

HOW PETTY IS PETTY CORRUPTION?

EVIDENCE FROM FIRM SURVEYS IN AFRICA

George R.G. Clarke^{*}

February 2008.

* The data used in this paper are from the World Bank's Enterprise Surveys (see www.enterprisesurveys.org). I would like to thank Omar Azfar, Alvaro Gonzales, Steve Knack, and Vijaya Ramachandran for helpful comments and discussions. Responsibility for all errors, omissions, and opinions rests solely with the author. This paper has not undergone the review accorded to official World Bank publications. The findings, interpretations, and conclusions expressed herein are those of the author and do not necessarily reflect the views of the International Bank for Reconstruction and Development / The World Bank and its affiliated organizations, or those of the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work.

Senior Economist, Eastern Europe and Central Europe—Private Sector, The World Bank, MSN J10-1001, 1818 H Street, NW, Washington, DC 20433. Tel: 202-473-7454. E-mail: gclarke@worldbank.org.

HOW PETTY IS PETTY CORRUPTION? EVIDENCE FROM FIRM SURVEYS IN AFRICA

Abstract

Recent firm-level surveys suggest that petty corruption is a serious problem for African firms, costing the average firm in many countries between 2.5 and 4.5 percent of sales. However, a minor difference in the way firms answer the question has a large effect on estimates of the size of the burden. On average, firms report payments that are between four and fifteen times higher when they report them as a percent of sales than when they report them in monetary terms. This paper discusses several possible reasons why there might be a difference including outliers, differences between firms that report bribes in monetary terms and firms that report them as a percent of sales, and the sensitivity of the corruption question. But none of these explanations explain the discrepancy. One plausible remaining reason is that firm managers overestimate bribes when they report them in percentage terms. If this is the case, petty corruption might be far less costly than the raw data suggest.

I. Introduction

How much does petty corruption—payments to government inspectors and bureaucrats to either avoid having to comply with government rules and regulations or to get licenses, utility connections and fulfill other government requirements more easily or quickly—cost firms in Sub-Saharan Africa? In surveys done in 2006/07, the average firm reported that bribe payments were equal to between 2.5 and 4.5 percent of sales in most low-income countries in the region.¹ Although this might not seem very much, it looks higher when compared to other costs. If these estimates are accurate, petty corruption costs the average manufacturing firm in most of these countries more than communications (telephone, fax, and Internet) or transportation (excluding fuel), about 30 to 80 percent of the cost of fuel and power, and about 10 and 20 percent of the cost of labor. These amounts are therefore not inconsequential. Moreover, because lying and non-responses are likely to bias estimates downwards, the actual cost is likely to be even higher.

But are these estimates accurate? The results from this paper show that the way that firms answer the question appears to have a large effect on estimated bribe payments and that, as a result, the cost of petty corruption might be significantly lower than this. In the World Bank's Enterprise Surveys, firms are able to answer the questions either as a percent of the firm's sales or in local currency. As discussed in detail in this paper, firms that answer the question as a percent of sales appear to consistently report far higher bribe payments—between four and fifteen times higher—than firms that report payments in local currency.

Observing a difference does not however tell us why this is the case or give us much idea about whether one approach is more accurate than the other. This paper looks at several possible reasons why the estimates might be so different—outliers, the way the question is asked, and differences between the firms that answer the question as a percent of sales and those that answer in local currency. None of these, however, appear to explain the difference. One remaining explanation is that firm managers that answer as a percentage overestimate the amount they pay. If this is the case, petty corruption might cost firms far less than the headline numbers suggest.

The concern of this paper is simply the monetary cost of petty corruption—not other distortions associated with corruption, which might still be significant, nor on other types of corruption (i.e., grand corruption) that also might be problematic.² That said, it seems reasonable

to expect that the distortions associated with petty corruption are at least partly affected by how much petty corruption costs firms. That is, firms' decisions would be more likely to be affected by bribe demands when those demands are greater. In addition, since the questions are asked similarly in Enterprise Surveys in other regions, it is likely that responses in these countries are affected in the same way as responses in Africa and therefore it is possible that this does not have a significant impact on countries' relative rankings.

II. Asking firms about corruption

Many measures of corruption are based upon managers' or experts' opinions of either how widespread corruption is or the extent to which it has an impact on firm operations. Although perception-based measures provide useful information, it is difficult to aggregate perceptions across firms when managers have different ideas about how great a problem corruption is. For example, is one major and one minor obstacle greater or less than two moderate obstacles in terms of a problem? It is also difficult to translate opinions into monetary costs and therefore to compare the cost of corruption with other costs (e.g., due to inefficient regulation, high taxes, or poor infrastructure). Finally, cultural differences can make it difficult to compare responses across countries and to compare the cost of corruption with other costs within countries.³ Because of these concerns, researchers have tried various approaches to quantify the cost of corruption.

Although it is difficult to quantify some types of corruption, petty corruption—payments to government inspectors and bureaucrats to either avoid having to comply with government regulations or to get licenses, utility connections and fulfill other government requirements more easily or quickly—could be measured directly. That is, like other costs, firms could document the bribes that they pay and report them to interested researchers. As well as providing a more objective indicator of the extent of corruption, this allows researchers to see what types of firms and households are more likely to pay bribes and that pay more in bribes.

Of course, it is unlikely to be this easy. When respondents are asked questions about illegal or immoral behavior, they are often less than forthcoming (Azfar and Murrell, forthcoming; Fowler, 1995; Iarossi, 2006). Because bribing government officials is illegal and morally ambiguous in most countries, managers might not be willing to admit to paying bribes—especially if doing so would open themselves up to being arrested.

There are several techniques to encourage firm managers to candidly answer questions on immoral and illegal behavior.⁴ Although the World Bank's Enterprise Surveys—the surveys used in the analysis in this paper—do not use the most sophisticated techniques to illicit honest responses to sensitive questions, such as randomized questions, questions about petty corruption are generally phrased in ways that allows respondents to answer without admitting that they pay bribes. For example, the question used in this paper is “we've heard that establishments are sometimes required to make gifts or informal payments to public officials to get things done with regard to customs, taxes, licenses, regulations, services etc. On average, what percentage of total annual sales, or estimated annual value, do establishments like this one pay in informal payments/gifts to public officials for this purpose?”⁵

Despite these efforts, lying and non-responses are likely to remain a problem—with both likely to bias estimates downwards.⁶ Based upon a survey of businesses in Romania, Azfar and Murrell (forthcoming) estimate that the percent of firms paying bribes might be one-third or more greater if all firm managers answered questions truthfully.⁷

But other differences also appear to affect responses. In most of the early Enterprise Surveys (before 2006), respondents were required to answer the question as a percent of sales. In the more recent surveys (2006 and later), firm managers have been able to choose how to respond to the question—either as percent of sales or in monetary terms. In practice, most enterprise managers in Sub-Saharan Africa answer this question as a percentage of sales—the first option on the questionnaire. It is not clear whether this is due to managers' preferences, interviewers' preferences, the phrasing of the question, or the arrangement of the questionnaire.

In theory, this should not affect results. Firms that answer the question as a percent of sales could calculate bribes as a percent of sales by first estimating them in monetary terms and then dividing this amount by sales, either implicitly or explicitly. If they took the estimate from their firm's accounts, this would probably be the most natural way to estimate the amount as a percent of sales.

In practice, estimates of bribes are not usually taken directly from the firms' accounts. Even if the firm did keep detailed accounts that clearly listed the bribes that it paid, it seems unlikely that the manager would be willing to share this information with an interviewer. Moreover, the question is phrased about ‘firms like yours’ rather than the actual firm's costs.

Since this is done to maintain deniability (i.e., to allow the manager to talk about other firms not their own), opening the books would shatter this illusion.

But even if the numbers don't come from their books, managers could still explicitly calculate this number (e.g., using a calculator or pencil and paper). During field interviews, however, most managers do not do this. One possible reason is that managers are often uncomfortable when asked questions about corruption and bribes. As a result, they often—although not always—choose to estimate the number in their head. Indeed, given that they can answer in monetary terms, it is not clear that why they would answer this question as a percent of sales if they were to do it in this way.

Although it seems that it should not matter whether the firm manager answers in terms of percent of sales or in local currency, there is evidence that it does. For firm managers that reported that firms like theirs paid bribes and chose to report the amount as a percent of sales, the average amount reported in most countries was between about 4 and 8 percent of sales (see Table 2). For firm managers that reported in terms of local currency, the average amount reported was mostly between about 0.5 and 1 percent of sales.⁸ In countries where at least five enterprises reported the amount in percentages and at least five in monetary terms, the difference is statistically significant at a five percent level or higher.

III. Why do firms that report bribes as percent of sales report paying more?

So why do firms that report bribes as percentages rather than as amounts report higher bribes? There are several plausible answers including: (i) outliers; (ii) difficulty of answering questions for 'firms like yours'; and (iii) firms that pay more in bribes might be more likely to answer in terms of percentages. In this section, we look at each of these explanations to see whether they appear to explain the difference.

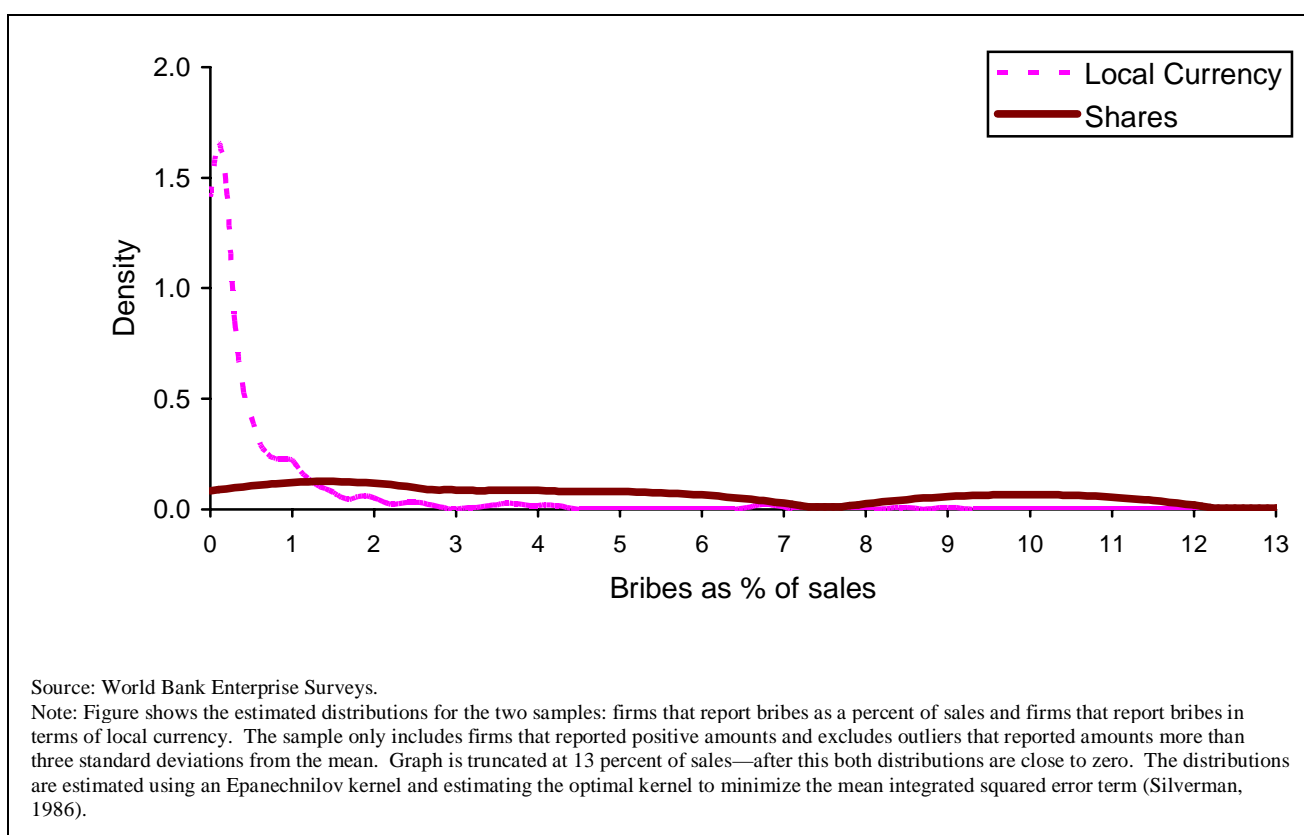
Outliers

Even firms that report that 'firms like theirs' have to pay bribes to get things done generally say that are equal to only a small amount relative to sales. This means that outliers can have a large effect on averages. Given that the average reported level of bribes is typically between about 2 and 5 percent of sales, a very small number of outliers—due to things such as enumerator error or innumerate managers—could have a large impact on the average. Because

of this, most analyses omit or ‘winsorize’ outliers when they calculate means or present medians rather than means so that a few outliers do not have a large impact on conclusions.⁹

For the countries in this analysis, outliers appear to affect the averages for firms that report bribes as shares more than they affect the averages for firms that report bribes in local currency (see Table 3). Except for Angola, where one firm that reports bribe payments in local currency is a large outlier, removing outliers does not affect the means for these firms. In contrast, removing outliers does generally affect the means for firms that report bribes as a percent of sales. Removing outliers therefore brings the means slightly closer together in most countries. But the gap remains quite large.

Figure 1: The distribution of reported payments is very different for firms that reported bribes as shares of sales and firms that reported bribes in local currency



Outliers are therefore not the whole story. Further evidence of this can be seen by looking at the entire distribution of responses for firms reporting in local currency and firms reporting as percentage of sales shows this clearly (see Figure 1). Across the 15 countries (see Table 2), about 83 percent of firms reporting in local currency reported payments that were for less than 1 percent of sales. Only 2 firms (less than one-half of one percent) reported payments

of 10 percent or more of sales. In comparison, only 8 percent of responses for firms reporting payments as a percent of sales were for less than 1 percent of sales and close to one-third reported amounts were 10 percent or more of sales. Moreover, for firms reporting payments as a percent of sales, there were several peaks at discrete numbers—1 percent (16 percent of firms), 2 percent (13 percent of firms), 5 percent (20 percent of firms), 10 percent (19 percent of firms), 20 percent (4 percent) and 30 percent (1.5 percent).

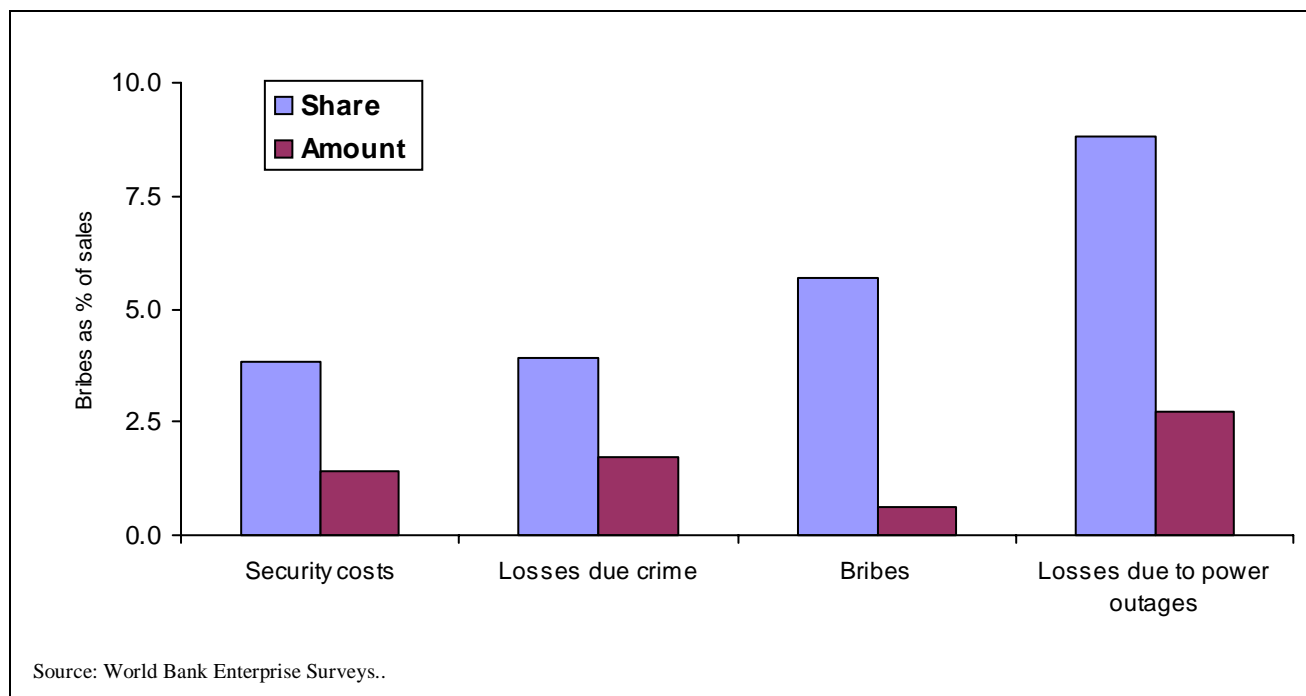
Difficulty of answering questions about ‘firms like yours’

To compare bribes for firms that report bribes in monetary terms and firms that report bribes as a percent of sales, bribes must be divided by sales for firms that report them in monetary terms or multiplied by sales for firms that report them as a percent of sales. Although it shouldn’t be a serious concern, it is possible that this might affect results. That is, whereas firms answer the question on bribes for a ‘firm like theirs’, they provide sales for their actual firm. As a result, the calculation is done dividing bribes for a ‘firm like theirs’ by their firm’s own sales. It is plausible that if firms consistently compare themselves to firms that are bigger or smaller than themselves, that this could affect the calculation.

Another possibility is that firms might be more comfortable answering sensitive questions as a percent of sales rather than in monetary terms and that this could affect averages. Iarossi (2006, p 50) notes that firms might prefer to answer questions on corruption when they can answer them in terms of ‘categories or percentages’ and notes therefore that asking the question in these terms might improve response rates or accuracy of responses.

This also does not appear to explain the discrepancy. In addition to the questions on bribes, other questions also allow respondents to respond as either a percent of sales or as a monetary amount. A similar pattern can be observed for these questions—firms that answered in monetary terms estimated amounts lower than firms that answered as a percent of sales for security costs, losses due to crime and losses due to power outages (see Figure 2). The differences were smaller for security costs and losses due to crime, but remained statistically significant. This suggests that the difference is not due to something specifically related to bribe payments such as the indirect phrasing or sensitivity of the question.

Figure 2: Firms that estimated losses due to crime, power outages and security in monetary terms also estimated lower amounts than firms that estimated losses as a percent of sales.



Differences between firms answering as percent and firms answering as amounts

Another possibility is that the firms that answer the questions as percentages might do so because they pay greater amounts as bribes. That is, firms that pay only small amounts as bribes or believe that firms like theirs only pay small amounts might be more likely to answer the question as an amount than firms that pay larger amounts. One possible reason for this might be that managers might find it difficult to answer the question as a percentage when the percentage is very small (e.g., less than one percent of sales).

Cross-sectional evidence. As a first step to seeing whether this appears to be the problem, we estimate the average treatment on the treated (ATT) using a treatment effects model based upon propensity score matching. This estimation allows us to compare average bribe payments for firms reporting bribe payments as percentages with similar firms reporting bribe payments in local currency (i.e., while controlling for observable differences between the two types of firms).

In the base model, the observable characteristics used to match firms through propensity score matching are size (log of number of employees) and sector (manufacturing, services, retail trade). In an extended model, additional control variables are added—whether the firm keeps

accounts that are audited by an external auditor, exports as a share of sales, whether the firm is foreign-owned, and whether the firm manager has a university-level education.¹⁰

In other specifications, other observable characteristics are added to the propensity score model. First, a set of variables are added to the base model representing interactions with regulatory authorities and infrastructure providers. These are a set of dummy variables indicating whether the firm got a new telephone connection, a new power connection, a construction license, an import license, or an operating license in the previous two years and a continuous variable representing how much of their time senior management spend dealing with government regulations and required meetings.¹¹ Gonzalez et al. (2007) show that these transactions (licenses and utility connections) are often associated with demands or expectation of bribes in many countries in Sub-Saharan Africa, using them to construct an index of graft. Second, a variable representing firm growth (average growth in employment over past three years) is included. Fast growing firms might be particularly susceptible to bribe demands if they need extra permission to expand or if they are more profitable.¹² This reduces sample size marginally since firms that are less than three years old are excluded. Third, variables representing profitability (profit per worker) and capital intensity (capital per worker) are included.¹³ This reduces sample size more significantly—mostly because capital and profits are only available for manufacturing firms (about one half to two-thirds of the sample in most countries). Finally all of these variables are included simultaneously.

The results from this model strongly suggest differences between firms reporting in terms of percent of sales and firms reporting in terms of monetary amounts remain different after controlling for these observable differences (see Table 4). The estimates suggest that in most countries, firms that reported amounts in monetary terms reported bribe payments between about 4 and 7 percentage points lower than if they had reported payments in terms of percentage of sales.

Are firms that report bribes in monetary terms less likely to pay bribes for specific transactions? If firms that report bribes in monetary terms actually did pay less in bribes than firms that report them as a percent of sales, then it seems plausible that they might be less likely to pay bribes for specific transactions. That is, firms that pay only small amounts as bribes or

believe that firms like theirs only pay small amounts might do so because they are less likely to pay bribes when they interact with regulators or utility company employees.

The enterprise surveys ask firms whether bribes were requested or expected for a series of transactions—getting telecommunications, power and water connections and getting construction, import and operating licenses. These questions were only asked to firms that reported that they had done these transactions in the past two years. To see whether firms that reported bribes in monetary terms were less likely to report paying bribes for these transactions, we regress a dummy variable indicating the firm reported bribes in monetary terms and a series of enterprise-level characteristics on dummy variables indicating that they reported bribes were requested or expected for these transactions. Since the dependent variable is a dummy variable, we use a probit regression.

The coefficient on the dummy variable indicating that firm reports bribes in monetary terms is positive in all regressions and is statistically significant in three of the six (see Table 7). This suggests that firms that reported bribes in monetary terms were more, not less, likely to report bribes for most transactions. The point estimates of the coefficients are large in some cases—firms that report bribes in local currency were between 5 and 23 percent more likely to report paying bribes for five of the six transactions. For the final transaction—getting a water connection—they were about 63 percentage points more likely to do so. This last regression, however, was based upon a relatively small number of transactions and so the coefficient is estimated imprecisely.

In summary, firms that report bribes in monetary terms are more, not less, likely to report bribes for specific transactions. This suggests that firms reporting bribes in monetary terms are not reporting lower amounts because they are less likely to pay bribes for specific transactions.

Panel Evidence. The cross-sectional analysis controls for observed differences in terms of enterprise characteristics, enterprise performance, and interactions with regulatory agencies. Unobserved differences, however, might account for part of the difference. To see if this is the case, we take an alternate approach using a panel of firms from Tanzania.¹⁴

In the 2006/07 Enterprise Surveys, the surveys used in the previous section, firms were able to answer the question either as a percent of sales or in monetary terms. In practice, most managers answered the question as a percent of sales. In most of the earlier surveys, managers

were only given one option—answering the question as percent of sales. This makes it difficult to make panel comparisons for the other two countries in Sub-Saharan Africa with panel information (Kenya and Uganda) because most firms answered the question as a percent of sales in both years.

But in one survey, the 2003 Enterprise Survey for Tanzania, firms were asked to answer the question in monetary terms. Because some of the firms were re-interviewed in 2006, this means that it is possible to make a small panel with most firms answering the question in terms of percent of sales in 2006 and in monetary terms in 2003. Including fixed effects means that it is possible to control for unobserved firm effects in the analysis. This makes it possible to see whether the same firms report higher bribes in 2006, when they mostly reported bribes as a percent of sales, than they did in 2003, when they had to report bribes in monetary terms.

Firms reported paying higher bribes on average in 2006 than in 2003. For the entire sample, including firms that reported not paying bribes, the average reported bribe payment was 0.1 percent in 2003 and 2.7 percent in 2006. For the panel firms, including firms that reported not paying bribes, the average reported payment was 0.1 percent in 2003 and 2.0 percent in 2006. The null hypothesis that the means are equal for the two samples is rejected at 1 percent level.¹⁵

This does not seem to be because corruption increased between 2003 and 2006. In fact, external evidence suggests that corruption fell over this period. In the Worldwide Governance Indicator database, Tanzania improved from the 19th percentile to the 43rd percentile between 2003 and 2006 (Kaufmann and others, 2007). Internal evidence in the two surveys is also consistent with the idea that corruption has improved since 2003. About 55 percent of firms said that corruption was a major or very severe problem in 2003 compared to about 25 percent in 2006.¹⁶ Among the panel firms, about 58 percent of firms said that corruption was a major or very severe problem in 2003 compared to about 9 percent in 2006.¹⁷

Although the mean level of bribes is very different, it is possible to do a more formal limited panel data analysis comparing the responses by firms in Tanzania in 2003 and 2006. To do this, we run a simple regression of bribe payments in the two years on a series of fixed firm effects and a dummy indicating whether the interview was delivered in 2003 or 2006.

In both years, significant numbers of firms report that they do not pay any bribes, meaning that the dependent variable is censored at zero. Including fixed effects in models with

censored dependent variables results in two econometric problems. The first problem is that if the firm did not report paying bribes in either 2003 or 2006, the coefficient on that firm's dummy will become infinitely negatively large when the model is estimated. As a result, firms that did not report paying bribes in either period have to be discarded (Maddala, 1983, p. 325).¹⁸ Similarly, only firms with observations in both periods can be included (i.e., if the firm must not have refused to answer in either period) or the dummy fully explains their payments. This reduces sample size considerably—from the 62 firms with panel information to only 26 firms.

A second problem is that fixed-effects maximum likelihood estimators can have an 'incidental parameters' problem when the number of cross-sectional units is large and the number of time periods is small (Neyman and Scott, 1948). That is, fixed effect maximum likelihood estimators are generally inconsistent when the number of time periods is fixed (i.e., T has to become large for consistency).¹⁹ Because of these concerns, we estimate the model using a semi-parametric least absolute deviations (LAD) estimator proposed by Honore (1992), which is consistent and asymptotically normal even with only two years of data.²⁰ This estimator is also more robust to distributional assumptions regarding the error term, remaining consistent in the presence of non-normal or heteroscedastic errors.

Table 6 shows the results from the fixed effects estimation. Although external evidence suggests that corruption fell in Tanzania between the two surveys, firms reported paying more in bribes in 2006 than they did in 2003 after including individual firm level fixed effects.

Moreover, firms that reported bribes in monetary terms in both years do not appear to report higher bribes in 2006 than in 2003. The coefficient on a dummy variable indicating that the firm reported bribes in monetary terms in 2006 is statistically significant and negative and is about the same size as the coefficient on the year dummy for 2006—suggesting that these firms reported similar bribes on average in the two years.

These results are consistent with the previous results, suggesting that firms that report bribes in monetary terms report lower bribes than firms that report bribes as a percent of sales. Although it is difficult to include additional control variables because the matrix used in the estimation becomes non-invertible when too many variables are included, the coefficients remain statistically significant when controls for number of workers and percent of time senior management spends dealing with government regulations and inspections are included.²¹

IV. Conclusions

Given that lying and non-responses are likely to bias estimates of bribe payments downwards, it might seem that the estimates from the Enterprise Surveys are likely, if anything, to underestimate the true cost of corruption. That is, bribe payments to get things done with respect to licenses, taxes and other services might exceed 2.5 percent of average sales in many low-income countries in Sub-Saharan Africa. The results from this paper suggest that this might not be the case.

Firm managers that report bribes as a percent of sales report that bribes are far higher than firm managers that report bribes in monetary terms (i.e., in local currency). If managers that reported bribes as a percent of sales estimated the amounts by estimating payments in monetary terms and then dividing by firm sales, we would not expect to see much of a difference between the two. That we do, suggests that managers do not do this kind of explicit calculation.

So why do we find a difference? It does not appear to be because of a few outliers and it does not appear to be something specifically related to the format or sensitivity of the question on corruption. Moreover, it does not appear to be because the firms that report bribes as a percent of sales are different than firms that report bribes in monetary terms either in terms of their observable characteristics or in the probability that they pay bribes for specific transactions. The analysis of panel firms in Tanzania also suggests that it is not due to unobservable firm-level characteristics.

So why is there a difference between the two amounts? One possibility is that firms are more likely to answer the question honestly or accurately when allowed to answer as a percent of sales. Iarossi (2006, p 50) notes that firms might prefer to answer questions on corruption when they can answer them in terms of ‘categories or percentages’ and so asking the question in these terms might improve response rates or accuracy of responses. Even if this were the case, however, it is not clear why this would result in a systematic downward bias for firms reporting bribes in monetary terms. This also doesn’t explain why less sensitive questions (e.g., on security costs or power outages) exhibit a similar pattern.

Another possibility—and one that is more likely in the opinion of the author—is that firm managers might not be very good at estimating amounts in percentage terms. This might be especially the case when the amounts are relatively small—as noted earlier most firms that

estimate amounts in monetary terms estimate amounts less than 1 percent of sales—and when the managers do not try to explicitly calculate percentages (e.g., by using calculators or pencil and paper).

If this is the case, petty corruption might be far less costly than headline estimates would suggest. For the 15 countries surveyed in 2006/07, the average firm that reported bribe payments in monetary terms reported payments that were between about 0.5 and 1.5 percent of sales compared to between 4 and 8 percent of sales for firms reporting as a percent of sales. Since firms only estimated bribe payments in either way if they reported that bribe payments were needed, both numbers overestimates the actual burden of petty corruption in Africa. Taking into account firms that report not paying bribes—but ignoring lying and non-responses in both cases—suggests that average bribes are probably closer to between 0.2 to 0.7 percent of sales when the estimates are based upon monetary amounts and between 2 and 5 percent of sales when are based upon share of sales (see Table 8).

For cross-country comparisons, it is not clear how large an effect it will have on rankings. That is, to the extent that estimates for all countries are equally biased upwards or downwards, it shouldn't affect relative rankings. Consistent with this, the estimate assuming that all firms reported in monetary terms is highly correlated at the country level with the estimate assuming all firms reported bribes as a percent of sales (simple correlation=0.82 and spearman rank correlation=0.79). The estimates for low-income countries appear more biased than the estimates for middle-income countries, perhaps because managers are better educated or more numerate in middle-income countries. But the difference in means is small.

The discrepancy, however, might affect comparisons between the cost of petty corruption and the cost of other things, especially when amounts for other estimates are given in monetary terms (e.g., when they are taken from company accounts). Under the first set of estimates, bribes appear to be more costly than either communication costs or transportation costs (excluding fuel) in most low-income countries in Sub-Saharan Africa and in some countries approach the cost of power and fuel. Under the second set of estimates, they are far lower than any of these costs in most countries. Although these are only the direct monetary cost of corruption—not the cost of other distortions associated with corruption—this suggests that petty corruption might be far less costly in most countries than the raw estimates would suggest.

So what are the lessons of this study? Whatever the reason for the difference, it would seem important to better understand why there are differences in the estimates of bribes and the other measures. Designing open-ended questions to better understand how firm managers answer these questions would therefore be useful. Documenting things such as whether managers actually perform explicit calculations, whether they appear evasive, whether they are trying to push past this question quickly and other such issues, might also make it easier to understand why this is the case. True randomized experiments asking some firms the question as a percent of sales and some as an amount would also be useful for confirming the results.

It also suggests that the questions should be asked one way or the other. Giving firms a choice could lead to bias in comparisons across countries when the percent of firms reporting in different ways differs across countries. Given that it seems easier for managers to estimate bribes in monetary terms rather than as a percent of sales, it would seem to make sense to ask this particular question in this way rather than as a percent of sales.²²

Since other questions appear to have similar problems—although possibly to a lesser extent than the question on bribes—similar advice probably holds for other questions such as security costs. When the amounts can be taken directly from a firms' books (e.g., security), it would probably be more natural to ask about them in monetary terms. For other questions such as losses due to power outages, where it might not be as natural to answer the question in monetary terms, it probably makes sense to ask different questions that allow researcher to assess the cost directly. For example, it might be possible to ask more direct questions on number and length of outages, how many lost hours of production this resulted in, and how many hours were later made up by either extending work time or by increasing productivity at other times. Similarly, firms could also be directly asked about the cost of a generator and the cost of running the generator relative to the cost of power from the grid.

V. References

- Azfar, Omar, and Peter Murrell. Forthcoming. "Identifying Reticent Respondents: Assessing the Quality of Survey Data on Corruption and Values." *Economic Development and Cultural Change*.
- Becker, Sacha O., and Andrea Ichino. 2002. "Estimate of Average Treatment Effects Based on Propensity Scores." *The Stata Journal* 2(4):358–377.
- Clarke, George R. G, Robert Cull, and Maria Soledad Martinez Peria. 2006. "Foreign Bank Participation and Access to Credit Across Firms in Developing Countries." *Journal of Comparative Economics* 34(4):774–796.
- Clarke, George R. G, and Lixin Colin Xu. 2004. "Privatization, Competition and Corruption: How Characteristics of Bribe Takers and Payers Affect Bribes To Utilities." *Journal of Public Economics* 88(9-10):2067–97.
- Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2002. "The Regulation of Entry." *Quarterly Journal of Economics* 117(1):1–37.
- Fisman, Raymond, and Jakob Svensson. 2007. "Are Corruption and Taxes Really Harmful to Growth? Firm Level Evidence." *Journal of Development Economics* 83(1):1–37.
- Fowler, Floyd J. 1995. *Improving Survey Questions: Design and Evaluation*. Thousand Oaks, CA: Sage Publications.
- Gelb, Alan, Vijaya Ramachandran, Manju Kedia Shah, and Ginger Turner. 2006. "What Matters to African Firms? The Relevance of Perceptions Data." World Bank: Washington DC. Processed.
- Gonzalez, Alvaro, J. Ernesto Lopez-Cordova, and Elio E. Valladares. 2007. "The incidence of Graft on Developing Country Firms." Policy Research Working Paper 4394. World Bank, Washington DC.
- Greene, William H. 2004a. "Fixed Effects and Bias Due to the Incidental Parameters Problem in the Tobit Model." *Econometric Reviews* 23(2):125–147.
- , 2004b. "The Behavior of the Fixed Effects Estimator in Nonlinear Models." *Econometrics Journal* 7(1):98–119.
- Heckman, James J., and Thomas E. Macurdy. 1980. "A Life Cycle Model of Female Labour Supply." *Review of Economic Studies* 47(1):47–74.

- Hellman, Joel, Geraint Jones, Daniel Kaufmann, and Mark Schankerman. 1999. "Measuring Governance and State Capture: The Role of Bureaucrats and Firms in Shaping the Business Environment." EBRD Working Paper 51. London, UK.
- Honore, Bo. 1992. "Trimmed LAD and Least Squares Estimation of Truncated and Censored Regression Models With Fixed Effects." *Econometrica* 60(3):533–565.
- Iarossi, Giuseppe. 2006. *The Power of Survey Design*. Washington DC: World Bank.
- Jensen, Nathan M., and Quan Rahman Aminur Li. 2008. "Heard Melodies Are Sweet, But those Unheard Are Sweeter : Understanding Corruption Using Cross-National Firm-Level Surveys." Policy Research Working Paper 4413. World Bank, Washington DC. Available on line at <http://go.worldbank.org/FVMFX9KVJ0>.
- Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi. 2007. "Governance Matters VI: Governance Indicators for 1996-2006." World Bank: Washington DC. Processed.
- Maddala, G. S. 1983. *Limited Dependent and Qualitative Variables in Econometrics Fe*. Cambridge, UK: Cambridge University Press.
- Neyman, J., and Elizabeth L. Scott. 1948. "Consistent Estimates Based on Partially Consistent Observations." *Econometrica* 49(1):1–32.
- Recanatini, Francesca, Scott Wallsten, and Lixin Colin Xu. 2000. "Surveying Surveys and Questioning Questions: Learning from World Bank Experience." Policy Research Working Paper 2307. World Bank, Washington DC.
- Regional Program on Enterprise Development, Africa Private Sector Group. 2007. "An Assessment of the Investment Climate in Tanzania." World Bank: Washington DC.
- Safavian, Mehnaz S., Douglas H. Graham, and Claudio Gonzalez-Vega. 2001. "Corruption and Microenterprises in Russia." *World Development* 29(7):1215–24.
- Silverman, Bernard W. 1986. *Density Estimation for Statistics and Data Analysis*. London: Chapman and Hall.
- Svensson, Jakob. 2003. "Who Must Pay Bribes and How Much? Evidence From a Cross Section of Firms." *Quarterly Journal of Economics* 118(1):207–230.
- World Bank. 2003. *Doing Business in 2004*. Washington DC: World Bank.

VI. Tables.

Table 1: Cost of bribes for manufacturing firms relative to other costs

	Bribes	Communication Costs	Transportation Costs	Electricity and Fuel Costs	Labor Costs	As % of power costs	As % of Labor Costs
Low Income Countries							
Guinea-Bissau	4.4%	0.3%	2.5%	5.8%	28.7%	75.9%	15.3%
Mauritania	4.4%	1.4%	1.7%	5.9%	14.9%	73.7%	29.3%
Guinea-Conakry	4.0%	0.8%	2.5%	5.9%	23.2%	67.7%	17.3%
Congo, DR	3.5%	0.8%	3.3%	4.2%	20.3%	82.7%	17.2%
Burundi	3.4%	1.2%	1.8%	4.4%	30.3%	75.9%	11.1%
Tanzania	2.9%	1.6%	1.8%	4.3%	20.3%	68.2%	14.5%
Gambia	2.9%	1.2%	3.8%	8.8%	22.1%	32.5%	13.0%
Uganda	2.8%	1.1%	2.8%	5.5%	23.5%	49.7%	11.7%
Kenya	2.3%	1.3%	1.4%	3.7%	15.9%	62.4%	14.7%
Ghana	1.7%	1.3%	3.3%	4.3%	30.9%	39.7%	5.6%
Rwanda	1.0%	1.2%	2.8%	5.5%	18.3%	18.9%	5.7%
Middle Income Countries							
Angola	3.2%	0.6%	1.2%	3.0%	34.8%	104.0%	9.1%
Botswana	1.1%	1.6%	2.3%	5.2%	20.3%	22.1%	5.7%
Swaziland	1.1%	1.0%	1.7%	4.7%	25.7%	23.1%	4.3%
Namibia	0.9%	1.3%	2.4%	4.9%	19.8%	18.1%	4.5%

Note: Calculations are for manufacturing firms only and so differ from figures in Table 2, which include all firms. The reason for this is that detailed cost breakdowns are only available for manufacturing firms.

Table 2: Average payments as percent of sales for firms reporting bribes, by how bribes were reported

	Obs.	Percent paying bribes	Average Payment (as % of sales)				T-test that difference is not zero
			All Firms	Firms reporting positive amount	Firms reporting as % of sales	Firms reporting as value	
Angola	398	46%	2.5	5.5	6.5	1.5	0.00
Botswana	285	28%	0.8	3.8	4.4	0.5	0.00
Burundi	260	56%	4.4	5.6	7.9	--- ^a	---
Congo, DR	337	84%	3.7	4.8	5.9	0.6	0.00
Gambia, The	140	52%	3.5	5.9	7.4	0.6	0.01
Ghana	494	37%	1.6	4.0	5.0	1.3	0.00
Guinea-Bissau	128	62%	2.8	4.8	6.6	0.1	0.00
Guinea-Conakry	220	85%	4.1	6.9	5.8	0.7	0.00
Kenya	646	79%	2.7	3.4	4.2	0.6	0.00
Mauritania	207	82%	3.8	4.4	4.9	0.8	0.00
Namibia	286	11%	0.3	3.2	3.4	0.2	0.02
Rwanda	209	20%	2.1	9.5	11.3	--- ^a	---
Swaziland	290	41%	1.2	3.3	3.0	--- ^a	---
Tanzania	415	49%	2.7	5.4	6.8	0.5	0.00
Uganda	508	51%	3.3	5.1	7.2	0.6	0.00

Note: Firms that reported amounts that are greater or less than the average by more than three standard deviations are omitted from averages.

^a. Average not report because fewer than five firms in category.

Table 3: Winsorized, Trimmed and Actual Means for payments, by how bribes were reported.

	All Observations		Firms more than 3 standard deviations from mean dropped		Top and bottom 5 percent winsorized	
	Local Currency	Share	Local Currency	Share	Local Currency	Share
Angola	4.6	7.8	1.5	6.5	1.5	6.7
Botswana	0.5	6.0	0.5	4.4	0.5	4.6
Burundi	--- ^a	8.2	--- ^a	7.9	--- ^a	8.1
Congo, DR	0.6	7.5	0.6	5.9	0.6	6.0
Gambia	0.6	9.2	0.6	7.4	0.6	7.9
Ghana	1.3	6.3	1.3	5.0	1.3	5.2
Guinea-Bissau	0.1	6.6	0.1	6.6	0.1	6.4
Guinea-Conakry	0.7	6.7	0.7	5.8	0.7	5.8
Kenya	0.6	5.7	0.6	4.2	0.6	4.3
Mauritania	0.8	5.7	0.8	4.9	0.8	4.7
Namibia	0.2	5.9	0.2	3.4	0.2	3.1
Rwanda	--- ^a	14.0	--- ^a	11.3	--- ^a	10.7
Swaziland	--- ^a	3.3	--- ^a	3.0	--- ^a	3.1
Tanzania	0.5	8.7	0.5	6.8	0.5	7.5
Uganda	0.6	8.0	0.6	7.2	0.6	7.1

Note: Table only includes firms reporting positive amounts. Columns (2) and (3) are averages for firms reporting positive amounts. . Columns (4) and (5) drops firms that reported amounts that are greater or less than the average by more than three standard deviations are omitted from the mean. . Columns (6) and (7) winsorized the top and bottom 5 percent of observations (i.e., sets firms in the top and bottom five percent of observations to the level of the 5th and 95th percentile. Winsorizing and trimming is done for the full sample not the sub-samples separately.

^a. Average not report because fewer than five firms in category.

Table 4: Average difference between firms reporting as amount and as percent based upon propensity scores

	Base	Extended	Regulatory Variables	Firm Growth	Firm Performance	All
Angola	-8.3*** (-3.60)	-8.9** (-3.25)	-9.1*** (-2.85)	-9.9*** (-3.27)	-6.9*** (-3.32)	--- ^a
Botswana	-4.0*** (-4.80)	-4.0*** (-5.14)	-4.4*** (-2.78)	-4.0** (-2.30)	--- ^a	--- ^a
Congo, DR	-5.8*** (-16.77)	-5.7*** (-12.92)	-5.9*** (-10.37)	-6.3*** (-11.20)	-5.5*** (-7.69)	-6.1*** (-4.86)
Gambia	-7.0*** (-4.01)	-7.6*** (-2.82)	-6.3 (-1.29)	--- ^a	--- ^a	--- ^a
Ghana	-5.4*** (-6.03)	-5.2*** (-6.01)	-5.0*** (-3.08)	-5.5*** (-5.05)	-4.7*** (-2.87)	-5.8*** (-2.81)
Guinea-Bissau	-6.5*** (-6.54)	-6.7*** (-6.44)	-4.0* (-1.65)	-8.5*** (-4.41)	--- ^a	--- ^a
Guinea-Conakry	-5.2*** (-6.61)	-5.2*** (-5.69)	-3.9** (-2.20)	-4.4*** (-4.81)	-5.7** (-2.57)	-3.3* (-1.70)
Kenya	-3.7*** (-12.56)	-3.7*** (-14.38)	-3.8*** (-11.48)	-3.6*** (-11.24)	-3.3*** (-9.14)	-3.9*** (-3.59)
Mauritania	-4.1*** (-7.24)	-3.5*** (-3.58)	-4.0** (-1.93)	-3.9*** (-3.56)	-3.4 (-1.08)	-1.3 (-1.26)
Namibia	-4.2** (-2.27)	-4.4** (-2.08)	--- ^a	--- ^a	--- ^a	--- ^a
Tanzania	-7.1*** (-9.22)	-6.7*** (-7.55)	-8.2*** (-5.93)	-7.1*** (-9.34)	-5.9*** (-4.38)	-5.7*** (-2.83)
Uganda	-6.3*** (-11.49)	-6.3*** (-11.73)	-6.1*** (-5.95)	-5.9*** (-5.29)	-6.4*** (-4.72)	-5.8*** (-3.45)

Note: The propensity score is estimated as a probit model including size and sector in the base model and including size, sector, whether the firm is foreign-owned, exports as percent of sales, whether the manager has a university education, and whether the firm has audited accounts in the extended model.

Matching is done based upon propensity scores and firms are matched using a Gaussian kernel. The model was estimated using STATA (Becker and Ichino, 2002). T-statistics are estimated by bootstrapping the standard errors. Models are only estimated over areas of common support. Bootstrapped T-stats are in parentheses. In Burundi, Rwanda and Swaziland, fewer than 5 firms reported bribes in US dollars in even the base model so these countries are omitted from the table

*** ** * Significant at 1, 5, and 10 percent significance levels.

^a Estimation of model fails due to too few observations. The main problem is that when only a few firms report bribes in dollars, the probit model perfectly predicts method of reporting.

Table 5: Control of Corruption in Tanzania (higher values mean less corruption))

Year	Percentile Rank (0-100)	Governance Score (-2.5 to +2.5)	Standard Error
1996	9.7	-1.09	0.25
1998	12.6	-1.07	0.19
2000	9.2	-1.07	0.19
2002	14.6	-1.00	0.17
2003	18.9	-0.88	0.16
2004	30.6	-0.65	0.15
2005	29.1	-0.73	0.15
2006	43.2	-0.37	0.15

Source: Kauffman, Kraay and Mastruzzi (2007)

Table 6: Differences in bribe payments for panel firms in Tanzania between 2003 and 2006.

Estimation Method	Least Absolute Deviations (LAD)		
Dependent Variable	Bribes as percent of sales		
Number of Firms	26	26	26
Year -- 2006 (dummy)	14.74 (4.77)***	14.78 (5.38)***	16.99 (4.90)***
Answered question in monetary terms in 2006 (dummy)	-13.78 (-4.46)***	-14.04 (-3.10)***	-20.09 (-3.08)***
Number of Workers (natural log)		-0.67 (-0.05)	
% of management time spent dealing with government regulation (percent)			0.23 (1.13)

*** ** * Significant at 1, 5, and 10 percent significance levels.

Table 7: Probability that firms that report bribes in local currency pay bribes for various transactions

	Probit					
	Dummy Variable Indicating firm had to pay bribe when getting:					
	Telephone Connection	Power Connection	Water Connection	Construction License	Import License	Operating License
Observations	492	453	109	227	335	1042
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm reported bribes in monetary terms	0.049 (0.78)	0.233*** (3.14)	0.631*** (3.55)	0.110 (1.07)	0.078 (0.76)	0.177*** (3.85)
Workers	0.002 (0.095)	0.021 (0.77)	-0.015 (-0.27)	-0.045 (-1.11)	-0.018 (-0.63)	0.006 (0.37)
Export Share	0.001 (0.62)	-0.000 (-0.20)	-0.003 (-1.03)	0.000 (0.19)	-0.001 (-0.64)	-0.003** (-2.34)
Foreign-owned	0.090 (1.20)	0.064 (0.76)	0.025 (0.15)	-0.102 (-1.03)	-0.028 (-0.38)	0.016 (0.30)
University-Education Manager	-0.050 (-1.15)	-0.025 (-0.46)	0.127 (1.03)	0.066 (0.79)	0.096 (1.52)	-0.009 (-0.26)
Pseudo-R-Squared	0.07	0.10	0.21	0.08	0.14	0.11

Note: Coefficients are marginal effect for continuous variables and are differences in probabilities for discrete variables.

*** ** * Significant at 1, 5, and 10 percent significance levels.

Table 8: Actual average bribe payments and estimated bribe payments if all firms reported bribes in either monetary terms or shares

	Average (all)	Estimated (monetary)	Estimated (shares)	Monetary estimate (as % of shares estimate)
Low Income (average)	3.0	0.4	3.5	12%
Ghana	1.3	0.3	1.5	19%
Kenya	2.3	0.3	2.6	11%
Tanzania	2.8	0.2	3.2	7%
Uganda	3.1	0.5	3.2	14%
Congo, DR	3.7	0.6	5.0	13%
Mauritania	3.7	0.4	4.0	9%
Guinea-Conakry	4.3	0.7	4.8	15%
Middle Income (average)	1.2	0.3	1.5	18%
Namibia	0.4	0.0	0.4	10%
Botswana	0.9	0.1	1.2	12%
Angola	2.4	0.6	2.8	21%
Memo: Small Countries				
Gambia	3.5	0.3	3.8	8%
Guinea-Bissau	3.0	0.1	4.4	1%

Note: Estimated values are calculated as follows. First, for the firms that reported positive bribe payments fitted values are calculated from a regression of estimated bribe payments on the variables in the extended model with the regulatory variables included (see Table 4), a series of country dummies, and a series of country specific variables indicating whether the firm estimated payments in monetary terms or as a percent of sales. The country specific variables indicating whether the firm estimated payments in monetary terms are set to zero for all observations to get a estimated share for monetary terms and set to one for all firms in the country to get the estimated share for share terms. For firms that report not paying bribes the fitted values are set to zero for each firm. The averages are then calculated over all observations in each country for each fitted value. The average across countries is a simple unweighted average. Since the estimates for the two small countries with less than 200 firm observations appear to be outliers, these are omitted from the averages.

¹ Detailed cost breakdowns are only available for manufacturing firms and so comparisons are for only these firms. As a result, numbers in Table 1, which are only for manufacturing firms are different from figures in Table 2, which are for all firms.

² See, for example, Fisman and Svensson (2007) for a study using firm-level data on the distortions related to corruption.

³ Some studies have found, however, that perceptions appear to line up fairly well with objective indicators of the investment climate. See, for example, Gelb et al (2006) for work using data from Africa or Hellman and others (1999) for work using data from Eastern Europe and Central Asia. However, other studies have found that measures based upon perceptions might be affected by things such as political freedom. Jensen et al (2008) show that non-response patterns and lying reduce measured corruption in politically repressive environments. Similar patterns also appear for less sensitive questions. In particular, Clarke et al (2006) show that firms appear to complain more about access to finance in countries that are more free politically than in other countries after controlling for other country and firm characteristics.

⁴ See, for example, the discussion in Iarossi (2006) or Recanatini and others (2000) for discussions of phrasing questions related to corruption.

⁵ In the question firm managers that reported applying for utility connections and licenses were asked whether ‘a gift or informal payment was expected or requested’ not whether a bribe was paid. Thus, they can admit that a bribe was requested without actually admitting whether it was paid. Iarossi (2006) also notes that respondents also appear to be more willing to answer questions on sensitive issues when the question is long—something the question on Enterprise Surveys questionnaire appears to fulfill. Azfar and Murrell (forthcoming) argue that even broad questions about corruption, including questions about ‘firm like yours’, suffer from serious problems with lying and non-response.

⁶ The non-response rate to this question on the enterprise surveys can be quite high. Although in the 2006/07 World Bank Enterprise Surveys in Sub-Saharan Africa, the non-response rate was close to 6 percent, in earlier World Bank Enterprise Surveys, the non-response rate was even higher—for example, about 14 percent in the 2003 Enterprise Survey conducted in Tanzania, 23 percent in the 2003 Enterprise Survey conducted in Kenya, and 49 percent in the 2003 Enterprise Survey in Uganda. Although it is not possible to know what firms that refuse to answer would have said, it seems plausible that firms that pay bribes (i.e., that are breaking the law or engaging in socially unacceptable behavior) will be more likely to refuse to answer than firms that do not. Azfar and Murrell (forthcoming) show results consistent with this. As a result, non-responses are likely to bias results downwards. Another problem, lying, is also likely to bias results downward. Firms that do pay bribes—or suspect that firms that are like theirs do—would appear more likely to say they don’t than firms that don’t pay bribes will be to say they do. That is, since paying bribes is illegal, it seems likely that the firms that are paying bribes are most likely to lie. Even if they don’t pay bribes but suspect that many ‘firms like theirs’ do, it seems possible that they might lie since they probably suspect that the interviewer will interpret a ‘yes’ to a question about whether firms like theirs pay bribes as indicating that they themselves do. Consistent with this concern, when managers do say that firms like theirs pay bribes during interviews, they often explicitly note that their company does not do so.

⁷ They do this by using a series of randomized questions to identify firm managers who give a set of answers that are very unlikely and show that these managers admit to corrupt interactions far less than other managers do.

⁸ Firms that report paying no bribes are excluded from these averages since it is not clear whether they would have reported bribes as a percent or in monetary terms.

⁹ On the World Bank’s Enterprise Surveys website (www.enterprisesurveys.org) averages for most firm-level variables other than averages of dummies are calculated omitting firms that report amounts that are over three standard deviations from the mean. Similarly, using a sample of firms from Uganda, Svensson (2003) excludes two outliers in the analysis in that paper.

¹⁰ See footnote 8 for a description of how firms not reporting bribes are treated

¹¹ An additional question on whether the firm got a water connection was omitted because this was not asked in most countries and so would restrict sample size significantly. Several analyses have shown that corruption is greater in countries where the burden of regulation is heavier (Djankov and others, 2002; World Bank, 2003). At the enterprise level, Safavian et al. (2001) show that firms in Russia that face more inspections are more likely to say that corruption is a problem.

¹² Safavian et al. (2001) find that firms in Russia that were growing more quickly are more likely to say that corruption is a problem than slower growing firms. Clarke and Xu (2004), however, do not find a statistically significant relationship between sales growth and bribe payments for sample of countries in Eastern Europe and Central Asia.

¹³ Svensson (2003) shows that firms that are more profitable and firms that are more capital intensive pay more in bribes in Uganda. Clarke and Xu (2004) also find that firms that are more profitable pay higher bribes in a sample of countries in Eastern Europe and Central Asia.

¹⁴ The panel data are described in detail in Regional Program on Enterprise Development (2007)

¹⁵ The t-statistic is 3.17 (p-value=0.00).

¹⁶ Comparisons are for manufacturing firms only since the 2003 survey only covered manufacturing firms.

¹⁷ In practice, this might underestimate the actual burden of corruption in 2006. A major electricity crisis in 2006 appears to have affected firms responses to perception-based questions. That is, complaints about every area of the investment climate except power were far more muted in the 2006 survey than they were in the 2003 survey (Regional Program on Enterprise Development, 2007).

¹⁸ When the model is estimated after these observations are dropped, the estimator is called an “unconditional estimator”. Heckman and Macurdy (1980) propose (in a slightly different Tobit-type model) an estimator that explicitly takes into account the conditioning that arises from discarding these observations (the conditional estimator). They note that since the two estimators require the same asymptotic assumptions for consistency, there is no theoretical reason to prefer the conditional estimator to the unconditional estimator (p. 59). Therefore, we present results from the unconditional model since it is significantly easier to estimate.

¹⁹ This suggests that including fixed effects might be problematic in this instance—since there are only two years of data in the current dataset. But as Greene (2004a; 2004b) points out, there are no general results showing that maximum likelihood estimators are *biased* when T is small. Further, recent Monte-Carlo studies suggests that the slope coefficients for fixed effects Tobit estimators do not appear to be biased even for models with very few time periods (Greene, 2004a; Greene, 2004b). This is in sharp contrast to other fixed effect maximum likelihood estimators, such as fixed effects Probit estimators, where the coefficients exhibit substantial bias for small T. However, the estimates of the disturbance variance do appear to be biased downwards (about 36 percent too small when T=2 in Greene’s analysis). This make the t-statistics appear larger than they would be and means that estimates of marginal effects that use mean values for calculations will be biased.

²⁰ The model is estimated in GAUSS using the PANTOB package written by Bo Honore. The program is available on Bo Honore’s website (<http://www.princeton.edu/~honore/>).

²¹ In particular, it becomes non-invertible when dummies for exporters, foreign-owned firms, or exports as a percent of sales are included. It also become non-invertible when number of workers and % of management time spend dealing with government regulations are included at the same time.

²² Another exception might be bribes that are used to win a government contract—this might be more naturally asked as a markup rather than an absolute amount if managers naturally think of it in this way.