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Jakob Svensson, Institute for International Economic Studies, Stockholm and CEPR

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Who Must Pay Bribes and How Much?* Evidence from a Cross-Section of Firms

This Paper uses a unique data set on corruption containing quantitative information on estimated bribe payments of Ugandan firms. The data has two striking features: not all firms report they need to pay bribes; and there is considerable variation in reported graft across firms facing similar institutions/policies. To explain these patterns we construct a simple bargaining model. The model yields predictions on both the incidence and the level of graft. Consistent with the model we find that variation in policies/regulations (across industries) explains the incidence of corruption, while variation in profitability and technology choice explains the variation in bribes for the group of bribe paying firms. These findings suggest that public officials act as price (bribe) discriminators, and that prices of public services are endogenously determined in order to extract bribes.

JEL Classification: D90, H20, K40 and L10
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Jakob Svensson
Institute for International Economic
Studies (IIES)
Stockholm University
S-106 91 Stockholm
SWEDEN
Email: jakob.svensson@iies.su.se

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1. Introduction

Research on the determinants of corruption has, with few exceptions, three features in common.[1] It is based on cross-country analyses. It exploits data on corruption derived from perception indices, typically constructed from foreign experts' assessments of overall corruption in a country. Finally, it explains corruption as a function of countries' policy-institutional environment.[2] These common features are interlinked. The use of cross-country data naturally lends itself to study macro-determinants of corruption (and vice versa), and given the difficulties (and costs) of collecting quantitative data on corruption, the use of perception data makes it feasible to study a large cross-section of countries.

While the literature has provided important insights on the aggregate determinants of corruption, it has also drawbacks. First, due to the aggregate nature of the data, it tells us little about the relationship between corruption and individual agents (firms). Second, the use of perception indices raises concern about perception biases. Most importantly, aggregate determinants cannot satisfactory explain the within-country variation in corruption. Specifically, firms facing similar institutions and policies may still end up paying different amounts in bribes (for the same set of services received).

This paper avoids the first two problems by using an unique data set on corruption containing quantitative information on estimated bribe payments of Ugandan firms. We ask two questions; Who must pay bribes?, and How much? As in the cross-country work we refer to the variation in policies/regulations (but cross industries) to answer the question of the incidence of corruption. We find that firms typically have to pay bribes when dealing with public officials whose actions directly affect the firms' business operations. Such dealings cannot be easily avoided when, for example, exporting, importing, or requiring public infrastructure services.[3]

[1] A (incomplete) list of recent contributions include Mauro (1995), Ades and Di Tella (1997, 1999), Persson, Tabellini, and Trebbi (2000), Svensson (2000a), and Treisman (2000).

[2] Kaufmann and Wei (1998) also use firm-level data (based on the Global Competitiveness Report index) to assess the validation of the "grease argument", but the data is perception based and derived from questions referring to country characteristics. Ades and Di Tella (1999) utilize the same source but use country averages. Hellman et al. (2000a,b) also use micro (firm-level) data. The data (for 20 countries) is numerical but ordinal (based on multi-category responses to questions on corruption). In line with (and complementary to) the cross-country literature, they explain corruption as a function of the political-institutional environment (property rights protection and civil liberties). Di Tella and Schargrodsky (2000) use quantitative micro data (from hospitals) to test the Becker and Stigler (1974) hypothesis on wages and audits.

[3] While being a novel result in terms of firm-level data, the finding that firms more exposed to foreign trade are more likely to pay bribes squares nicely with the theoretical literature on rent-seeking and trade (see for example Krueger, 1974, and Bhagwati, 1982), as well as the recent

How much must graft-paying firms pay? To answer this we develop a simple bargaining model in which firms, if forced to pay bribes in order to continue their operations, must bargain about the amount with a rent-maximizing public official.[4] The group of graft-paying firms face the same set of rules and regulations, but they differ in profitability and choice of technology. In the model, these firm characteristics determine the bargaining outcome. We combine the quantitative data on corruption with detailed financial information from the surveyed firms to test the bargaining hypothesis. Consistent with the model we find that firms' "ability to pay" (i.e., current and expected future profitability) and "ability to refuse to pay" (i.e., expected cost of reallocation or to what extent the installed capital stock is sunk) can explain a large part of the variation in bribes across graft-reporting firms. Moreover, the results are statistically robust and remain intact when instrumenting for profits. These findings suggest that public officials act as price (bribe) discriminators, and that prices of public services are endogenous, determined in a bargaining process where firms' outside options matter. From a policy perspective the results point to a range of non-traditional and complementary options to reduce corruption, namely actions on the part of the business community to strengthen the bargaining position of individual firms.

Modern research on the economics of corruption began with Rose-Ackerman (1975, 1978). Despite more than two decades of research, however, economic studies on corruption at the firm level are rather limited. Shleifer and Vishny (1993) analyze a bureaucracy selling a government-produced good (e.g., a permit), noting that if the officials do not coordinate the extraction of bribes they fail to internalize the effect of their demands for bribes on other officials' income, leading to very high corruption levels. Moreover, they argue that the need for

cross-country literature on openness and corruption (see Ades and Di Tella, 1999). Wade's (1982) account of corruption in the public canal irrigation system in India is also consistent with our finding on the incidence of corruption and public service provision.

[4]The model rests on two assumptions. First, public officials are expected profit maximizers, subject to the constraints that the firm might exit and that the official might get caught and punished. Second, by exiting firms can avoid paying bribes. Both assumptions are consistent with case-study evidence of corruption in Sub-Saharan Africa and elsewhere. Thomas (1999) argues that the lack of control over personnel decisions, the lack of performance-based evaluations and hiring, and the power to fire government post-holders instantly with minimal explanation in many Sub-Saharan African countries, have given bureaucrats and office holders with hiring and firing power opportunity to demand a share of the income stream from those lower in the hierarchy (see also Wade, 1982, for a detailed description of how illicit revenue from the distribution of water and contracts in India are aggregated and channeled up the bureaucratic and political hierarchy). Increased uncertainty of tenure has also created strong incentives for those in government posts to extract as much and as quickly as possible to protect against impending unemployment or transfer to a less lucrative position (see also Bayart, 1993). De Soto (1989), Johnson et al. (1998), Johnson et al. (2000), and Friedman et al. (2000) show that corruption (opportunity of rent extraction) drives firms to the unofficial economy.

secrecy makes corruption much more distortionary than taxation. Bliss and Di Tella (1997) study the relationship between corruption and competition. They show that if bureaucrats have the power to extract money from firms under their control, they will drive the most inefficient firms out of business, enhancing the profitability of remaining firms, which in turn makes it possible to demand larger bribes. Choi and Thum (1999) use a similar model to study the effects of repeated extortion.[5] Our model builds on this body of work, although it differs in one key aspect: firms' ability to pay bribes or avoid them differs in observable ways, so public officials make different bribe demands across firms.

This paper is organized as follows. In section 2 a simple model is presented. Section 3 discusses the implication of relaxing some of the simplifying assumptions in the model. Section 4 takes the model's prediction to the data and discusses the empirical findings. Section 5 concludes.

2. A Model for Estimating the Incidence and Level of Graft

Below we set out a simple model to guide the empirical work. The objective is to show that firm- and location-specific features have implications for the incidence and level of graft.

Consider an economy consisting of a large number of firms. Each firm is in the territory of one public official. The official is assumed to be an expected profit-maximizer. Thus, in each period he maximizes bribe payments subject to the constraints that the firm might exit (in which case no bribes are collected), and that he might get caught and punished.

Public officials have discretionary power within the given regulatory system to customize the nature and amount of harassment on firms to extract bribes. The extent to which bribes can be collected depends on officials' "control rights" over firms' business operations. We consider only private firms so by control rights we mean the extent to which public officials can constrain firms' business decisions and influence their cash flows. These indirect control rights stem from the existing regulatory system and the discretion public officials have in implementing, executing, and enforcing rules and benefits that affect firms, such as business regulations, licensing requirements, permissions, taxes, exemptions, and public-goods provision.[6]

[5] For recent surveys of the literature on corruption, see Bardhan (1997) and Wei (1999).

[6] As in Shleifer and Vishny (1994) the degree of control rights determines the threat point or the leverage in the "negotiation" between a public official and a firm. When bureaucrats have low control rights a firm may refuse to pay the demanded bribes without any major consequences on its business operations. However, when public officials have high control rights, the firm must either pay the bribe or exit.

Bureaucrats' degree of control rights differ across sector and location. To simplify, we assume there are two sectors, $j = \{a, b\}$, which differ with respect to bureaucratic control. Specifically, firms in sector a must pay if bribes are demanded, or exit, while firms in sector b have enough leverage to avoid paying bribes without any significant impact on their business operations.

A public official dealing with a firm in sector a will demand a bribe if the expected gain of receiving the bribe is larger than the expected cost. That is,

$$g - \delta m g > 0$$

where g is the graft and δ is the probability of getting caught. We assume that the punishment of getting caught (or personal cost of being fired under corruption accusations) is proportional to the bribe payment, with $m > 0$ being the punishment coefficient. Thus, $\delta m g$ is expected punishment (or cost) of demanding bribes.

As in Ades and Di Tella (1999), Erard and Feinstein (1994), and others, we allow for the existence of both honest and dishonest public officials. Thus, we let the personal cost m differ across individuals. The distribution of m is assumed to be uniform over $[0, \bar{m}]$ and is known to all players.

At time 0 public officials choose what sector to work in. The wage rate is normalized to zero. Sector a employs a share α of the total number of public servants. A bureaucrat who is indifferent between what sector to work in will be randomly selected into a sector with openings.

The equilibrium allocation of public officials is easy to characterize. All public servants with personal cost $m \leq \delta^{-1}$; i.e., bureaucrats that will always ask for a bribe, will choose to work with firms in sector a, while all civil servants with personal cost $m > \delta^{-1}$ will be randomly allocated to the remaining openings. Thus, bureaucrats more prone to demand bribes will choose to work in agencies that have discretionary power over firms.[7] We assume $\alpha > (\bar{m}\delta)^{-1}$, implying that not all public officials in sector a are corrupt.

Public officials are randomly matched (within each sector) with firms in each period. The probability that a randomly drawn firm i must pay bribes, denoted by $p(i)$, is then simply

$$p(i) = \sigma(i \in a) * \rho \tag{2.1}$$

where $\rho = (\alpha\delta\bar{m})^{-1}$ is the probability that a randomly picked bureaucrat in sector a will ask for bribes and $\sigma(i \in a)$ is the probability that firm i is active in sector a.

Firms' maximize present discounted value of expected cash flows (i.e., profits net of bribes). Each firm i is endowed with capital k and an individual-specific

[7] This endogenous response to differences in control rights is consistent empirical evidence on corruption in the public sector (see for example Wade, 1982, and World Bank, 1998a).

skill factor η_i (knowledge) of production in sector a. Invested capital is partly sunk. Let α_i be the share of invested capital that could be resold and reinvested. Thus, $(1-\alpha_i)k_i$ is the reallocation cost of moving from sector a to sector b. At time 0 each firm faces the choice of either investing in sector a or in sector b. Due to indivisibilities of capital, the firm must decide to invest in only one sector.

The firms produce two goods; x_1 and x_2, which are traded on the world market. The world market prices θ and 1, respectively, are exogenously given as the country is a price taker. The production technologies are $x_{i1} = f(k_i, l_i; \eta_i)$ and $x_{i2} = f(k_i, l_i)$, where $f_\eta(\cdot) > 0$ and l is labor. There is unlimited labor supply at the wage rate w (markup on the rural subsistence wage). We assume that the price of good 1 is uncertain; i.e., θ_t is a stochastic variable. θ_t is assumed to be independently and identically distributed over time, with bounded support $[\underline{\theta}, \bar{\theta}]$. Time t profit in sector a can then be written as a function of the observable inputs k and l,

$$\pi(k, l(w/\theta_t); \eta, \theta_t \,|\, a) = \theta_t f(k, l(w/\theta_t); \eta) - wl(w/\theta_t),$$

where firm-specific superscripts have been dropped for convenience and where the labor demand function, $l(w/\theta_t)$, is implicitly defined by the first-order condition, $\theta_t f_l(k, l; \eta) - w = 0$. Period t profits in sector b are defined analogously.

If a firm invests in sector a and faces a corrupt bureaucrat, the firm must either pay the required bribe or exit the sector. Exit constitutes an optimal response if the expected loss of exiting (foregone net profits today and next period) is lower than the expected gain (alternative return on reversible capital next period). That is,

$$\pi(k, \theta_t, \cdot| \, a) - g(\theta_t) + E_t\beta \left[\pi(k, \theta_{t+1}, \cdot| \, a) - pg(\theta_{t+1})\right] \le \beta\pi(\alpha k, \cdot| \, b), \qquad (2.2)$$

where E_t is the expectation operator conditional on information at time t and $g(\theta_t)$ is graft in period t as a function of θ_t. In (2.2), the first two terms are current net profit when facing a corrupt official. The third expression is expected discounted next period profits. In period $t+1$ the firm makes expected profit $E_t\pi(k, \theta_{t+1}, \cdot| \, a)$, and with a probability p faces a corrupt official and must also pay bribes. The term on the right side of the exit constraint (2.2) is the discounted profit the firm would make if it sold and reinvested its partly sunk capital in sector b the first period.

Firms cannot borrow to pay bribes, so in each period the firms' realized cash flow must be non–negative; that is,[8]

$$\pi(k, \theta_t, \cdot| \, a) - g(\theta_t) \ge 0, \quad \text{for all } t. \qquad (2.3)$$

[8]The results are not qualitatively affected if we allow the firms to borrow.

We can now determine the equilibrium graft by solving for the recursive equilibrium. Assume (2.3) holds (a sufficient condition is stated below). The corrupt bureaucrat will demand a bribe payment so as (2.2) just binds. Rewriting (2.2) yields,

$$g(\theta_t) = \pi(\theta_t, \cdot|\, a) + E_t\beta\left[\pi(\theta_{t+1}, \cdot|\, a) - pg(\theta_{t+1})\right] - \beta\pi(\alpha k, \cdot|\, b). \tag{2.4}$$

Equation (2.4) gives a mapping from the space of possible $g(\theta)$ into itself: a given $g(\theta)$ implies expected $t+1$ net profits, which in turn implies a new $g(\theta)$ from (2.4). The fixed point of this mapping is,

$$g_i^*(\theta_t) = \pi(k, \theta_t, \cdot|\, a) + \frac{(1-p)\beta}{1+\beta p} E_t\pi(k, l^i, \theta_{t+1}, \cdot|\, a) - \frac{\beta}{1+\beta p}\pi(\alpha k, \cdot|\, b)\ . \tag{2.5}$$

Equation (2.5) suggests that the amount of bribes a firm needs to pay depends positively on current and expected future profits, and negatively on the alternative return to capital, $\pi(\alpha k)$. Having a technology with a low sunk cost component strengthens the firm's "bargaining" position in that exiting becomes more profitable. As a result the public official will demand a lower bribe. Higher profits today or higher expected future profits have the reverse effect, the firm's bargaining position weakens and it is forced to pay higher bribes.

Note that $g(\theta_t)$ is a negative function of p. That is, the lower the probability that bureaucrats in sector a demand bribes, the higher the equilibrium graft when matched with a corrupt official. Expected graft, however, is a positive function of p.

From (2.5) it is straightforward to determine under what conditions the borrowing constraint (2.3) holds. Specifically, equation (2.3) holds if

$$1 - \frac{\pi(\alpha k, \cdot|\, b)}{E_t\pi(k, l^i, \theta_{t+1}, \cdot|\, a)} \leq p\ . \tag{2.6}$$

Thus, if p is sufficiently high $g^*(\theta_t)$ is always less than current gross profits.

3. Extensions and implications

Before proceeding to estimate equations (2.1) and (2.5) it is useful to consider relaxing some of the simplifying assumptions in the model. This is important not only to show to that the model's qualitative results are robust to alterations, but also to better understand the empirical findings presented below.

In reality, a bureaucrat does not have full information about a firm from whom he wishes to extract bribes. The shock θ and profits are not directly observed, neither is the sunk cost component. In the working paper version of this paper (available upon request) we show that incomplete information will create informational rents that firms can capture. Thus, the linear relationship between profits and grafts identified in equation (2.5) will only be an approximation.

In the model, each firm is in the territory of one official. As in Bliss and Di Tella (1997) and Choi and Thum (1999), we thus abstract from coordination issues and competition among public officials. Allowing competition among bureaucrats might increase the firm's bargaining power and thus reduce the equilibrium graft, but would not change the qualitative relationship between ability to pay and equilibrium graft.[9]

We have taken the technology choice (α_i) as given. Allowing the firm to choose what capital goods to purchase complicates the picture since low sunk costs imply that the cost of exiting becomes smaller and, from equation (2.5), lower grafts when matched with a corrupt official.[10] Thus, the firm might find it profitable to choose a "technology" that yields higher per-period operation costs but indirectly reduces the amount of bribes the firm needs to pay. In the working paper version of the paper we endogenize the choice of α_i and show that the choice of technology depends on the parameters of the model and in particular on p. For the empirical work it should be noted that the "technology-effect" would tend to mask the negative relationship between reallocation costs and corruption, and thus work against us.

There is no feedback from corruption to equilibrium profits in the model, although in reality this might be important. However, our more restrictive set-up is accurate first approximation. Most firms in the sample are small (median firm has 34 employee). Causal empiricism suggests that in general and in Uganda in particular, the regulatory process is not captured by these types of firms but a small set of large, politically powerful enterprises. Moreover, the inherent uncertainty of tenure for those in government posts, documented by for example Thomas (1999), suggests that public officials heavily discount the future. Thus, dynamic graft-schemes that intend to maximize revenue by implicitly controlling entry and exit may simply not be credible. In addition, the feedback from corruption to profits has already been extensively studied in the literature (see Bliss and Di Tella, 1997). Therefore we abstract from it in order to focus on the novel issue of determining the differences in bribe demands across firms. Finally, for the reverse causation argument to bias the results it must be the case that the size of the government favor (and the resulting gain for the firm) is linked to the amount

[9] To the extent that officials impose costs rather than benefits, it is not clear why competition would reduce corruption (see discussion in Rose-Ackerman, 1999).

[10] The technology choice in a model of repeated rent extortion is studied in detail in Choi and Thum, 1999.

paid in bribes. Our identifying assumption is that the price of a government favor is determined by the firm's ability to pay.

Despite these arguments it is important to understand how the results would change if we allowed a feedback, either directly or indirectly, from corruption to profits. The rent-seeking and regulatory capture approach also predicts a positive relationship between profits and corruption. In these strands of the literature the association arises because bureaucrats and politicians compete for rents associated with bribes and kickbacks by selling government favors. Alternatively, regulations benefiting firms are "acquired" by industries through bribes. Thus, the relationship is driven by reverse causation. The extortion model of Bliss and Di Tella (1997), where corruption may cause exit (or restrict entry) and thus profitability of the remaining firms, also suggests a positive association between bribes and profits. The interpretation, however, is slightly different: profitable firms are forced to pay higher bribes but one reason for why they are profitable in the first hand is that other potential competitors have been driven out of the market.

As discussed in detail in section 4.3, empirically we try to separate the aforementioned effects by instrumenting for profits.

4. Estimating the Incidence and Level of Graft

4.1. Specification

Equations (2.1) and (2.5) provide a structural framework to study the incidence and level of graft across firms. The incidence equation (2.1) states that the probability that a randomly drawn firm i must pay bribes depends on sector/location specific factors and a vector of unobservable variables $\boldsymbol{\rho} = [\alpha \;\; \delta \;\; \bar{m}]$. To estimate (2.1) we replace the common (across firms) and unobservable variables $\boldsymbol{\rho}$ with a random variable ν. Thus

$$p_i = \boldsymbol{\chi}'\mathbf{w}_i + \nu_i \ , \tag{4.1}$$

where $\mathbf{w}_i$ is a vector of sector and location specific variables. Since p_i is not observed the incidence equation is reformulated as a probit model,

$$\Pr\left(e_i = 1\right) = \Phi(\boldsymbol{\chi}'\mathbf{w}_i) \tag{4.2}$$

where $e_i = 1$ $[e_i = 0]$ is the event that a firm [does not] faces a corrupt bureaucrat and must pay bribes and Φ is the standard normal distribution function.

To estimate the graft level equation (2.5) we replace the unobserved $\bar{\pi}(k, l, \cdot)$ with current stock of capital (k) and labor (l) plus a forecast/measurement error

ε, and the unobserved $\pi(\alpha k, \cdot)$ with a proxy of αk plus a measurement error ξ. The resulting specification is

$$g_i = \gamma_0 + \gamma_\pi \pi_i + \gamma_k k_i + \gamma_l l_i + \gamma_{\alpha k} \alpha_i k_i + \mu_i, \qquad g_i > 0 \tag{4.3}$$

where γ_0, γ_π, γ_k, γ_l, $\gamma_{\alpha k}$ are coefficients and $\mu_i = \varepsilon_i + \xi_i$. We assume that ν_i and μ_i have a bivariate normal distribution with zero means and correlation δ, and let σ_μ denote the standard deviation of μ. According to the model γ_π, γ_k, $\gamma_l > 0$ and $\gamma_{\alpha k} < 0$.

The sample selection model (4.2)-(4.3) can be estimated by a two-step procedure (see Heckman, 1979) to yield information on both the incidence and level of graft across firms. The first stage regression is given by (4.2) and the second stage regression is,

$$g_i = \gamma_0 + \gamma_\pi \pi_i + \gamma_k k_i + \gamma_l l_i + \gamma_{\alpha k} \alpha_i k_i + \gamma_\lambda \hat{\lambda}_i + \mu_i \tag{4.4}$$

where $\gamma_\lambda = \delta \sigma_\mu$ and $\hat{\lambda}_i = \phi\left(\hat{\boldsymbol{\chi}}' \mathbf{w}_i\right) / \Phi\left(\hat{\boldsymbol{\chi}}' \mathbf{w}_i\right)$ is the inverse Mills ratio included to adjust for sample selection bias.[11]

4.2. Data

The data used in the paper is from the 1998 Ugandan enterprise survey (see Reinikka and Svensson, 2001a, for details). The survey, carried out during January-June 1998, was initiated by the World Bank and the Uganda Private Sector Foundation. Its primary goal was to collect data on constraints facing private enterprises in Uganda.[12]

The sampling frame was based on an industrial census from 1996 and was confined to five general industrial categories (commercial agriculture, agro-processing, light manufacturing, construction, and tourism).[13] These five sectors employ 80 percent of the total labor force in the industrial sector. The sample size was 250 establishments (out of 1282 enterprises in the census in the five industrial categories). Balancing the importance of the different industrial categories at

[11] Note that the disturbance term in the second stage regression is heteroskedastic, $\mathrm{Var}(v^i) = \sigma_\mu^2(1 - \delta^2 \zeta_i)$, with $\zeta_i = \hat{\lambda}_i(\hat{\lambda}_i + \hat{\boldsymbol{\chi}}' \mathbf{w}_i)$.

[12] The motivation for the survey was to examine the extent to which liberalizations and the profound macroeconomic and structural reforms implemented in the 1980s and the 1990s translated into higher private investment and growth, and to identify what key factors constrained private sector expansion. The survey data have been used to examine a wide variety of issues, including evaluating the effects of trade liberalization on firm productivity (Gauthier, 2001); assessment of the bad news principle (Svensson, 2000b); studying the effects of, and coping with, poor public service provision (Reinikka and Svensson, 2001b).

[13] The five sectors could be further classified into 14 three-digit ISIC-categories.

present with the likely importance in the future, the initial plan prescribed selecting 50 establishments in commercial agriculture, 50 in agro-processing, 100 in other manufacturing, 25 in construction, and 25 in tourism. Five geographical regions were covered in the sample (Kampala, Jinja/Iganga, Mbale/Tororo, Mukono, and Mbarara). 70 percent of total employment is confined to these regions. Three general criteria governed the choice of procedure in selecting the sample from the eligible establishments. First, the sample should be representative of the population of establishments in the specified industrial categories. Second, the establishments surveyed should account for a substantial share of national output in each of the industrial categories. Third, the sample should be sufficiently diverse in terms of firm size to enable empirical analysis on the effects of firm size. To account for these three considerations, a stratified random sample was chosen using employment shares as weights (Reinikka and Svensson, 2001).

The empirical strategy used to collect information on bribe payments across firms in Uganda featured the following seven components.

- An employers' association (Ugandan Manufacturers' Association) carried out the survey. In Uganda, as in many other countries, people have a deep-rooted distrust of the public sector. To avoid suspicion of the overall objective of the data collection effort, the survey was done by a body in which firms had confidence. The co-operation with the main private sector organizations had the additional advantage that most entrepreneurs felt obliged to participate in the survey.

- Questions on corruption were phrased indirectly to avoid implicating the respondent of wrongdoing. For example, the key question on bribe payments was reported under the following question, "Many business people have told us that firms are often required to make informal payments to public officials to deal with customs, taxes, licenses, regulations, services, etc. Can you estimate what a firm in your line of business and of similar size and characteristics typically pays each year?".

- Corruption-related questions were asked at the end of the interview, by which time the enumerator presumably had established credibility and trust.

- Multiple questions on corruption were asked in different sections of the questionnaire.[14]

- Each firm was typically visited at least twice by one or two enumerators (to accommodate the manager's time schedule).

[14]The survey instrument had roughly 150 questions (500 entries), and about 10 were related to corruption.

- Survey experts trained the enumerators.
- Corruption related questions (and the whole survey instrument) were carefully piloted and built on existing surveys on regulatory constraints.

The data collection effort was also aided by the fact that the issue of corruption has partly been desensitized in Uganda. The past few years have seen several awareness-raising campaigns on the subject and nowadays the media regularly reports on corruption cases.[15]

It is worth noting that even with underreporting and non-responses, as long as the sample is representative and the misreporting is not systematically correlated with the firm characteristics, these problems only stack the deck against us.

We were able to collect bribery data for 176 firms out of 243 sampled. Of the 67 firms that did not respond to the main corruption question, about one-third declined to answer other sensitive questions (e.g., about costs and sales). The approximately 40 firms that declined to answer the main corruption question did not (as a group) differ significantly in size, profits, and location from the group of graft-reporting firms. Thus, no evidence suggests that the sample of 176 firms is not representative.

Reported bribe payments (*graft*) is the main corruption variable used in the paper. However, the survey contained information on other variables (e.g., cost data on the provision of public services) that can reveal evidence of corruption. The respondents were asked for the total cost (including informal payments) of acquiring a connection to the public grid and acquiring a telephone line. As discussed in Svensson (2001), controlling for location, firms should pay the same amount to acquire these services. Thus, deviations from the given price typically reflect graft. The partial correlation (controlling for location) between connection costs and bribes is 0.67, and the correlation between excess price of telephone connections and reported bribe payments is 0.41. Thus, reported bribe payment is highly correlated with other corruption-related variables derived from the survey data. The consistent findings across measures significantly enhance the reliability of the bribe data.

Of the 176 firms that replied to the question on graft, 33 (19%) reported that they did not have to pay bribes, while 143 (81%) reported that they did. Table 1 shows noticeable differences between the two groups of firms, corresponding to the model's prediction.[16] Non-bribing firms have characteristics suggesting

[15] See Ruzindana et al. (1998) and World Bank (1998b).

[16] As a consistency check, we compared the subsample of firms that reported zero bribe payments with the subsample that reported positive graft to control if the former group systematically answered "difficult" questions with "0". This does not seem to be the case. There is no significant difference in the share of zeros reported to questions such as cost of security, profit

they operate in sectors with little or no contact with bureaucrats. They receive significantly fewer public (infrastructure) services. They are less involved in foreign trade. They pay fewer types of taxes (particularly when controlling for tax exemptions), and they spend significantly less time dealing with government regulations and less money on accountants and specialized service providers to deal with regulations and taxes.

At the same time, the groups are similar with respect to cost of security and the incidence of robbery and theft. These results suggest that while being in sectors where bureaucrats have few "control rights" over a firm's business operations insulates the firm from public corruption, it does not protect it from other sources of discretionary redistribution, such as theft.

The average firm in the non-bribing group has fewer employees but the difference is not significant when all firms are included in the samples. If three outliers (firms with two standard-deviations more employees in the subsample) are dropped from the sample of non-bribing firms the difference is significant (p-value 0.02).

For the firms that reported positive bribes, the average amount of corrupt payments was about US$ 8,300 (in 1997), with a median payment of US$ 1,800. These are large amounts, corresponding, on average, to US$ 88 per worker, or roughly 8 percent of total costs.[17] In 1997, the median firm paid bribes equivalent to 28 percent of its investment in machinery and equipment. The distribution of bribes is depicted in Figure 1 and Figure 2.

4.3. Results

Table 3 reports a series of probit regressions, corresponding to equation (4.2). Data sources and definitions are reported in appendix and summary statistics in Table 2. As evident, the incidence of corruption is significantly correlated with the measures of the extent to which firms have dealings with the public sector. Firms receiving public services (*infrastructure services*) and who are engaged in trade have a higher probability of facing a corrupt official. The result holds both when trade is measured as share of export (*export*) and as a dummy variable taking the value 1 if the firm either exports or imports or both and zero otherwise (*trade*). Likewise, firms that pay more types of taxes (*pay tax*) face a higher probability of having to pay bribes.

In column (5), *infrastructure services*, *trade*, and *pay tax* are entered jointly. The resulting multicollinearity problem masks the individual effects (by increasing

tax, and investment, between the two subsamples.

[17]For comparison, the cost of fuel (which is heavily taxed) constituted on average 6.2 percent of total costs, wages constituted on average 17.9 percent.

the standard errors of the coefficients), although they are jointly significant.[18] To overcome the multicollinearity problem the three variables are combined into a "formal sector index" by principal components analysis. The composite variable *formal sector* is the first principal component. The results of using *formal sector* as regressor is shown in column 6 and illustrated in Figure 3. A firm with extensive dealings with the public sector is more likely to face corrupt officials and thus have a higher probability of having to pay bribes.

We next turn to an explicit examination of the amount of bribes paid. To estimate equation (4.4) we need data on π_i, k_i, l_i, and α_i. Profits are defined as gross sales less operating costs and interest payments (*profit*). Capital stock is measured as the "resale value" of plant and equipment (*capital stock*); i.e., the monetary value the firm manager reported it would get if it sold all of its machinery and equipment. Labor force is total employment (*employment*). All data are for 1997 and the monetary values are expressed in U.S. dollars. Summary statistics are reported in Table 4.

The reallocation costs of shifting sector/location is not observable and we therefore choose to estimate it using data on reported capital stock values. Apart from resale values, the firms also reported "replace value"; i.e., how much it would cost to replace all machinery and equipment with similar new assets. The ratio of resale to replace values captures the extent of physical depreciation and capital mobility. Controlling for physical depreciation, a lower resale to replace ratio suggests higher reallocation costs; i.e., a lower α. We estimate α by regressing the ratio of resale to replace values on the average age of the capital stock and a constant. The residual, denoted by *sunk cost component*, captures the part of the divergence between the resale and replacement values of capital that is independent of age (i.e., does not depend on depreciation). A negative value indicates high reallocation costs (i.e., an irreversible capital stock).[19]

The dependent variable, g_i, is reported bribe payments to public officials, both in U.S. dollars (in Table 5), in logarithms (in Table 6), and per employee (Table 7-8).

Table 5 (Regression 1) reports the base specification. The standard errors are derived from the appropriate covariance matrix of γ.[20] All variables enter significantly and with expected signs. Corruption is positively correlated with

[18] The correlation between *pay tax* and *trade* is 0.60, the correlation between *pay tax* and *infrastructure services* is 0.47 and the correlation between *trade* and *infrastructure services* is 0.35.

[19] Ramey and Shapiro (1998) derive a similar measure to estimate the cost of reallocation of capital across firms and sectors. They estimate an average discount value on capital using equipment-level data from aerospace auctions and show that the discount is a function of the specificity of capital and thinness of resale markets.

[20] See Heckman (1979) for an expression of the asymptotic covariance matrix.

current and expected future profits, and negatively correlated with the alternative return to capital.[21] An increase in the stock of capital has a positive "direct" effect on required bribe payments, but due to partly sunk investments it also affects the equilibrium amount of graft through the multiplicative term $\alpha_i k_i$. The marginal effect of k_i is positive for $\alpha_i < 0.023$, implying that for roughly 76 percent of the firms in the sample, investment is associated with higher bribe payments.

There are two apparent outliers in the sample.[22] Regression 2 displays the same regression once these outliers are dropped from the sample. The fit of the regression improves and the standard errors of all variables are significantly reduced.

In Regression 3 we add the sunk cost proxy to check if the restricted specification reported in columns (1)-(2) is valid. The sunk cost proxy is insignificant and all other results are unchanged, thereby providing support for the specification derived from the model.

The base specification is augmented with additional controls in columns (4) and (5). Regression 4 adds a measure of the degree of competition (number of competitors for the firm's principal product). An often put forward approach to corruption control suggests that increasing competition may be a way to reduce the returns from corrupt activities (see e.g., Rose-Ackerman, 1999). However, once controlling for π_i, k_i, l_i, and $\alpha_i k_i$, the degree of competition adds no new information.[23]

We experimented with several other controls, including industrial category dummies (reported in Regression 5), regional dummies, and market share. None of these variables had any significant effect on g_i once the variables identified by the model were included.

Table 6, Regression 1, displays the base specification with the logarithm of bribe payment as dependent variable. The fit of the model improves and all vari-

[21] Although the sunk cost component is a generated regressor, the second stage least square estimator is a consistent estimator of the true standard error of the coefficient on αk since α is a residual generated regressor (Pagan, 1984). To the extent that αk is measured with errors, $\alpha k + \epsilon$, (due to measurement errors in reported resale and replace values), the coefficient will be biased toward zero, and thus the reported coefficient is likely to provide a lower bound (in absolute terms) of the effect of αk on g.

[22] One firm reported (negative) profits almost 7 standard deviations below the mean, and one firm reported bribe payments almost 8 standard deviations above the mean. We suspect the outliers are due to reporting errors. The two observations are outliers also in the regressions; i.e., based on the residuals, and remain outliers when scaling with employment.

[23] This result provide some supports for recent theoretical work on corruption and competition which stresses that both variables are endogenously determined. If this is the case it is incorrect to take the number of firms as an indicator of the level of competition in the market, since corruption affects the flow of returns from a particular investment and thus the number of firms in a free-entry equilibrium (see Bliss and Di Tella, 1997).

ables enter significantly at the 1 percent level. Regression 2 shows the reestimated model (4.4) with all variables expressed in logarithms. Since both *profit* and the *sunk cost component* take negative values, we add constants to these variables, implying that the elasticities of bribe payments with respect to *profit* and *sunk cost component* are not constant. All variables remain highly significant and continue to be so if the *sunk cost* proxy is entered linearly (not shown).

4.3.1. Robustness test

A possible objection to the results reported in Table 5 and 6 is that they are driven by spurious correlation (all variables are correlated with size). Simply controlling for size in the regression may not overcome the problem. To check that the results are not influenced by a size-effect we reestimated the model in rates by scaling all variables with employment size. Table 7, column (1), shows that the relationship between current and expected profit rates (the latter proxied by capital/employment) and the bribe rate continues to hold. Also, the alternative return per employee remains significantly negatively correlated with the bribe rate.

We tested the identifying assumption in the Heckit model - that is, some variables (*formal sector index)* only explain selection in the first-stage but are excluded from the second stage equation - by regressing the estimated residuals from the second stage equation on *formal sector index.* The *formal sector index* entered with a p-value of 0.92, suggesting that while location/sector plays a role in separating firms that have to pay bribes from those that do not, the "degree of formality" does not matter once the firm is matched with a corrupt bureaucrat with power to extract bribes.

Up until now we have relied on the restrictions of the model to estimate equation (4.4). Specifically, the model places restrictions on the supply of bribes (firms' incentives to pay bribes) since profits (π) are not influenced by the amount paid in bribes. However, other assumptions on the supply side would suggest that firms that pay high bribes get valuable government favors in return. Alternatively, by controlling exit and entry into the market public officials can raise profitability of the remaining firms and thus their ability to pay bribes.

We deal with the potential endogeneity problem by instrumenting for profits. We use two sets of instruments. The first set of instruments consists of firm specific variables which we argue are uncorrelated with both the error term in (4.4) and reported bribes, but are correlated with firms' profit potential (and realized profits). The instrument set includes proxies of human and social capital: a dummy variable indicating if the owner/manager has a University diploma (*university*); a dummy indicating if the owner/manager has had previous experience from working abroad or in a foreign owned firm (*experience*); age of the firm (*age*); and a measure of foreign ownership (*foreign*). In a large panel of firms from five African countries, Reinikka and Svensson (2001) show that foreign ownership, age, and experience explain a large part of the variation of profits across firms. We also include the cost of security per employee (*cost of security per employee*). As discussed in Collier and Gunning (1999), risk arising from, for example, crime is an important determinant of the performance of African enterprises. The cost of security is one proxy of the cost of risk management.[24]

As an additional robustness test we also use a different set of instruments: industry-location averages of profits. This is a potentially good candidate for an instrument since the data reveals that there are systematic differences in profit rates across sectors. Presumably, having netted out the firm-specific component of profits, the differences in observed profits depend on the underlying characteristics of the industries and/or locations that determine their profitability. Furthermore we know that in the sample of bribe-paying firms, the industrial and regional dummies are uncorrelated with the reported level of bribe payments.

Table 8 reports the results of using instrument variables techniques, with the bribe rate (bribe payment in U.S. dollars per employee) as dependent variable.[25]All variables continue to enter significantly. The coefficients on the profit rate are in fact even larger than those reported above. Most likely this result is driven by the fact that the IV-strategy also mitigates the attenuation bias due to measurement errors in the profit term.[26] The instruments perform well. The partial R^2 (netting out the common variables) in the first-stage regression is 0.05, implying that more than half of the explained variation in the profit rate is picked up by the vector of firm-specific instruments. The Hausman test also reveals that we cannot reject the null hypothesis of the validity of the instruments; that is, we find no evidence that the instruments for the profit rate belong in the corruption regression. The results using industry-location averages as instrument are similar.

Despite the IV-results, it should be stressed that some firms may still benefit (and possibly a lot) from corruption. What this type of econometric work identifies is what is true on average, and on average the data suggest that the level and rate of grafts are influenced by the firms' abilities to pay. This result

[24]Table 5 suggests other variables that appear to be uncorrelated with reported bribes, but potentially correlated with profits, such as number of competitors and market share. However, since there might be an indirect link between these variables and corruption, we do not include them as instrument. In so doing we attempt to identify the "exogenous" component of profit, and thus control for the possible feedback from corruption to profits through the market structure.

[25]The results are similar, though slightly weaker, when running the regression in levels.

[26]Due to lack of valid instruments we cannot instrument also for the capital stock (and employment). If we estimate a reduced form model, excluding k and l, the results (for *profit*) are similar to those reported above.

is also consistent with other preliminary work on the Uganda data set. Fisman and Svensson (2000) show that once controlling for possible simultaneity biases, there is a strong negative relationship between bribery payments and firm growth (growth in sales or employment). The effect is about three times greater than that of taxation and much stronger after outliers are excluded. Svensson (2001), studying the cost of obtaining connection to public services, finds that there is no significant statistical relationship between the cost (including informal payments) and the time it takes to get connected to the public grid and/or acquire a telephone line. Finally, adding variables that presumably capture firms' incentives to pay bribes (and potential gain of paying bribes), such as a dummy variable taking the value 1 if the firm sells part of its output to the government (*sell to government*), and an index of tax exemptions (*exemptions*) does not change the results. Both variables enter insignificantly and all other variables remain unchanged (Regressions 2 and 3 in Table 7). By itself this result does not exclude the possibility that firms are bribing public officials for contracts and exemptions, but it suggests that prices of such favors are functions of firms' abilities to pay.

In Table 9 we have calculated the effects on corruption (bribe payment) of a one standard deviation increase in the explanatory variables. The calculations show that the effects identified in the model are large. For example, a one-standard deviation increase in profits is associated with US$ 113 in additional bribe payments per employee (equal to 0.82 standard deviation), while a one-standard deviation reduction in the sunk cost component implies a reduction in bribes of around one-third standard deviation.

5. Concluding remarks

15 years ago in the *Handbook of Econometrics* survey of economic data issues, Griliches (1986) observed " ...since it is the "badness" of the data that provides us with our living, perhaps it is not at all surprising that we have shown little interest in improving it, in getting involved in the grubby task of designing and collecting original dataset of our own". Griliches observation is still a fair one when it comes to data on governance and corruption. One contribution of this paper has been the collection of what we believe to be an unique data set with quantitative (cardinal) measures of corruption and detailed financial information of surveyed firms to analyze the causes and consequences of corruption at the firm level. Despite our data collection strategy, however, cases of misreporting are likely to remain in the sample. For this reason the paper has not focused on the level or incidence of bribes, but rather on their correlates. We believe that the strategy used to collect information on grafts has minimized any systematic biases

in the correlation between reported grafts and the set of explanatory variable we use.

A simple model of bureaucratic extortion provided the analytical framework for this investigation. In the model firms can choose in what sector to invest in and sector-specific characteristics determine the extent to which dealings with the public sector are required. If a firm is forced to pay bribes in order to continue operation, the equilibrium bribe is determined as the outcome of a bargaining process. The group of graft-paying firms face the same set of rules and regulations, but they differ in profitability and choice of technology. These firm characteristics determine the bargaining outcome. Consistent with the model we find that the incidence of corruption can be explained by the variation in policies/regulations (across industries), while the variation in reported bribe payments for firms that do pay bribes can be explained by measures capturing firms' bargaining power vis-à-vis the public sector. The more a firm can pay the more it has to pay. The more profitable outside option a firm has the less it has to pay. These findings are consistent with the view that civil servants spend time learning about their "customers" and adapt their bribe requests accordingly. In other words, prices of public services are endogenously determined in order to extract bribes. While causality is difficult to prove, we have provided two pieces of evidence suggesting that the results are not driven by the reversed mechanism. First, the level of grafts is determined not only by the ability to pay (profitability), but also by firms outside options. Second, the results remain intact when instrumenting for profits.

In the model, corruption has potentially two adverse consequences: it discourages investment in sector a and shifts production to sector b, and if firms not only can choose between sectors but realistically also can choose what technology to apply, firms will tend to pick a more reversible (but possibly less efficient) capital stock. Evaluating the cost of corruption (and the mechanisms), is an important agenda for future research.

These results have clear policy implications (for an elaborated discussion on policy issues see Svensson, 2001). If the bribe a firm needs to pay is an outcome of a bargaining process, collective action on the part of the business community so as to strengthen the bargaining position of individual firms may be a successful strategy to reduce the cost of doing business in countries suffering from systemic corruption. Collecting and disseminating information about corrupt practices; informing the private sector and the public about service standard, guidelines and norms of major service providers; increasing individual firms ability to commit to no-bribery; and recognizing those how are doing a good work by resisting corruption, are examples of such measures.

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A. Appendix

A.1. Data description

capital stock = resale value of plant and equipment in US$ (1997); *competitors* = number of competitors for the firm's principal product; *cost of accountant* = monthly cost of accountant, lawyer, agent, specialized service provider to deal with regulation and taxes in US$ (1997); *cost of security* = annual cost of security in US$ (1997); *distance* = distance (miles) from Kampala; *employment* = total employment (1997); *experience* = binary variable taking the value 1 if the owner/manager has had previous experience from working abroad or in a foreign owned firm; *export* = share of sales exported (1997); *foreign* = foreign ownership in percent; *formal sector* = first principal component derived from principal components analysis of 'trade', 'pay tax', 'infrastructure service'; *graft* = reported bribe payment in 1997 in US$; *infrastructure service* = index (0-5) of availability of public services (electricity, water, telephones, waste disposal, paved roads), 1 if available 0 otherwise, index is the sum of the binary availability variables for the five services; *incidence of robbery and theft* = binary variable taking the value 1 if the firm was a victim of robbery, and/or theft during 1995-1997, 0 otherwise; *pay tax* = index (0-6), sum of six binary (0=no, 1=yes) variables reflecting types of taxes the firm pays (import duty, import commission, withholding tax, excise tax, VAT, corporate tax [profit tax]) (1997); *pay tax* (log) = logarithm of (1+*pay tax*); *profit* = gross sales less operating costs and interest payments in US$ (1997); *sunk cost component* = residual from the regression of the ratio of resale to replace values of the capital stock to the average age of the capital stock and a constant (all variables in logs); *sell to government* = binary variable taking the value 1 if the firm sells part of its output to the government, 0 otherwise; *tax exemptions* = index (0-2) of tax exemptions on corporate tax, import duties, with 0=no exemptions, 2=fully exempted; *time spent dealing with taxes and regulations* = percentage of senior management's time spent each month dealing with government regulations (1997); *trade* = binary variable taking the value 1 if the firm either exports or imports itself or both and zero otherwise (1997); *university* = binary variable taking the value 1 if the owner/manager has a University diploma.

Table 1: Sample characteristics

	Firms that reported zero bribe payments		Firms that reported positive bribe payments		p-value
	Mean	No.	Mean	No.	
Infrastructure service	3.24	33	3.70	134	0.048
Export	0.15	33	0.33	134	0.016
Pay tax	2.58	33	3.04	134	0.184
Pay tax (not tax exempted only)	2.50	30	3.28	110	0.031
Time spent dealing with taxes and regulations (log)	1.93	32	2.49	134	0.016
Cost of accountant etc. (log)	3.30	31	4.74	121	0.016
Cost of security (log)	7.17	32	7.48	131	0.569
Incidence of robbery and theft	0.52	33	0.58	134	0.497
Employment size (log)	3.61	33	3.88	134	0.342

Note: Variables defined in appendix A.1. Numbers in the last column are p-values for a test of the null hypothesis that the two means are equal.

Table 2: Summary statistics

	Mean	Std	Max	Min	No
Infrastructure service	3.47	1.29	5	0	243
Trade	0.51	0.50	1	0	227
Pay tax	2.77	1.83	6	0	235
Formal sector index	4.45	1.89	7.79	0	227

Figure 1: Distribution of firms according to bribe payments (log)

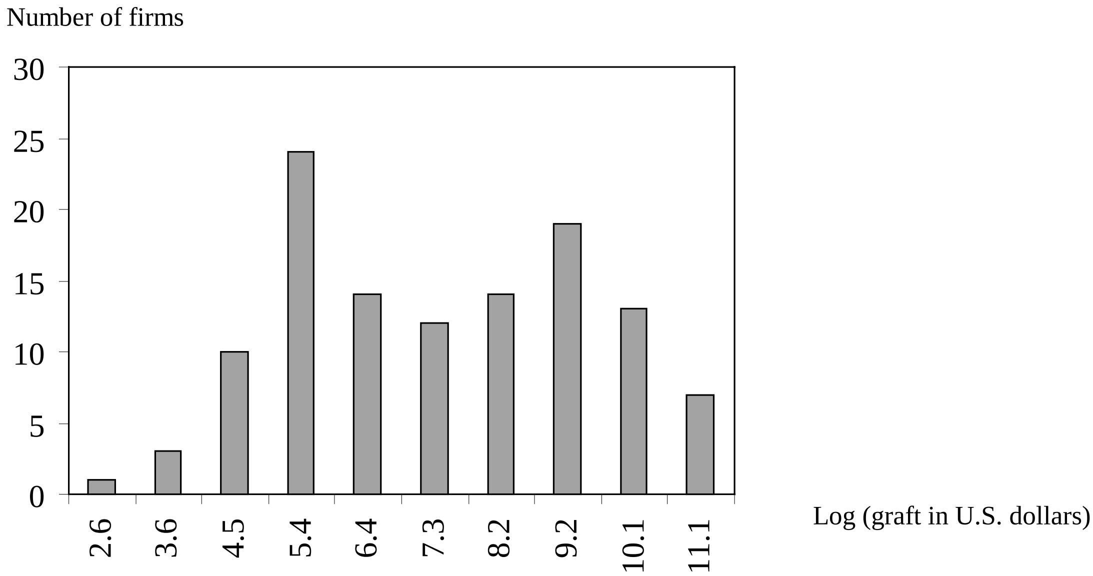


Figure 2: Distribution of firms according to bribe payments

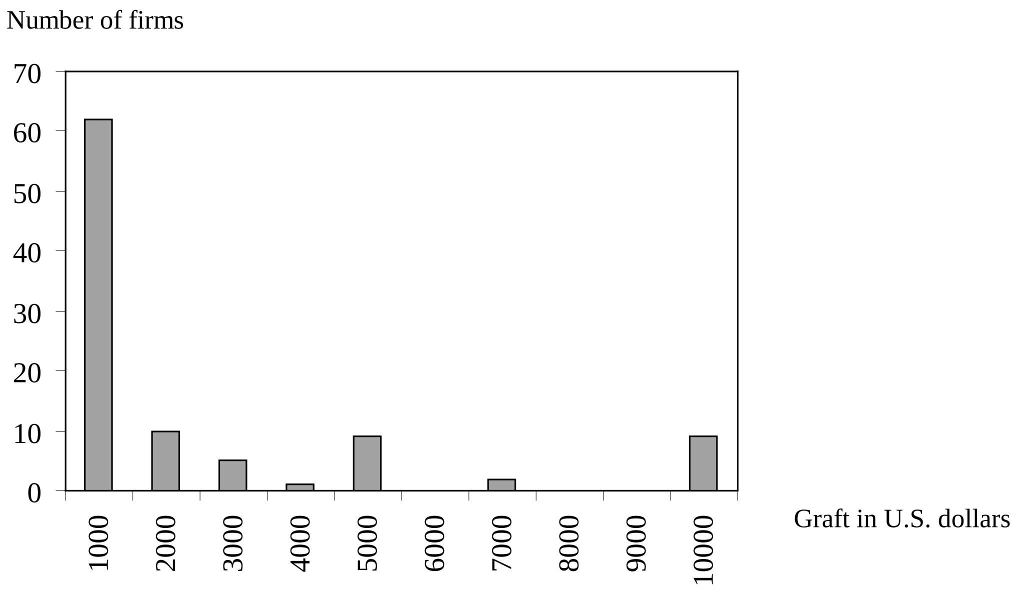
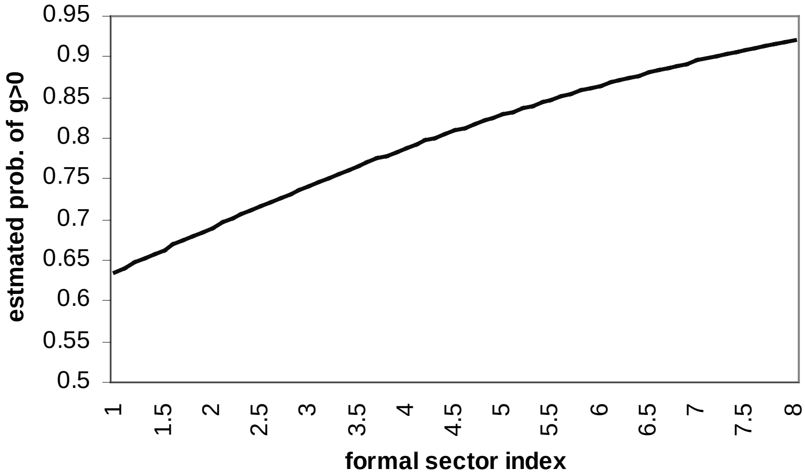


Table 3: Probit regressions on the incidence of corruption

Equation	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Incidence of graft	Incidence of graft	Incidence of graft	Incidence of graft	Incidence of graft	Incidence of graft
Constant	0.203 (.342) [.554]	0.747 (.131) (.000)	0.647 (.155) [.000]	0.428 (.276) [.121]	-0.010 (.393) [.979]	0.179 (.331) [.588]
Employment	8.4E-5 (4.3E-4) [.848]	-7.6E-5 (4.3E-4) (.859)	-7.9E-5 (4.4E-4) [.857]	-8.2E-5 (4.4E-4) [.852]	-1.5E-4 (4.5E-4) (.736)	-1.2E-4 (4.4E-4) [.784]
Infrastructure service	0.192 (.094) [.041]				0.156 (.102) [.124]	
Export		0.596 (.277) [.031]				
Trade			0.430 (.238) [.070]		0.292 (.265) [.271]	
Pay tax (log)				0.374 (.220) (.089)	0.153 (.256) [.549]	
Formal sector index						0.151 (.073) [.038]
Observations	176	176	167	173	173	167

Note: Dependent variable "incidence of graft" takes the value 1 if the firm reported positive bribe payments and 0 otherwise. Standard errors in parenthesis and p-values in brackets.

Figure 3: Estimated probability of having to pay bribes



Note: Based on Regression 6, Table 3, with size evaluated at the mean.

Table 4: Sample characteristics of firms that reported positive bribes

	All firms[a]	All firms	Firms reporting low bribe payments	Firms reporting high bribe payments
Profit				
- *mean*	211,060	284,390	57,540	540,110
- *median*	27,270	27,270	11,230	95,690
- *Std. dev.*	1,134,460	1,048,116	119,660	1,489,290
Bribes				
- *mean*	7,850	6,270	280	13,020
- *median*	910	910	180	9,090
- *Std. dev.*	19,840	13,480	280	17,390
Resale value				
- *mean*	365,760	346,760	174,550	540,890
- *median*	90,910	90,910	38,640	227,270
- *Std. Dev.*	667,190	648,260	394,500	809,010
Employment				
- *mean*	119	109	36	192
- *median*	34	33	20	81
- *Std. dev.*	262	251	53	346
Reversibility				
- *mean*	.001	.001	.002	-.000
- *median*	.011	.011	.012	.009
- *Std. dev.*	.034	.034	.033	.035
Obs.	119	117	62	55

Note: Sample of firms for which data on corruption and other variables are available. Profits, bribes, resale values in U.S. dollars. Low bribe payment is graft smaller than US$ 1000.

a. Including two extreme outliers.

Table 5: Corruption regressions

Equation	(1)[a]	(2)	(3)	(4)	(5)
Dep. variable	Graft in US$	Graft in US$	Graft in US$	Graft in US$	Graft in US$
Constant	9,531 (6,693) [.157]	8,701 (4,509) [.056]	8,910 (5,101) [.083]	8,500 (4,609) [.068]	12,962 (5,685) [.025]
Profit	0.0033 (.0014) [.021]	0.0037 (.0010) [.001]	0.0036 (.0010) [.000]	0.0036 (.0011) [.001]	0.0034 (.0010) [.002]
Employment	17.11 (7.21) [.019]	11.39 (4.76) [.018]	11.53 (4.28) [.008]	11.48 (4.98) [.023]	11.31 (5.04) [.027]
Capital stock	0.0071 (.0032) [.030]	0.0059 (.0023) [.011]	0.0061 (.0032) [.011]	0.0060 (.0024) [.012]	0.0050 (.0025) [.046]
Sunk cost component∗ capital stock (“alternative return”)	-0.309 (.119) [.011]	-0.259 (.089) [.004]	-0.290 (.096) [.003]	-0.259 (.090) [.005]	-0.260 (.089) [.004]
Sunk cost component			31,202 (36,634) [.396]		
Competitors				16.46 (131.5) [.900]	
λ	-16,638 (17,774) [.351]	-16,105 (11,849) [.177]	-16,489 (12,896) [.204]	-16,307 (11,607) [.163]	-25,833 (13,052) [.051]
Industry effects	No	No	No	No	Yes
χ^2					11.10 [.520]
Wald	18.27 [0.00]	29.63 [0.00]	31.85 [0.00]	29.05 [0.00]	24.38 [0.00]
S.E. regression	18,728	12,168	12,184	12,278	12,217
Adjusted R2	0.11	0.18	0.18	0.18	0.18
Observations	119	117	117	116	117

Notes: Standard errors in parenthesis are adjusted for heteroskedasticity (Heckman, 1979). P-values in brackets. λ is the inverse Mills ratio to adjust for selectivity with selection equation given by $P(e_i=1)=\Phi(c,employment,formal)$; i.e., Regression 6, Table 3. χ^2 is the test statistic for the null hypothesis that all industry effects are zero. Wald is test statistic for the null hypothesis that the coefficients on π, k, l, αk are zero.

a. Including two extreme outliers.

Table 6: Corruption regressions

Equation	(1)	(2)
Dep. Variable	Graft in US$ (log)	Graft in US$ (log)
Constant	8.83 (.892) [.000]	-85.1 (28.6) [.004]
Profit	5.5E-7 (1.0E-7) [.000]	
Profit (log)[a]		5.46 (1.79) [.003]
Employment	0.0023 (.0004) [.000]	
Employment (log)		0.649 (.162) [.000]
Capital stock	9.8E-7 (3.5E-7) [.006]	
Capital stock (log)		1.50 (.679) [.030]
Sunk cost component∗capital stock	-3.5E-5 (1.3E-5) [.007]	
Sunk cost component∗capital stock (log)[b]		-1.84 (.924) [.049]
λ	-7.32 (2.15) [.001]	-3.17 (1.78) [.078]
Wald	51.64 [0.00]	63.85 [0.00]
S.E. regression	1.74	1.61
Adjusted R2	0.35	0.44
Observations	117	117

Notes: Standard errors in parenthesis are adjusted for heteroskedasticity (Heckman, 1979). P-values in brackets. λ is the inverse Mills ratio to adjust for selectivity with selection equation given by $P(e_i=1)=\Phi(c,employment,formal)$. Wald is test statistic for the null hypothesis that the coefficients on π, k, l, αk are zero.

a. A constant 1E+7 is added to "profit (log)" to avoid negative values.

b. A constant 2 is added to "sunk cost (log)" to avoid negative values.

Table 7: Corruption rate regressions

Equation	(1)	(1)	(2)
Dep. Variable	Graft per employee in US$	Graft per employee in US$	Graft per employee in US$
Constant	120.1 (45.1) [.009]	105.8 (44.4) [.022]	140.2 (44.2) [.002]
Profit per employee	0.0041 (7.4E-4) [.000]	0.0041 (7.4E-4) [.000]	0.0043 (7.7E-4) [.000]
Capital stock per employee	0.0042 (.0022) [.062]	0.0044 (.0022) [.048]	0.0041 (.0022) [.070]
Sunk cost component* capital stock per employee ("alternative return per employee")	-0.238 (.091) [.010]	-0.243 (.089) [.008]	-0.238 (.090) [.009]
Sell to government		8.60 (22.1) [.704]	
Exemption			11.2 (16.4) [.495]
λ	-175.2 (119.2) [.144]	-152.3 (111.3) [.188]	-265.9 (130.0) [.043]
Wald	36.20 [0.00]	35.89 [0.00]	37.84 [0.00]
S.E. regression	123.0	121.8	121.0
Adjusted R2	0.21	0.21	0.23
Observations	117	114	108

Notes: Standard errors in parenthesis are adjusted for heteroskedasticity (Heckman, 1979). P-values in brackets. λ is the inverse Mills ratio to adjust for selectivity with selection equation given by $P(e_i=1)=\Phi(c,employment,formal)$. Wald is test statistic for the null hypothesis that the coefficients on π/l, k/l, $\alpha k/l$ are zero.

Table 8: IV-regressions on corruption

Equation	(1)[a]	(2)[b]
Dep. Variable	Graft per employee in USD	Graft per employee in USD
Constant	113.8 (56.5) [.047]	121.9 (53.40) [.024]
Profit per employee	0.0076 (.0038) [.050]	0.0052 (.0017) [.002]
Capital stock per employee	0.0035 (.0027) [.187]	0.0039 (.0023) [.098]
Sunk cost component∗ capital stock per employee ("alternative return per employee")	-0.265 (.102) [.011]	-0.246 (.094) [.011]
λ	-194.7 (157.6) [.219]	-189.2 (144.8) [.194]
Wald	9.73 [0.02]	15.65 [0.00]
Hausman	2.85 [0.58]	
S.E. regression	131.8	124.2
Observations	114	117

Notes: Standard errors in parenthesis are adjusted for heteroskedasticity (Heckman, 1979). P-values in brackets. λ is the inverse Mills ratio to adjust for selectivity with selection equation given by $P(e_i=1)=\Phi(c,employment,formal)$. Wald is test statistic for the null hypothesis that the coefficients on π/l, k/l, $\alpha k/l$ are zero. Hausman is the TR^2-test statistic for the null hypothesis of no overidentifying restrictions.

a. Instrument vector consist of the variables *university, experience, foreign, age, cost of security per employee,* and the covariates in Regression 1.

b. Instrument vector consists of industry-location averages of the profit rate and the covariates in Regression 2.

Table 9: Effects on corruption of changes in firm characteristics

Equation	(1)(i)
	Change in bribe payment per employee US$ (st.d.) due to a one standard deviation increase in:
Resale value per employee	25.6 (0.19)
Profit per employee	113.3 (0.82)
Reversibility index	-42.0 (-0.30)

Note: Calculations based on Regression 1, Table 8, with standard deviations in parenthesis.