]							
7	Profitability	0.04 [a]	-0.02 [a]	-0.06 [a]	-0.02 [a]						
8	Market Share	-0.00	0.01 [a]	0.19 [a]	0.17 [a]	-0.00 [a]					
9	Leverage	0.01 [a]	-0.02 [a]	-0.12 [a]	-0.11 [a]	-0.25 [a]	-0.03 [a]				
10	Cash Flow	0.04 [a]	-0.01 [a]	-0.01 [a]	-0.02 [a]	0.65 [a]	-0.00	-0.25 [a]			
11	Bribery Mean	0.00	-0.02 [a]	-0.06 [a]	0.13 [a]	0.02 [a]	-0.05 [a]	0.01 [a]	-0.00		
12	Bribery Dispersion	-0.00	-0.00	-0.16 [a]	-0.03 [a]	0.02 [a]	-0.05 [a]	0.00 [a]	-0.01 [a]	0.57 [a]	
13	Rule of Law	0.03 [a]	0.06 [a]	0.25 [a]	-0.12 [a]	-0.02 [a]	0.09 [a]	-0.01 [a]	0.02 [a]	-0.47 [a]	-0.35 [a]

Note: The Table reports pairwise correlations between all used variables. The definitions of the variables are in the text and Appendix B. Number of observations is 678,381, non-missing for all variables. The symbols [a], [b], and [c] denote significance at the 1%, 5%, and 10% levels, respectively.

4. Empirical Methodology

The identification of the relation between bribery and firm performance is not straightforward due to possible endogeneity. Bribery may influence firm performance by increasing or reducing constraints on operation and growth, while better performing firms

may have a greater willingness and ability to pay bribes. This reverse causality can be further induced by unobservable factors that correlate with both firm performance and bribery practices, such as managerial talent and firm culture.

In the context of this study, the endogeneity problem is largely reduced for several reasons. First of all, we control for firm fixed effects that remove time-invariant unobservable factors that could potentially cause both firm performance and bribing behavior. The identification in our regression analysis thus comes from within firm variation over time, and we assume bribery measures to be exogenous. Second, instead of bribing behavior of individual firms, we employ more aggregated measures – bribery mean and dispersion in a local market defined by industry, firm-size, and location-size characteristics. Arguably, an individual firm has a negligible influence on these aggregate measures.[17] This influence is further decreased when firm performance and bribery measures come from different independent data sources (Anos-Casero and Udomsaph, 2009).

Nevertheless, in the next section we first compare the estimates identified from within-firm variation with the estimates identified from within-cluster variation to demonstrate the reduction of the endogeneity bias. This occurs because average firm performance within a cluster more likely affects mean bribery, inducing a bias of the estimates (upward bias if better performing firms are ready to bribe more frequently). Admittedly, firm fixed effects are not able to eliminate biases due to temporal endogeneity.

[17] In view of the difficulty in finding appropriate instruments for bribery measures, the use of industry-location or industry-location-firm size average measures of bribery or obstacles to firm growth and operation instead of firm-specific measures is a handy approach to reduce the endogeneity problem in existing research, which employs cross-sectional data from BEEPS, WBES, or IC (Investment Climate). See, for example, Dollar et al. (2005), Aterido et al. (2011), and Commander and Svejnar (2011).

Our empirical specification is a typical growth equation, originally proposed by Evans (1987), where the dependent variable is the growth rate and the independent variables are lagged to control for initial conditions.[18]

$$y_{it} = \beta_0 + \beta_1 Bribery\ Mean_{ct} + \beta_2 Bribery\ Dispersion_{ct} + \gamma X_{it-1} + \upsilon_i + \nu_t + \varsigma_s + \varepsilon_{it,} \quad (1)$$

where y_{it} is the performance measure of firm i at time period t; it is either real sales or labor productivity growth rates, averaged over three-year periods (1999-2001, 2003-2004, 2005-2007). $Bribery\ Mean_{ct}$ and $Bribery\ Dispersion_{ct}$ are the mean and standard deviation of the frequency to pay bribes in cluster c. The coefficients of interest are β_1 and β_2. Their positive signs would favor the 'grease the wheels' hypothesis of corruption.

The vector X_{it-1} stands for the vector of firm-level control variables. They are measured at the beginning of each time period (i.e. at 1999, 2002, and 2005), to control for the initial conditions, and to reduce possible endogeneity between them and firm performance measures. The full set of control variables is described in Section 3. The term υ_i removes unobserved firm fixed effects that can create across-time correlation of the residuals of a given firm (e.g. managerial skill). The term ν_t removes unobserved time fixed effects that can be responsible for the correlation of the residuals across different firms in a given year (e.g. aggregate shocks or business cycles). The term ς_s captures unobserved firm-size fixed effects (micro, small, and medium-large firms) that can lead to the correlation of the residuals across firms of a given size category due to, e.g., specific regulations attached to firms of a particular size;[19] and ε_{it} is the *i.i.d.* random component. We estimate specification (1) using standard errors robust to heteroskedasticity and clustered at the firm

[18] Similar specifications are also widely used in the literature that studies the effects of privatization, political connections, and other events on firm performance, see, for example, Hanousek et al. (2007) and Boubakri et al. (2008).

[19] We control for firm-size fixed effects, because firm size is included in the criteria defining clusters, and some firms move from one size category to another over time. The country, location and industry factors from the criteria are removed when firm fixed effects are taken into account. The exclusion of firm-size fixed effects, however, does not affect the results.

level. In addition, we account for influential observations using Cook's distance as the data for CEE countries are highly volatile.[20]

Finally, we are concerned about measurement error in the bribery variables. Under the assumption of the classical measurement error – it does not correlate with the error from the regression – the coefficients of interest would be biased towards zero. This assumption seems plausible as we use two combined independent datasets. In addition, we believe that the possible measurement error is averaged out in our bribery mean measure; this, however, may not be the case for bribery dispersion. The retained measurement error, therefore, could attenuate the estimates.

5. Results and Discussion

5.1. Baseline Results

Table 3 reports the results of the estimation of specification (1). Odd columns present the results for the dependent variable, real sales growth, and even columns – for labor productivity growth. In columns I–IV we control for time, country, industry, location, and firm-size fixed effects. In columns V–VIII we add firm fixed effects.

Table 3: Baseline results

	(I) Sales	(II) Productivity	(III) Sales	(IV) Productivity	(V) Sales	(VI) Productivity	(VII) Sales	(VIII) Productivity
Bribery Mean	-0.039[a]	-0.016[a]	-0.057[a]	-0.033[a]	-0.042[a]	-0.072[a]	-0.096[a]	-0.139[a]
	(0.004)	-0.004	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Bribery Dispersion			0.056[a]	0.054[a]			0.174[a]	0.219[a]
			(0.007)	(0.006)			(0.008)	(0.007)
Total Assets	-0.019[a]	0.003[a]	-0.019[a]	0.003[a]	-0.075[a]	-0.038[a]	-0.076[a]	-0.040[a]
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Employees	-0.260[a]	0.085[a]	-0.260[a]	0.084[a]	-0.072[a]	-0.005[c]	-0.070[a]	-0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Total Assets Sq.	0.003[a]	-0.002[a]	0.003[a]	-0.002[a]	0.003[a]	-0.002[a]	0.003[a]	-0.002[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Employees Sq.	0.017[a]	-0.001[a]	0.017[a]	-0.001[a]	-0.009[a]	0.021[a]	-0.009[a]	0.020[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	0.009[a]	-0.053[a]	0.010[a]	-0.053[a]	0.003	-0.024[a]	0.001	-0.028[a]
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Market Share	-0.046[a]	-0.406[a]	-0.048[a]	-0.407[a]	-0.928[a]	-1.108[a]	-0.916[a]	-1.045[a]
	(0.012)	(0.015)	(0.012)	(0.016)	(0.081)	(0.085)	(0.078)	(0.080)
Leverage	0.042[a]	0.008[a]	0.042[a]	0.008[a]	0.032[a]	0.040[a]	0.031[a]	0.039[a]
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)

[20] Cook's distance is a measure based on the difference between the regression parameter estimates $\hat{\beta}_i$ and what they become if the i^{th} data point is deleted $\hat{\beta}_{-i}$. Observations for which this distance exceeds 4/N are removed as outliers, where N is the number of observations used in the regression (Cook, 1977).

Cash Flow	0.126[a]	0.047[a]	0.124[a]	0.048[a]	0.074[a]	0.031[a]	0.076[a]	0.037[a]
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Time, Country, Industry, and Location size FEs	yes	yes	yes	yes	-	-	-	-
Firm, Time, and Firm size FEs	-	-	-	-	yes	yes	yes	yes
N observations	653,460	651,849	652,950	651,415	628,239	627,758	627,459	627,067
N group					446,205	446,280	445,678	445,807
R2 adjusted/within	0.081	0.074	0.081	0.074	0.218	0.111	0.224	0.117
Average bribery mean effect	-1.22%	-0.49%	-1.79%	-1.02%	-1.29%	-2.22%	-2.97%	-4.32%
Average bribery dispersion effect			1.49%	1.45%			4.66%	5.87%
Average total effect			**-0.30%** [c]	**0.42%** [b]			**1.70%** [a]	**1.55%** [a]

Note: The Table reports the results of the estimation of specification (1) for two performance measures as dependent variables: real sales growth and labor productivity growth. All control variables are measured at the beginning of each time period (i.e., at 1999, 2002, or 2005). The definitions of the variables are in the text and Appendix B. The average effects are the products of the estimated coefficients on bribery mean and dispersion and the sample average values of the corresponding variables; the average total effect is the sum of these two effects. Standard errors shown in parentheses are robust to heteroskedasticity and clustered at the firm level. Cook's distance is used to account for influential observation. The symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

If better firm performance is generally associated with higher participation in bribery, then $\hat{\beta}_1$ in within-cluster regressions (columns I–IV) should be biased upward, because cluster-level firm performance may more likely affect cluster-level bribery. If lower performing firms have more incentives to bribe in order to take shortcuts, then the bias could be downward. Even if we are not certain about the bias direction, controlling for firm fixed effects should reduce this bias. The coefficient $\hat{\beta}_1$ is smaller in columns V–VIII compared to columns I–IV, advocating for the lessening of (upward) endogeneity bias, and the use of firm fixed effects regressions.[21]

The comparison of columns I–II with III–IV and of columns V–VI with VII–VIII also shows that the inclusion of bribery dispersion variable into regressions does not change the sign or significance of $\hat{\beta}_1$. This permits us to analyze both bribery mean and dispersion variables together. The bottom of Table 3 shows the average effects of the bribery mean and dispersion on firm performance as well as their sum.[22]

[21] In the case of bribery dispersion, in within-cluster regression, its impact on firm growth is also more diluted than in within-firm regression.

[22] We compute the average effects as a product of the sample average value of the bribery mean or bribery dispersion and the corresponding estimated coefficient. For example, in column VII of Table 3, the average effect of the bribery mean on sales growth is $(-0.096 \times 0.311) \times 100\% \approx -2.97\%$,

Using the regressions from columns VII and VIII as benchmarks, *ceteris paribus*, the increase in bribery mean by its average value is associated with a 3.0% and 4.3% decrease in corresponding firm performance measures. These numbers are relatively large since the average real sales growth is 4.6% and the average labor productivity growth is negative 3.1% in our sample. The results thus show that bribery is a burden for firm performance, which is consistent with some previous findings at both the micro (Fisman and Svensson, 2007; De Rosa et al., 2015) and macro level (Mauro, 1995; Aidt et al., 2009).

The estimates of the coefficients on bribery dispersion, in contrast, are positive for both dependent variables, and highly significant. For a given level of bribery mean in a local market, the average bribery dispersion effects are 4.7% and 5.9% for the two performance measures. The sum of the average bribery mean and dispersion effects is positive and equals 1.7% for sales growth and 1.6% for labor productivity growth.

These results suggest that while a higher level of bribery impairs sales and labor productivity growth, firms grow faster in local environments with a higher dispersion of individual firm bribes. Hence bribery 'greases the wheels' of doing business for individual firms, but harms firms' collective economic performance. In more dispersed environments, firms that are more efficient in bribery (but not necessarily inefficient in production) – those that have more information about 'greasing the wheels', are discriminated by the public officials in a mutually beneficial way, with lower costs or higher willingness to bribe – apparently bribe more frequently. Owing to bribes, they most likely generate higher growth rates than if they were not to bribe. Their non-bribing (or less frequently bribing) counterparts must be efficient in production and growth to compete with bribing firms. In this case, both types of firms are able to generate increasing sales and labor productivity growth rates in a local market.

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where −0.096 is the estimate of the coefficient on the bribery mean and 0.311 is the sample average of the bribery mean variable.

In less dispersed local bribery environments, if the number of bribing firms prevails, negative externality from bribery (such as incentives to induce the bureaucratic burden by public officials) can slow down growth rates. If the number of non-bribing firms dominates, then there can be fewer incentives for firms to be efficient and compete aggressively with occasionally bribing firms.

The results also show that the effects of bribery mean and dispersion are sounder for labor productivity than for sales growth rates. This suggests that participation in bribery affects the employment structure of firms. In highly corrupt environments, firms likely employ a non-optimal (higher) number of workers due to misallocation of talent, in accordance with Murphy et al. (1991) and Dal Bo and Rossi (2007). It may also be the case that public officials (or local government), having established a connection with a firm, do not allow it to dismiss its workers in order to keep high employment figures and more loyal voters. However, bribing firms that have an opportunity to gain a competitive edge over their non-bribing counterparts (in more heterogeneous environments) are able to adjust the employment structure to an optimal level and increase performance.

The results thus show that bribery can work as the 'grease the wheels' instrument, despite its overall damaging effect. The existence of a certain number of bribing firms in a local market increases aggregate firm performance, as the positive effect from the bribery dispersion exceeds the negative effect from the bribery mean. To some extent these findings are in line with theoretical predictions of Acemoglu and Verdier (2000), Infante and Smirnova (2009) and De Vaal and Ebben (2011).

The following subsections examine the effect of bribery with respect to the heterogeneity of firms and environments, to better understand what drives the relation between bribery and firm performance. The last subsection describes robustness checks.

5.2. Heterogeneity of Firms

5.2.1. Manufacturing and Service Firms

In our dataset, firms from manufacturing sectors represent only 14.5% of the sample. On average, they tend to have lower sales growth, higher labor productivity growth, and pay bribes less often than firms from service sectors.[23] Panel A in Table 4 presents the results of the estimation of specification (1) for manufacturing, service, and construction firms separately. In this table, for the sake of space, we present only average bribery mean and dispersion effects, while the full estimation results are available in the Online Appendix. The estimated coefficients on bribery mean and dispersion are different for the manufacturing and services firms.

Higher bribery mean in a local environment significantly reduces the performance of manufacturing firms, especially the real sales growth. Operating in more bribery heterogeneous environments does not bring them benefits either (see columns I–II, Panel A in Table 4). One explanation of this result is that larger manufacturing firms are more visible and attractive to corrupt public officials. At the same time size can make these firms less flexible in responding to the bribery and lessen the capacity to extract benefits in dispersed local bribery environments. Manufacturing firms also tend to have a larger share of foreign ownership and exports, which is usually associated with higher management standards, stricter attitudes against corruption and, perhaps, a poorer ability to deal with it.[24]

Another explanation for the result may be that our bribery measure does not reflect well the nature of corruption practices among manufacturing firms. These firms arguably require fewer permits, licenses, and inspections than do service firms but might depend more heavily on relationships with customers and supply chains. Their corruption practices, therefore, might instead consist of kickbacks between businesses.

[23] These statistics are available in the Online Appendix.
[24] Unfortunately, data limitations do not allow us to control for firm ownership structure or export shares.

Service firms, in contrast to manufacturing, are usually smaller, more flexible, and likely to interact more often with public officials. Although on average they suffer as well from a higher bribery mean, they are also able to gain significantly in local markets with higher bribery dispersion, see columns III-IV in Panel A, Table 4. To a large extent these service firms belong to wholesale and retail industries as they represent about a half of the whole sample. Approximately 15% of the sample belongs to the construction industry. The last two columns in Panel A, Table 4 show that construction firms are able to gain very high returns in dispersed bribery environments, possibly related to bribery associated with public construction tenders, building permits, related regulations, etc.

Table 4: Different types of firms

	(I) Sales	(II) Productivity	(III) Sales	(IV) Productivity	(V) Sales	(VI) Productivity
Panel A: Manufacturing and service firms						
	Manufacturing		Services		Construction	
N observations	88 917	88 960	442 567	441 964	96,137	96,402
Average bribery mean effect	-6.99 [a]	-3.95 [a]	-1.08 [a]	-3.57 [a]	-3.74 [a]	-5.05 [a]
Average bribery dispersion effect	-0.68	-2.37 [a]	3.65 [a]	6.30 [a]	10.42 [a]	7.79 [a]
Average total effect	**-7.67 [a]**	**-6.32 [a]**	**2.57 [a]**	**2.73 [a]**	**6.68 [a]**	**2.74 [a]**
Panel B: By firm size: Micro, small and large firms						
	2–10 employees		11–49 employees		50+ employees	
N observations	291 283	291 513	228 848	228 688	107 719	107 728
Average bribery mean effect	-0.76 [a]	-2.79 [a]	-3.80 [a]	-3.79 [a]	-6.78 [a]	-5.04 [a]
Average bribery dispersion effect	0.87 [c]	2.83 [a]	7.55 [a]	7.20 [a]	4.11 [a]	3.83 [a]
Average total effect	**0.11**	**0.04**	**3.74 [a]**	**3.41 [a]**	**-2.67 [a]**	**-1.21 [a]**

Note: The Table reports the average bribery mean and dispersion effects (in percentages) after estimation of specification (1) for different subsamples of firms for two performance measures as dependent variables: real sales growth and labor productivity growth. The definitions of the variables are in the text and Appendix B. The average effects are the products of the estimated coefficients on bribery mean and dispersion and the sample average values of the corresponding variables; the average total effect is the sum of these two effects. In Panel A firms are divided on subsamples of manufacturing (ISIC codes 15–36), services (ISIC codes 51–93) and construction (ISIC code 45) sectors. In panel B firms are divided into subsamples of micro (2–10 employees), small (11–49 employees), and medium and large (more than 50 employees) firms. Standard errors shown in parentheses are robust to heteroskedasticity and clustered at the firm level. Cook's distance is used to account for influential observation. The symbols a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

5.2.2. Firm Size

The literature usually documents corruption as a greater obstacle for micro and small firms than for large firms, and hence it impedes the performance of smaller firms more (e.g., Beck et al., 2005; Aterido et al., 2011). This is explained, for example, by the fact that smaller firms have weaker bargaining power and less influence on public officials. In the present study, however, bribery measures the frequency of paying bribes 'to get things done' and may not reflect corruption as an obstacle. We observe that the bribery mean increases with firm size, hence, we do not expect the same results as the cited literature suggests.

Panel B in Table 4 presents the results of the estimation of specification (1) for three subsamples of micro, small, and medium and large firms. The signs of the coefficients on bribery mean and dispersion are the same as in the case for the whole sample; the magnitudes, however, are different for the three subsamples. It turns out that the growth rates of micro firms are the least affected by bribery, larger firms suffer the most from a higher bribery mean, and small firms are able to extract the greatest benefits in more heterogeneous local environments.

One explanation of this finding is that firms of different size category carry different regulatory burden. These differences are usually designed to promote the growth and development of small businesses and encourage entrepreneurship (World Bank, 2004; European Commission, 2011). Smaller (micro) firms are often required to comply with softer regulatory standards such as reporting and keeping records for inspections. They may also be exempted from some taxes, or have lower tax rates (Gauthier and Goyette, 2014). Further, smaller amounts of bribes can be extracted from firms with a smaller number of employees and turnover.

5.3. Heterogeneity of Environments

5.3.1. Countries' Institutional Environments

Although the countries from the CEE region underwent transition at approximately the same time, they are heterogeneous with respect to the quality of formal and informal institutions, as well as their overall corruption levels (Figures A.1 and A.2 in Appendix A). Not surprisingly, countries that entered the European Union in 2004 (Slovenia, Hungary, Poland, the Czech Republic, Slovakia, Estonia, Latvia, and Lithuania) tend to have less corruption, while Russia and Ukraine appear to be the most corrupt according to the Control of Corruption indicator. In this section we analyze how local bribery environments affect firm performance depending on the level of countries' institutional strength.

We use the rule of law indicator from the WGI database to proxy for the strength of countries' institutions. It captures the incidence of crime, effectiveness of the judiciary, enforcement of contracts, and property rights protection.[25] We rescale this indicator to a variable that ranges from 0 to 1, where higher values stand for a stronger rule of law. We augment the specification (1) with interaction terms between rule of law and bribery measures to see how country institutions are associated with the bribery – firm performance relationship.

Columns I-II in Table 5 report the coefficients of interest from the estimation of these specifications and Figure A.3 in Appendix A depicts the average bribery mean and dispersion effects for different values of the rule of law indicator.[26] The results suggest that in countries with stronger institutions the negative impact of the bribery mean is more pronounced. In countries with the weakest rule of law indicator, such as in Serbia between 1999 and 2001, the effect is positive, but not significant. The improvement of institutions also increases growth gains from the bribery dispersion in local markets. Hence, a higher probability of being caught and stricter law enforcements make bribery more detrimental,

[25] *The rule of law indicator is a widely used institutional quality measure, see, for example, Dreher et al. (2014), and Michalopoulos and Papaioannou (2014). We acknowledge that this indicator can correlate with other country factors such as human capital, economic development or level of democracy; and these other factors can drive our results. However, since the correlation between rule of law and these factors is likely high, we believe that the indicator captures well the aggregate institutional environments.*

[26] *Full results are available in the Online Appendix.*

while the possibility of discriminating amongst firms brings higher benefits. Our findings signal that, in countries with weaker institutions, bribery more often 'greases the wheels' of doing business. At the same time higher pervasiveness of corruption provides fewer benefits to firms in more bribery heterogeneous environments. These results are in line with the country-level studies of Aidt et al. (2008) and Meon and Weill (2010). Aidt et al. (2008) show theoretically and empirically that, in countries with good institutions, corruption can be detrimental to economic growth, while in countries with bad institutions, corruption does not impact growth. They explain it by endogeneity and self-reinforcement of growth and corruption, when higher growth leads to lower corruption which, in turn, improves growth. Meon and Weill (2010) demonstrate that corruption improves aggregate efficiency in countries with better governance quality. Our findings, however, contradict the empirical firm-level evidence of De Rosa et al. (2015) showing that bribery is more harmful in non-EU countries. The differences might come from the fact that we use improved data and methodology in the current paper.

Table 5: Heterogeneity of countries' and local environments

	(I) Sales	(II) Productivity	(III) Sales	(IV) Productivity
Bribery Mean	0.010	0.003	-0.271 [a]	-0.291 [a]
	(0.008)	(0.008)	(0.011)	(0.011)
Bribery Mean*	-0.284***	-0.441***		
Rule of Law	(0.020)	(0.020)		
Bribery Dispersion	0.110***	0.203***	-0.040 [a]	0.033 [b]
	(0.012)	(0.011)	(0.015)	(0.015)
Bribery Dispersion*	0.202***	0.081***		
Rule of Law	(0.027)	(0.027)		
Rule of Law	-0.822***	-0.181***		
	(0.020)	(0.019)		
Bribery Mean*			0.688 [a]	0.588 [a]
Bribery Dispersion			(0.040)	(0.040)
N observations	627,634	626,869	627,546	626,995
N group	446,004	445,806	445,726	445,773
R2 within	0.240	0.127	0.225	0.119

Note: The Table reports the results of the estimation of augmented specification (1) for two performance measures as dependent variables: real sales growth and labor productivity growth. The definitions of the variables are in the text and Appendix B. In columns I-II, specification (1) includes bribery mean and dispersion variables interacted with the rule of law indicator. In columns III-IV, specification (1) includes interaction between bribery mean and dispersion variables. Standard errors shown in parentheses are robust to heteroskedasticity and clustered at the firm level. Cook's distance is used to account for influential observation. The symbols [a], [b], and [c] denote significance at the 1%, 5%, and 10% levels, respectively.

5.3.2. Local bribery environments

Our baseline results show that, *ceteris paribus*, a higher bribery mean (dispersion) leads to lower (higher) economic performance of firms. In this subsection, we examine the interaction between these two characteristics of local bribery environments. In particular, we are interested in how the bribery mean affects firm growth rates depending on the extent of bribery dispersion.

Columns III-IV in Table 5 offer the results of estimation for specification (1), in which the interaction term between the bribery mean and dispersion is included. The coefficient on the interaction term is positive, large and significant. This implies that firms more likely increase their growth rates if they operate in local bribery environments, in which corruption stakes and the opportunities to gain from corruption are higher. Figure A.4 in Appendix A shows average bribery effects on sales and productivity growth rates for the range of bribery dispersion values. When bribery dispersion exceeds 0.4, these effects become positive. This value of bribery dispersion falls into the 95th percentile of the sample distribution. If the bribery dispersion equals zero and the bribery mean increases by its sample mean value, then firms' growth decreases to the negative rates, -8% and -9% for sales and labor productivity correspondingly. In the environments where all firms uniformly participate in bribery practices, corruption is extremely harmful.

5.4. Robustness Checks

In this section we describe robustness checks which we conduct to verify the stability of our results. The complete estimation results are available in the Online Appendix.

As a first robustness check we use bribery measures constructed as dummy variables from the original frequency of paying bribes. The first measure takes value one if firms report that they bribe public officials sometimes, frequently, usually, or always to 'get things done', and zero otherwise, as in De Rosa et al. (2015). The second measure takes

value one if firms report that they bribe seldom, sometimes, frequently, usually, or always, and zero if never. These measures are averaged within clusters. The bribery dispersion variable is computed as before. The estimates of the coefficients of interest in the regressions with new bribery measures remain similar to those from baseline results; only their magnitudes are slightly smaller. The results therefore are not influenced by the construction of the bribery mean measure.

Although the bribery measure is consistently defined across three waves of BEEPS, the structure of the questionnaire and stratification of surveyed firms were slightly changed in the last wave. In addition, the number of firms in the Amadeus database increases over time. To see if these changes impact the results, we estimate specification (1) separately for the first and second, and for the second and third time periods. In addition, we estimate specification (1) separately for Russia and Ukraine only, and for the rest of the countries excluding Russia and Ukraine, since these are the most corrupt and represent about half of the whole sample. Again, the estimates confirm that sample restrictions do not affect the main outcome.

To ensure a stable structure of BEEPS within clusters, rather than unconditional averaging of the bribery measure from BEEPS, we compute the bribery mean variable keeping constant such firm characteristics as foreign ownership, export, and firm age. We then use this 'conditional' bribery mean variable to estimate specification (1). The bribery dispersion variable, meantime, remains the same. The main results stay qualitatively the same. Structuring the BEEPS and Amadeus data within clusters in another way, we compute the bribery mean and dispersion variables using the bribery measure from BEEPS multiplied by the proportions of young and old firms within corresponding clusters from Amadeus. When we use these weighted measures to estimate specification (1), the coefficients of interest only increased in absolute values.

The main analysis assumes growth rates averaged over three years and control variables measured at the beginnings of the three-year periods. As a robustness check we estimate specification (1) on yearly data (nine years in total) with lagged control variables, using two methods. First, we use conventional firm, firm-size and time-fixed effects estimation as before. Second, we include a lag of the dependent variable among the explanatory variables to control for autocorrelation in residuals and apply Arellano and Bond's (1991) dynamic panel data estimation technique.[27] The coefficients of interest are not qualitatively different from the main results, meaning that neither the data structure nor possible autocorrelation drive the results.

In the main analysis we require each cluster to have no fewer than four observations in order to compute bribery mean and dispersion. Obviously, the higher the number of observations in a cluster, the better is the measurement accuracy of these variables. Therefore, we also conducted the analysis under a constraint of no fewer than three observations and no fewer than five observations in each cluster. The results are qualitatively the same. The magnitudes of the coefficients of interest, however, become larger when bribery mean and dispersion are computed more accurately.[28]

Given that we can only use location size, but not region in the criteria defining clusters, we check if the results remain the same when location size is excluded from the criteria. First, we estimate specification (1) for the subsample of firms located in the capitals of countries, since they are the only cities exactly identified in BEEPS and Amadeus. Second, we estimate specification (1) on the dataset when location size is omitted from the criteria. Remarkably, the results remain qualitatively the same in both cases.

[27] In particular, we estimate specification (1) in first differences and use the second lags of independent variables (except for the bribery mean and dispersion, since they do not change across the three year periods) as instruments. Difference-GMM estimation performs better than system-GMM estimation. Although the latter preserves the relationship between firm performance and bribery measures, it does not remove AR(2) correlation in the data which could indicate problems with the specification of the system of equations. Therefore we report only the results of difference-GMM estimation.

[28] This fact also confirms that possible measurement error in our bribery variables could lead to attenuation of the estimates.

In our bribery mean variable, the measurement error and perception bias are likely reduced due to averaging out. The aggregation, however, does not solve the problem of missing data. About 10% of the sample in BEEPS does not report frequency of bribing; this, however, is the smallest number relative to other questions about corruption. To check whether missing values affect the results, we estimate specification (1) putting lower weights on clusters with a higher number of missing observations. The weight is equal to the ratio of the number of non-missing values to the total number of observations in a cluster. The estimated coefficients of interest are nearly identical to those from the main analysis, ruling out the problem of missing data in the original bribery measure.

For another robustness check, we do not account for influential outliers using Cook's distance; we change the rule for defining outliers from 1% of the top and bottom of distribution to 5%, and do not use data imputation (see Online Appendix). The estimates of the coefficients of interest remain virtually the same as before and, therefore, robust to the definition of outliers and the imputation procedure. The stricter rule for outliers accounting, though, slightly increases the magnitudes of the coefficients on the bribery mean and dispersion and doubles the overall fit of the regressions.

Finally, in specification (1) we add variables that measure different obstacles to firms' operation and growth obtained from BEEPS. These measures are averaged within our clusters in the same way as the frequency of bribery. By including these obstacles we check whether the bribery mean and dispersion explain the participation of firms in bribes, but not other phenomena. We analyze the cases for corruption, tax administration, and obstacles in obtaining business licenses and permits. The inclusion of these obstacles into the specification does not change the significance and signs of the main results.

6. Conclusion

This study empirically examines the relationship between 'local bribery environments' and firm performance in Central and Eastern European countries. It provides an explanation for divergent consequences of bureaucratic corruption found in previous research.

To overcome the data and methodological limitations of existing empirical literature on bureaucratic corruption and firm performance, we combine large and reliable firm financial data from the Amadeus database with firm bribery practices from BEEPS. We define local markets by clusters of firms sharing the same country, industry, firm size and location size characteristics. Within those clusters we compute the mean and standard deviation of the frequency of paying bribes to public officials to 'get things done', and assign them to each firm from the Amadeus database belonging to the same cluster. These two statistics describe a local bribery environment: the equilibrium level of bureaucratic corruption in a local market, and bribing behavior of firms shaped by firms' willingness to bribe, discretionary power of public officials to extract bribes, and uncertainty about environments. Accounting for firm-level fixed effects, focus on local bribery environments and the use of two independent data sources help us mitigate the endogeneity concerns between bribery and firm performance measures.

Exploring within-firm variation, the results suggest that a higher bribery mean in a local market retards both real sales and labor productivity growth. The increase in the bribery mean by its average sample value is associated with about a 3.0% and 4.3% decrease in corresponding firm performance measures. This outcome complements some of the existing empirical research on the consequences of corruption at the macro- and micro-levels. We also find that conditional on a given level of bureaucratic corruption, higher bribery dispersion facilitates firm performance. The average bribery dispersion effects are positive and equal to 4.7% and 5.9% for the two performance measures, so that the trade-offs between bribery mean and dispersion are positive, too. These results are robust to various specification checks and sample restrictions.

Our findings suggest that at least some bribing firms receive preferential treatments from public officials, while non-bribing firms seem to be efficient in production and growth in more dispersed bribery environments. The presence of a certain number of bribing firms in a local market increases aggregate performance, which is in line with Acemoglu and Verdier (2000), Infante and Smirnova (2009) and De Vaal and Ebben (2011). High dispersion of individual firm bribes in some environments can thus explain the persistence of corruption and advocate the 'grease the wheels' hypothesis.

In addition, we find that firms are more likely to increase their growth rates in the environments with both higher bribery mean and higher dispersion. The main results of the paper hold most strongly for services and construction firms. The effects of a local bribery environment appear to be more important for firms with more than 10 employees. The impact of bribery mean and dispersion on firm performance also seems to be less sound in countries with weaker institutions.

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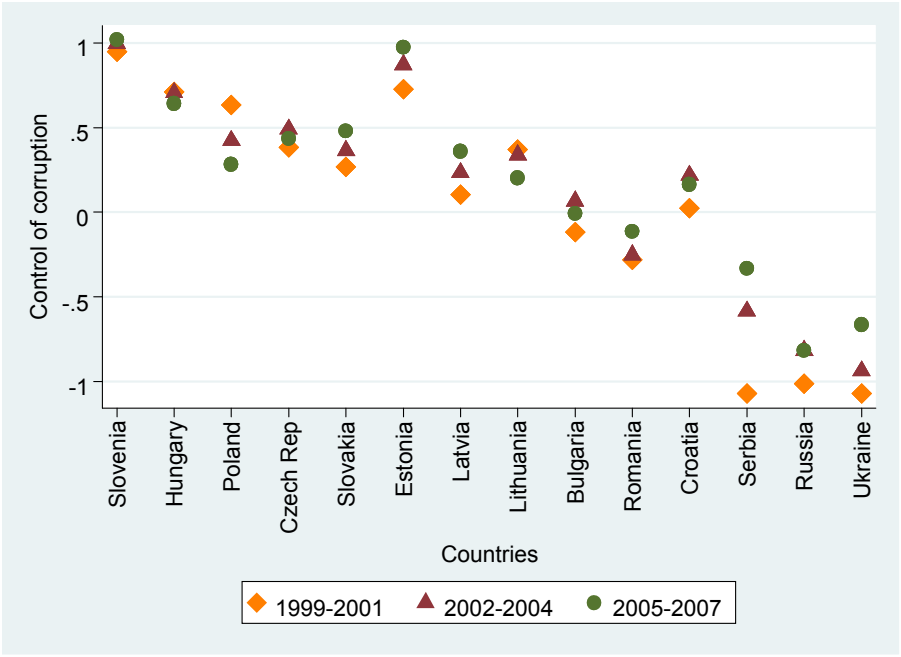
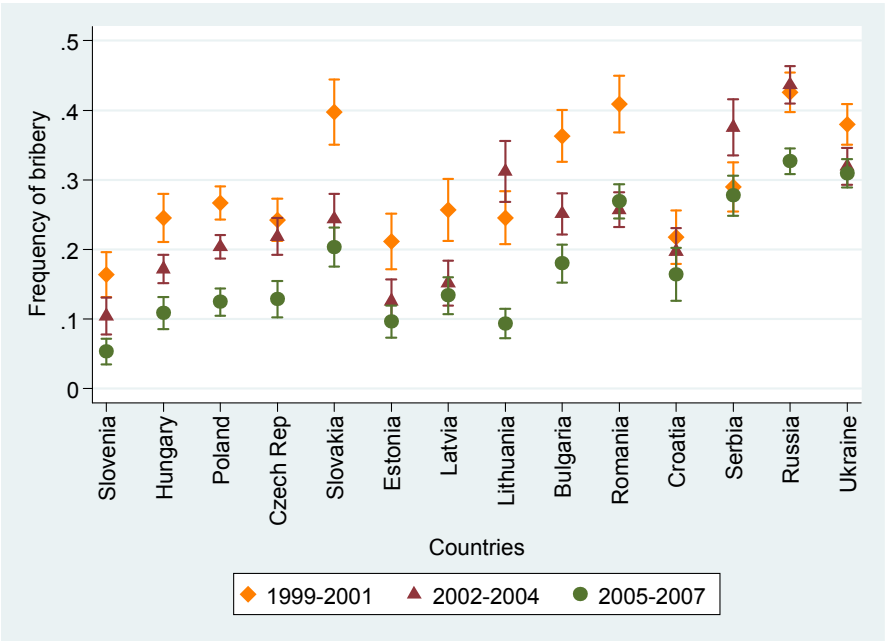
Appendix A: Figures

Figure A.1: The Control of Corruption indicator



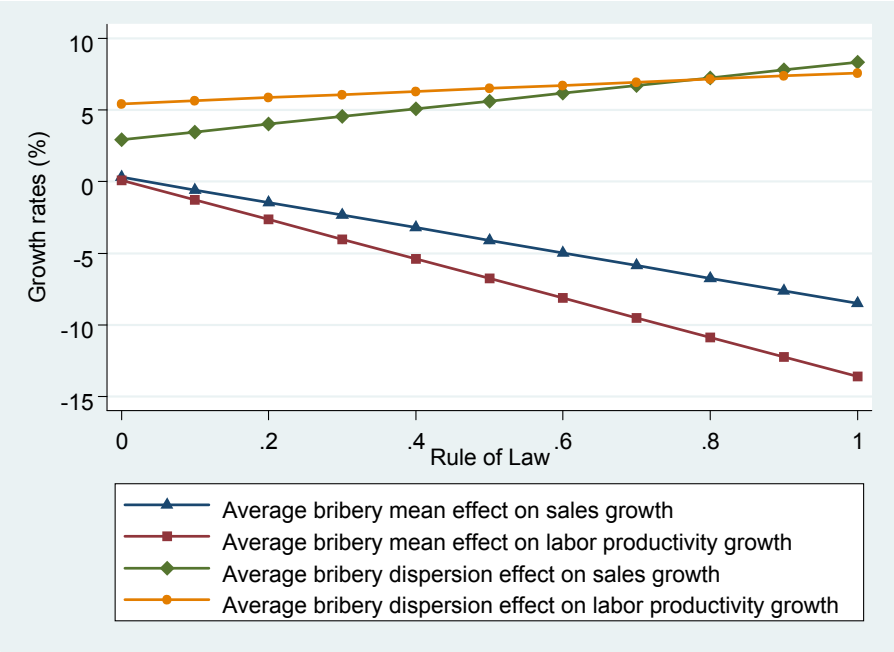
Note: The Figure shows the variation of the Control of Corruption indicator across countries and time periods. For each time period the average value over three years is taken. Higher values stand for lower overall corruption levels.

Figure A.2: Bribery mean



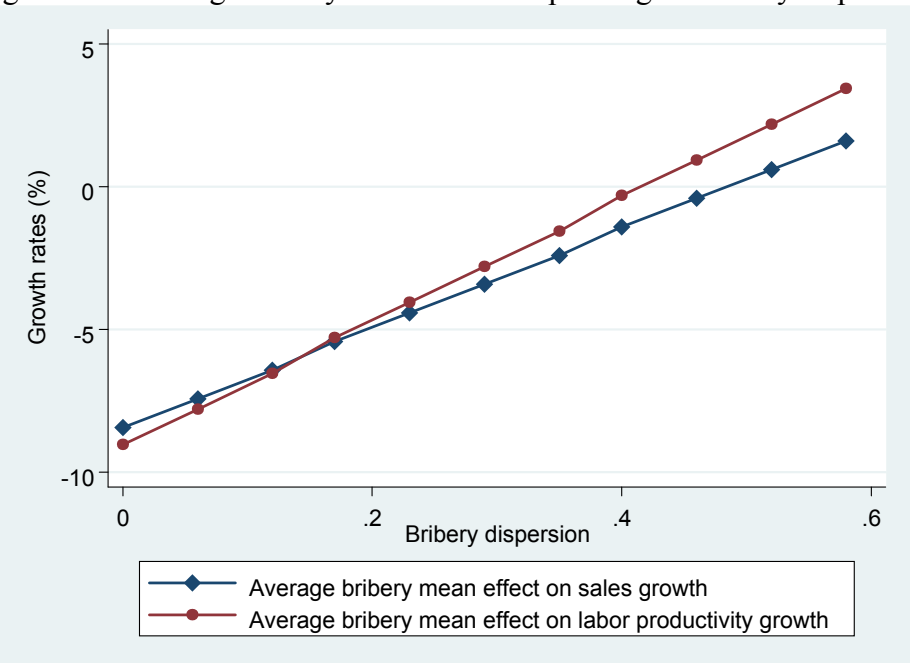
Note: The Figure shows the variation of the bribery mean constructed from BEEPS (before linking it to firm financial data from Amadeus) across countries and time periods. Spikes represent 95 percent confidence intervals. Higher values indicate a higher frequency of bribing.

Figure A.3: Average bribery mean and dispersion effects depending on countries's institutions



Note: The Figure shows average bribery mean and dispersion effects depending on different values of the rule of law indicator for sales and labor productivity growth rates. Higher values of rule of law correspond to stronger institutions.

Figure A.4: Average bribery mean effects depending on bribery dispersion



Note: The Figure shows average bribery mean effects depending on different values of the bribery dispersion for sales and labor productivity growth rates.

Appendix B: Definitions of variables

Name	Definition and Source
Bribery Mean	Mean bribery level in a local environment, computed as the average of frequency of bribing (scaled to [0, 1] variable) within a cluster defined by country, time period, industry, firm size, and location size. Source: BEEPS.
Bribery Dispersion	Dispersion of individual firm bribes in a local environment, computed as the standard deviation of frequency of bribing (scaled to [0, 1] variable) within a cluster defined by country, time period, industry, firm size, and location size. Source: BEEPS.
Sales Growth	First difference of logarithms of operational revenue (in USD, 2000 prices), averaged over three-year time periods. Source: Amadeus.
Labor Productivity Growth	First difference of logarithms of operational revenue (in USD, 2000 prices) over number of employees, averaged over three-year time periods. Source: Amadeus.
Total Assets	Logarithm of total assets. Source: Amadeus.
Total Assets Squared	Logarithm of total assets squared. Source: Amadeus.
Employees	Logarithm of number of employees. Source: Amadeus.
Employees Squared	Logarithm of number of employees squared. Source: Amadeus.
Profitability	EBIT (earnings before interest and taxes) over total assets. Source: Amadeus
Market Share	Operational revenue of a firm divided by the total operational revenue of an industry (defined at the four-digit level). Source: Amadeus.
Leverage	Total debt (current liabilities plus long term debt) over total assets. Source: Amadeus.
Cash Flow	Cash flow over total assets. Source: Amadeus.
Control of Corruption	Indicator that shows overall level of corruption in a country. Higher values stand for lower corruption levels. Source: Worldwide Governance Indicators Database, World Bank.
Rule of Law	Indicator that shows overall quality of institutions in a country. Original indicator is a scaled to [0, 1] variable. Higher values stand for stronger institutions. Source: Worldwide Governance Indicators Database, World Bank.