Foreign Bribery: Incentives and Enforcement*

Jonathan M. Karpoff [a]
University of Washington

D. Scott Lee[b]
University of Nevada, Las Vegas

Gerald S. Martin[c]
American University

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Abstract

We use data from enforcement actions initiated under the U.S. Foreign Corrupt Practices Act (FCPA) to examine firms' incentives to pay bribes and their costs when they are caught. Bribery is associated with projects that are valuable even considering the expected penalties. For firms that are caught, the average ex post NPV net of penalties is still non-negative and the reputational loss is negligible. For a subset of firms that face comingled charges for financial fraud, however, the direct cost and reputational loss are large and the ex post NPV is negative.

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[a] Email: karpoff@uw.edu, Foster School of Business, University of Washington, Seattle, WA 98195, USA.
[b] Email: scott.lee@unlv.edu, Lee Business School, UNLV, Las Vegas, NV 89154, USA.
[c] Email: gmartin@american.edu, Kogod School of Business, American University, Washington, DC 20016, USA.

I. Introduction

The Foreign Corrupt Practices Act of 1977 (FCPA) prohibits U.S. companies from paying bribes to foreign government officials to obtain business or influence regulation. FCPA enforcement has become a top priority for U.S. law enforcement agencies (Breuer, 2011), and the majority of anti-bribery enforcement actions since the law was passed have been initiated within the last ten years. Anti-bribery laws have been passed in many other countries, but the U.S. stands out for its vigorous enforcement.[1]

The surge in bribery enforcement has spawned new debate over the prevalence of bribery, the profitability of bribe-related projects, and the penalties imposed on firms that are caught bribing. Critics argue that anti-bribery enforcement actions impose large costs and legal risks on firms (see Weismann and Smith, 2010), which now invest heavily in compliance programs.[2] Defenders of the law argue that bribery is pervasive and that anti-bribery enforcement efforts are required to decrease corruption that is socially inefficient (e.g., see Kennedy and Danielsen, 2011; the U.S. Department of Justice and Securities Exchange Commission, 2012). Both sides have worked to change U.S. anti-bribery laws, although recent trends favor increased enforcement.[3]

To date, this debate has proceeded without systematic evidence on foreign bribery and its enforcement. As Lawler (2012) points out, there is little evidence on (i) the prevalence of foreign bribery, (ii) the value of the contracts obtained with bribes, or (iii) the sizes of the bribes that are paid. The economic and policy debate centers on firms' costs from bribery enforcement actions, but there is no systematic evidence on

[1] Member nations in the Organization of American States and Organization for Economic Cooperation and Development agreed in 1996 and 1997 to work to pass anti-bribery laws. Most of these countries, however, have never enforced an anti-bribery law and the number of enforcement actions brought by U.S. agencies exceeds that of all other countries combined. For example, the OECD (2016) reports that 39 "entities," which include but are not limited to publicly traded corporations, have faced criminal sanctions for bribery by non-U.S. OECD countries from 1999 through 2015. By comparison, the SEC and DOJ brought bribery-related enforcement action against 143 publicly traded corporations through May 2013.

[2] Press articles frequently highlight the high costs of FCPA compliance (e.g., Jones, 2012). To illustrate such costs, Koehler (2016) estimates that Wal-Mart spends $520,000 per working day on FCPA compliance costs. See also Herrington (2015) for a discussion of the costs of FCPA-related civil liability.

[3] U.S. Chamber of Commerce proposals to constrain the application of the FCPA have motivated several Congressional hearings since 2010. Despite these efforts, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 increases many firms' potential liability for bribery violations. Bills introduced in the 112th and 113th Congresses seek to provide a private right of action for persons and firms who are damaged by a foreign business that violates the FCPA, thus further increasing some firms' potential liabilities from bribery. See the Searle Civil Justice Institute (2012) for summaries of current policy disputes and reform efforts regarding the FCPA.

(iv) the probability that a bribe-paying firm will be caught and face enforcement action, or (v) the types and sizes of the penalties it will face.[4] Becker's (1968) analysis implies that firms pay bribes because it is profitable to do so and that enforcement penalties should decrease the expected profitability, but there is no evidence on (vi) the ex ante net present value of projects that are obtained with bribes, (vii) the ex post value of these projects for firms that are caught, or (viii) whether the penalties are sufficiently high to drive firms' ex post gains into negative territory – a condition for deterrence. As highlighted by the Searle Civil Justice Institute (2012), there also is little evidence on whether firms' values change (ix) when they announce projects that might be tainted with bribes, or (x) when they are caught engaging in bribery.

This paper seeks to address all of these issues. We are able to make progress on a large number of research questions by examining a comprehensive database of all 143 enforcement actions initiated against publicly traded companies for foreign bribery by the U.S. Department of Justice (DOJ) and Securities and Exchange Commission (SEC) from 1978 through May 2013. To guide our analysis we use a framework that characterizes the relationships between the ex ante and ex post net present value of projects that involve bribery, the size of bribe payments, the costs to firms that face bribery-related enforcement action, and market reactions to news about (possibly) bribe-tainted projects and about the revelation of bribery. This framework is expressed as five equations with 12 parameters.

We provide estimates for the 12 parameters by directly measuring five of them, estimating two others, and solving for the remaining five parameters using the five-equation framework. The five parameters we directly measure are: the size of the bribe, the value of the benefit obtained by the bribe, the change in firm value when the bribery and related enforcement activity are revealed, the direct costs to the firm from being targeted for enforcement action, and the effect on firm value of any financial restatement associated with the bribery. The two estimated parameters are the probability that a firm with foreign sales engages in bribery and the probability that a bribe-paying firm will be caught and targeted for enforcement action. To estimate these probabilities, we develop a prediction model similar in nature to Altman's (1978) z-score for predicting

[4] The costs to targeted firms are central to arguments that the FCPA should be amended (e.g., see the Committee on International Business Transactions, 2011). It also is common to argue that firms that are caught paying bribes suffer large reputational losses (Sampath, Gardberg, and Rahman, 2011; Serafeim (2013); and U.S. Department of Justice and Securities and Exchange Commission, 2012, p. 3). Our results indicate that, while the reputational costs of financial fraud are large, the reputational costs of bribery are negligible.

bankruptcy, but augmented by signal detection theory. Our base-case estimate is that 22.9% of all Compustat-listed firms with foreign sales engaged in prosecutable foreign bribery programs at least once during our 36-year sample period, and the probability that a bribe-paying firm faces enforcement action is 6.4%.[5]

We use the five directly measured parameters and two probability estimates to solve for the five remaining parameters using our five-equation framework. We find that bribes tend to be paid for benefits whose values average 3.3% of the bribing firm's market capitalization. Net of the expected costs of bribery and the chance of being caught, the mean ex ante NPV of a bribe-related project is 2.35% of the firm's market capitalization. Firms apprehended for bribery face costs that average 5.1% of market capitalization, including 3.3% in direct costs and 1.0% in reputation losses. These large costs drive the average ex post NPV of the bribe-related project into negative territory, as the average ex post NPV for apprehended firms is -2.39% of market capitalization.

These overall averages, however, obscure an important pattern in the data. Thirteen of the firms in our sample have financial fraud charges comingled with their bribery charges. In all of these cases the fraud charges are not directly related to the bribery charges, but the same regulatory releases that convey information about the bribery also convey information about the financial fraud. Unable to disentangle the impacts of these two simultaneous types of news, we instead examine how the characteristics of the firms with only bribery charges differ from those of firms with comingled fraud. Firms without comingled fraud use bribes to obtain smaller benefits and pay smaller bribes than the fraud firms. When caught, they experience smaller direct costs and smaller share price reactions to their financial restatements. But the most important distinction is that, when their misconduct is revealed, firms without comingled fraud charges experience losses in share values that are only 1/13 of the losses suffered by bribe-paying firms that do face fraud charges (the mean loss is 2.6% compared to 33.1% for firms with fraud charges). The largest source of this difference is that firms with fraud charges experience large reputational losses – averaging 18.8% of share value – compared to negligible

[5] In Section VIII we report on extensive robustness tests of these two probability estimates. The base-case estimates are somewhat, although not highly, sensitive to alternate assumptions in the estimation process. The estimates of the other ten parameters, however, are highly robust even to large changes in these two probability estimates. For example, our conclusion that the ex ante NPV of the bribe-related project is positive is robust as long as the probability that a bribing firm gets caught is less than 52.8% – an extremely unlikely deviation from our base-case estimate of 6.4%.

reputational losses for bribe-paying firms without fraud charges. Reputational losses measure the long-term impact on the firm's operations and contracting with investors, suppliers, or customers. These results indicate that the revelation of bribery, by itself, has little long-term impact, as long as the bribery is not comingled with charges of financial fraud. Because non-fraud firms face relatively small costs even when they are caught bribing, the average ex post NPV of the bribe-related activity is non-negative for the majority of firms without comingled fraud charges (+0.4% of market capitalization). Thus, even for firms that are caught, the net benefits of their bribe-related projects are non-negative (as long as the firm avoids comingled fraud charges).

We conduct numerous tests to examine the sensitivity of our estimates to alternative measures and assumptions. For a subset of 62 cases in our sample, we have data on the change in the firm's share price upon the initial announcement of the project that subsequently was tied to bribery. This allows us to directly measure one of the imputed parameters (ΔV_1) from our main tests. The directly measured and imputed values are similar (3.3% vs. 3.1%). Re-calibrating the model for this subset of 62 cases yields results for all 12 parameters that are similar to our main results. In another test, our procedure to identify bribing firms based on ex ante characteristics accurately flags 80% of bribing firms in a holdout sample of recent bribery cases. Further tests indicate that our results and inferences are robust to alternative assumptions used to derive our estimates of the probability of bribing and the probability of getting caught.

This paper makes several contributions to the research literature. First, our data include all foreign bribery-related enforcement actions initiated by the SEC and DOJ under the FCPA. This allows us to provide descriptive information about the frequency of these enforcement actions, their distributions across firm size and industry, and the countries in which bribes are paid. The industries that appear most frequently in our sample include heavy manufacturing, pharmaceuticals, and oil and gas, and the countries that appear most frequently are China, Nigeria, Iraq, Indonesia, Saudi Arabia, India, and Mexico.

Second, our data allow us to describe the characteristics of bribe-paying firms that face FCPA enforcement. For these firms, the probability of paying bribes in any given firm-year is negatively related to current operating performance and positively related to: (i) firm size, leverage, and R&D intensity; (ii) the level of corruption within the firm's industry as measured by Transparency International; (iii) the number of geographic segments in which the firm operates and the level of corruption in those markets as measured by

the World Bank's World Governance Institute Control of Corruption index; and (iv) an aggressive corporate culture as defined by Miles and Snow (2003). Examples from our sample that generally fit these characteristics include General Electric, HCA Hospital Corporation, and Royal Dutch Petroleum.

Third, we find that firms' share prices increase significantly (on average 3.3%) upon news of a project that subsequently is tied to bribe payments, and that share prices decrease significantly (on average 5.44%) upon news that a firm engaged in bribery. Hence, capital markets incorporate the benefits of bribe-related projects and the costs of enforcement.

Fourth, we document that firms caught bribing experience significant direct penalties, including legal costs, fines, penalties, and monitoring costs, that average 3.27% of firm value. Bribe-paying firms that avoid comingled fraud charges, however, suffer no significant loss in reputation. That is, the revelation that a firm engaged only in bribery does not appear to harm its contracting relationships with suppliers, investors, or customers. This implies that virtually all of the cost imposed on a bribe-paying firm that is caught is imposed via legal sanctions and not via market transactions. In this regard, the revelation of bribery is similar to the revelation that a firm violated an environmental regulation, and is not similar to revelations that a firm engaged in consumer fraud or financial misrepresentation (e.g., see Amiram et al., 2017).

Fifth, our application of signal detection theory provides a solution to a challenging problem that plagues many investigations into illegal business activities. As Dechow et al. (2011) and Dyck, Morse, and Zingales (2014) point out, empirical tests typically rely on samples of firms that are caught engaging in the activity. Firms that engage in the activity but are not caught, in contrast, remain unobserved. Signal detection theory provides guidance in weighing Type I and Type II errors in classifying firms as engaging in the activity (i.e., as bribe payers).[6] Our baseline estimate is that 22.9% of all Compustat-listed firms with foreign sales engaged in prosecutable bribery programs during at least one five-year period sometime between 1978 and 2010. We do not take a position on whether this estimate is particularly high or low, and in Section VIII we examine how this estimate is affected by time variation and changes in our estimation assumptions. We

[6] Similar applications of signal detection theory are used in medical efficacy trials, psychophysics, epidemiology, radiology, machine learning, data mining research, and securities litigation risk. See Green and Swets (1966), Swets (1988), Grzybowski and Younger (1997), Fawcett (2006), Metz (2006), Zou, O'Malley, and Mauri (2007), and Kim and Skinner (2012).

emphasize, however, that estimates of the other central parameters of our five-equation framework – including the ex ante and ex post NPV of bribery-related projects and the size of the reputation loss for firms that are caught – are not highly sensitive to even large deviations from this 22.9% baseline estimate.

Sixth, our estimates yield inferences about managers' motives to engage in bribery. We find that, on average, the ex ante NPV of a bribe-related project is strongly positive even considering the cost of the bribe and the expected penalties if the firm is caught. This result implies that bribery is not a manifestation of a managerial agency problem, as it might be for other types of business misconduct (e.g., see Burns and Kedia, 2006). Rather, firms bribe because they seek profitable projects. Furthermore, the ex post NPV of the bribe-related project is non-negative even including the enforcement-related costs (for firms that avoid any associated charges of financial fraud), indicating that the penalties are insufficient to provide much deterrence.

Seventh, our results allow us to measure the division of gains from bribe-related business. We find that bribe recipients capture 17.8% of the value of the benefit for which bribes are paid, on average. This evidence is inconsistent with arguments that bribe recipients extract most of the surplus from bribe-related contracts, and suggests that the average ex ante NPV of bribe-related project is positive, in part, because bribe-paying firms transfer only a small portion of the project value to bribe recipients.

Eighth, our analysis allows us to examine policy questions about the optimal penalties for bribery. Using our baseline estimate that the probability of getting caught is 6.4%, total penalties imposed on bribe payers would have to increase by 8.3 times to drive the average ex ante NPV to zero. If the penalties remain at historical levels, the probability of getting caught would have to increase to 52.8% to achieve the same objective. This implies that bribe-tainted projects will continue to be profitable, at least on an ex ante basis, unless there is a substantial increase in the penalties for bribery or the probability of getting caught, or both. We do not address the debate over whether it is good public policy to discourage bribery in the first place (e.g., see Shleifer and Vishny, 1993). But if it is desirable to discourage bribery, our results support the view that enforcement efforts and penalties should be increased to achieve an optimal level of deterrence.[7]

[7] Our analysis applies to firm-level incentives and deterrence, as we do not consider other consequences to bribe-paying managers. In our sample, a total of 31 individuals have been sentenced to prison terms that average 15.3 months for foreign bribery. Greater deterrence also can occur if managers experience significant reputational or legal penalties.

This paper proceeds as follows. Section II reviews the Foreign Corrupt Practices Act of 1977, current policy debates regarding anti-bribery enforcement efforts, and related research. Section III presents the framework we use to guide our empirical estimation, and Section IV describes our data. Section V presents evidence on the five parameters we can measure directly for all firms in the sample plus the one parameter we can measure for a subset of 62 firms. Section VI develops an empirical model to estimate the probability that firms with foreign sales pay bribes and the probability that a bribe-paying firm will face enforcement action for bribery. The results in Sections V and VI are combined in Section VII to derive inferences about the ex ante and ex post NPV of bribery, the reputational loss and total cost associated with the revelation of bribery, the fraction of bribe-related benefit that is transferred to bribe recipients, and the implications for optimal penalties. Section VIII presents the results of robustness tests that examine the sensitivity of our inferences to alternate specifications and assumptions in estimating the probability a firm bribes and the probability that a bribing firm is caught. Our sample of bribery-related enforcement actions spans a 35-year period, so we also consider time variation in our empirical estimates. Section IX concludes.

II. The Foreign Corrupt Practices Act of 1977

The Foreign Corrupt Practices Act of 1977 (FCPA) prohibits U.S. companies from paying bribes to foreign government officials to obtain business or influence regulation. Political pressure to enact anti-bribery legislation dates at least to 1975, when the International Chamber of Commerce established a committee to recommend steps to combat corporate extortion and bribery. The following year, the former Prime Minister of Japan was indicted for taking $2 million in bribes for assisting the Lockheed Corporation in selling 21 passenger jets to a Japanese airline. Subsequent revelations indicated that many U.S. firms were bribing foreign officials to obtain business and misrepresenting their financial statements to avoid detection by auditors and investors. Contemporaneously, congressional investigations into the Watergate scandal revealed that many corporations maintained slush funds to court favor from both domestic and foreign government officials. In response, the SEC proposed an amnesty period to encourage firms to conduct independent internal investigations and voluntarily disclose questionable payments. More than 400 firms, including 100 firms in the Fortune 500, subsequently disclosed illicit payments that totaled more than $300 million.

These events helped motivate Congress to pass the FCPA in 1977. As amended by the Act, 15 U.S.C. §§ 78dd (Section 30A in the Securities Exchange Act of 1934) prohibits any issuer, domestic concern, or other persons from making payments to foreign officials or foreign political parties to obtain or retain business. Before 1977, federal powers to prosecute foreign bribery relied primarily on anti-fraud and money laundering provisions of the Currency and Foreign Transactions Reporting Act and the Travel Act. Enforcing these older Acts proved difficult because they required either proof of intent (*scienter*), racketeering, or failure to report foreign currency transactions. With the FCPA, U.S. regulators could now impose civil and criminal penalties for bribery in and of itself.[8]

The FCPA is the topic of extensive coverage in the legal literature and blogosphere.[9] Researchers also have examined how corruption affects economic performance (e.g., see Shleifer and Vishny, 1993, 1994; Acemoglu and Verdier, 2000; Bertrand et al., 2007; Guiso et al., 2009; Rose-Ackerman, 2010), the causes of corrupt behavior (Fisman and Miguel, 2007; Svennson, 2003), and whether bribery is inherently wrong (Green, 2005).

There is, however, comparatively little empirical research on anti-bribery enforcement activity. Zeume (2016) examines changes in U.K firms' values around the passage of the U.K. Bribery Act and infers that the prospect of higher penalties decreased U.K. firms' values. Hines (1995) finds that anti-bribery enforcement decreases firms' investment in foreign countries, although Graham (1984) reports that the FCPA had no effect on U.S. firms' market shares in other countries. Smith, Stettler, and Beedles (1984), Sampath, Gardberg, and Rahman (2011), and Gardberg, Sampath, and Rahman (2012) conclude from event study evidence that bribe-paying firms that are caught experience large reputational losses, and Serafeim (2013) reaches a similar conclusion from survey evidence. In contrast, we find that the reputational losses for bribery are negligible,

[8] For a more detailed history of the FCPA, see the Searle Justice Civil Institute (2012). To aid in the prosecution of its anti-bribery rules, the FCPA also added three financial reporting provisions: (i) 15 U.S.C. §§ 78m(b)(2)(A), which requires firms to keep and maintain books and records that accurately reflect all transactions; (ii) 15 U.S.C. §§ 78m(b)(2)(B), which requires firms to devise and maintain a system of internal accounting controls; and (iii) 15 U.S.C. §§ 78m(b)(5), in which no person shall knowingly circumvent or knowingly fail to implement a system of internal accounting controls or knowingly falsify any book, record, or account. See Maher (1981), Karpoff, Lee, and Martin (2008a), and Shearing and Sterling (2012) for detailed descriptions and analyses of these provisions.

[9] For examples, see Cohen, Holland and Wolf, 2008; Davis, 2002; Dugan and Lechtman, 1997; Erbstoesser, Struck and Chesley, 2007; Huskins, 2007; and Timmeny, 1982; and also www.fcpaprofessor.com, www.anticorruptionblog.com, and www.fcpablog.com.

implying that reputational costs for do not work to deter bribery. Our results differ in part because, unlike previous studies, our tests control for the direct costs imposed by regulators and the confounding effects of comingled fraud charges. In another related paper, Cheung, Rau, and Stouraitis' (2012) examine the sizes and benefits of the bribes paid by 107 firms around the world from 1971-2007, and infer that each dollar of bribe paid increases firm value by $11. We estimate, in contrast, a 5.6 average ratio of gross benefit to bribe amount.[10] One reason our estimate of the average benefit ratio is smaller is that, unlike Cheung et al. (2012), we include the expected costs to firms of possibly getting caught and paying penalties.

III. A framework for empirical analysis

Our data, which are described in Section IV, present new evidence on the benefits from projects associated with bribes, the stock price reaction to news that the firm has been caught bribing, the bribe amount, and the direct penalties and costs imposed on firms that face bribery charges. In this section we present a five-equation framework that allows us to extend this information to derive inferences about several additional characteristics that are not directly observable. These include the ex ante NPV of the bribe-related project, the ex post NPV for firms that are caught, and the reputational loss for firms that face bribery charges. Figure 1 and the discussion below illustrate how these measurable and unobserved parameters interrelate. Note that we do not seek to model managers' decision to engage in bribery or the unconditional value of paying a bribe. Rather, we characterize the relationships between our measured variables and several underlying characteristics of the bribery-related activity that are not directly measurable.

III.A. The bribe payment

We begin by assuming that a firm seeks to secure or retain a business project in a foreign country at time t_0. The business projects in our sample of enforcement actions include construction and supply contracts; licenses and permits that facilitate a specific business activity; and reductions in regulatory burdens, tariffs, or taxes. If the firm is successful, it receives a benefit X at time t_1, where $X > 0$. X is the project's "gross" net

[10] As reported in Table 6, the average bribe is 0.58% of market capitalization, and the average gross value of the project for which a bribe was paid is 3.25% of market capitalization. The ratio equals 5.6.

present value because it does not include the cost of the bribe itself or any costs if the firm is caught paying a bribe. X does, however, include the value of any interaction effects with other potential current or future projects. (In our empirical sample, for example, some bribe-related projects helped to establish working relationships that led to additional future business.) If the firm pays no bribe, the firm obtains the project with probability γ_n, where the n subscript stands for "no bribe." However, with probability p_b the firm receives a private signal $i=1$ indicating that the firm can increase its likelihood of winning the project by paying a bribe B. As an example of such a private signal, a foreign official can signal his receptiveness to bribes through an intermediary. The bribe increases the probability of securing the project to $\gamma_b > \gamma_n$. We assume that $\gamma_b'(B) > 0$ and $\gamma_b''(B) < 0$ for all $B > 0$, and that $\gamma_b \rightarrow 1$ as $B \rightarrow \infty$. With probability $1–p_b$, $i = 0$, and the signal indicates that the firm cannot influence its chances of winning the project by paying a bribe. This intuition can be expressed as follows:

$$\begin{aligned} &\text{Signal:} \quad \Pr\{i = 1\} = p_b: \quad \gamma_b(B) > \gamma_n \text{ for } B > 0,\ \gamma_b'(B) > 0,\ \gamma_b''(B) < 0 \\ &\qquad\qquad \Pr\{i = 0\} = 1 - p_b: \quad \gamma_b(B) = \gamma_n \text{ for all } B > 0\ . \end{aligned} \tag{1}$$

If the firm receives the signal $i = 0$, it does not pay a bribe and secures the project with probability γ_n. However, if the firm receives the signal $i = 1$, paying a bribe can influence the outcome and increase the probability of securing the project. Upon receiving the signal, the firm weighs the benefits of bribing against the cost, which consists of the bribe itself, B, plus the expected cost p_cC of being caught bribing. Here, p_c is the probability of getting caught and C is the penalty imposed on the firm if it is caught bribing. We assume both the probability and the penalty increase with the size of the bribe $C'(B) > 0$, $C''(B) \geq 0$, $p_c'(B) > 0$, and $p_c''(B) \geq 0$ for $p_c \in (0,1)$. Conditional upon receiving the signal $i = 1$, the optimal bribe amount B^* satisfies the first-order condition:

$$\gamma_b'(B^*)X = 1 + \partial(p_cC)/\partial B^* \tag{2}$$

That is, the firm increases B until the marginal increase in the expected value of the project equals one plus the marginal increase in the expected cost of getting caught bribing.

Our assumptions imply that some positive bribe amount will be paid if $i = 1$. Certainly, a firm's decision to pay a bribe could also depend on its governance, the prospect of legal costs, or the manager's own code of ethics and reputational risk. In our framework, such cost considerations are included in C. We also could rule out some bribe payments even when $i = 1$ by assuming a firm-specific fixed cost component to C, or a threshold level of B below which $\gamma_b(B) = \gamma_n$,. Adding such features to our framework, however, does not materially affect the inferences from the data.[11]

The project negotiation and any associated bribe payment are not public knowledge until the firm secures the project. At time t_1 the firm learns whether it wins the project. If it does, the firm announces the project award to the public. If a bribe B^* was paid, the value of the project net of the expected penalty from being caught is:

$$Ex\ ante\ NPV = X - B^* - p_c C. \tag{3}$$

We call this the *Ex ante NPV* because it is the value of the project before the firm learns whether it will be caught and face a bribe-related penalty. If the firm pays a bribe, it learns whether it has been caught at time t_2. If so, the *Ex post NPV*, net of the realized penalty, is

$$Ex\ post\ NPV = X - B^* - C. \tag{4}$$

III.B. Investors' inferences from the project award and the revelation of bribery

We assume that investors do not know the firm was negotiating a potential project at t_0 or, when the project is announced, whether the firm paid a bribe. But they have rational expectations. If a project is awarded at t_1, they know or can estimate X, γ_n, $C(B)$, and $p_c(B)$. They also know p_b, the probability that the firm paid a

[11] Again, our framework does not characterize the internal processes by which firms choose to pay bribes, the negotiations between bribe payers and recipients, or competition among multiple bidders (e.g., see Svensson, 2003). We have considered extensions in which bribes reflect value-decreasing agency problems; in which investors have biased expectations of the project value, bribe amount, or the costs of getting caught paying a bribe; or in which the firm receives the signal i=1 and nonetheless chooses not to pay a bribe with probability δ. None of these additional assumptions has a material effect on the framework or our inferences from the data.

bribe, and they know the function $\gamma_b(B)$. So, conditional on a bribe being paid, investors can infer the size of the bribe, B^*.

If the firm obtains the project at t_1, the firm's share price increases to reflect the project's value X and the possibility that a bribe was paid to get it:[12]

$$\Delta V_1 = X - p_b B^* - p_b p_c C \tag{5}$$

At t_2, the firm and investors both learn whether the firm faces a penalty for paying a bribe. If the firm is caught the ex post NPV is $X - B^* - C$ and its change in value at t_2 will reflect the ex post NPV of the project minus the change in firm value at t_1. Let ΔV_2 equal the change in value at t_2 conditional upon being caught:

$$\begin{aligned} \Delta V_2 &= (X - B^* - C) - \Delta V_1 \\ &= -[(1 - p_b)B^* + (1 - p_b p_c)C] \end{aligned} \tag{6}$$

If the firm is not caught at t_2, investors infer that either (i) the firm did not pay a bribe at t_1 (with probability 1-p_b), or that (ii) the firm paid a bribe and did not get caught (with probability p_b). The change in firm value at t_2 if the firm is not caught bribing equals $p_b p_c C > 0$. In our empirical estimation we label the date of the initial announcement that a firm paid a bribe as t_2 and do not attempt to measure the (small) positive share price reaction to the complementary event of no news that the firm paid a bribe.

Previous research indicates that firms face both direct and indirect penalties when they break the law and are caught (e.g., see Alexander, 1999; Murphy, Shrieves, and Tibbs, 2009). Karpoff, Lee, and Martin (2008a) partition the total cost into three components:

$$C = C_{direct} + C_{restate} + C_{reputation} \tag{7}$$

[12] This formulation assumes that investors do not partially anticipate the project award, so the change in share price at t_1 reflects the full value of the project and any potential bribe-related costs. If, in contrast, we assume investors know a project is being negotiated and the date on which the project will be awarded, e.g., they know that if the firm gets the project it will do so at t_1, the project would be partially anticipated and ΔV_1 would reflect only the unanticipated realization of the project value. In Section VI we show that the value of ΔV_1 imputed from the model is close to our direct measure of ΔV_1 based on stock price reactions, implying that our assumption is approximately accurate and that there is no meaningful anticipation of the project award in the firm's stock price.

C_{direct} represents direct costs, which include all fines, penalties, and settlement costs imposed on the firm, plus any expenses paid by the firm to conduct an internal investigation of its (alleged) misconduct. $C_{restate}$ is the restatement correction, which is the amount that investors adjust the firm's value in light of any revelation that its financial statements previously were in error. As we discuss in section V.D, firms that are charged with foreign bribery sometimes have to restate their financial statements to correct prior efforts to camouflage the bribery. $C_{restate}$ reflects the reversal of any price inflation that may have occurred because of these prior efforts. $C_{reputation}$ is the firm's reputation loss from the revelation of its misconduct. The reputation loss is the present value of the higher future costs and lower future revenues that are expected to accrue to the firm as its counterparties change the terms with which they are willing to trade with the firm. As discussed in Section II, policy makers and previous researchers have argued that firms that are caught committing bribery incur large reputational losses. This is an empirical matter we address by estimating the average value of $C_{reputation}$.

Equations (3) through (7) constitute the framework we use to guide our empirical analysis. In the following sections we measure three parameters (X, B, and C_{direct}) from data in the SEC and DOJ's enforcement releases and the firms' reports filed with the SEC. We use event study methods to estimate ΔV_2 and $C_{restate}$. The two probabilities, p_b and p_c, are estimated using a calibration procedure that is reported in Section VI. The remaining five parameters (ΔV_1, *Ex ante NPV*, *Ex post NPV*, C, and $C_{reputation}$) are inferred from equations (3) through (7). As a robustness test, we also are able to estimate ΔV_1 directly for a subset of 62 cases in our sample for which we have data on the initial announcement of the project that subsequently was tied to bribery. For this subset, we measure ΔV_1 directly and impute X from equations (3) through (7). The parameter estimates from this alternative test are similar to our main results.

IV. Data

Our sample consists of all enforcement actions initiated by the SEC and DOJ from January 1, 1978 through May 31, 2013 for foreign bribery under the Foreign Corrupt Practices Act of 1977. To identify the enforcement actions, we searched for specific references to the bribery provisions of the FCPA (e.g. United States Code 15 U.S. Code §§ 78dd-1, 78dd-2, 78dd-3 and 30A) using CCH Wolters Kluwer and the PACER

database.[13] We also search for the terms "bribery," "Foreign Corrupt Practices Act," and "FCPA," and read all resulting SEC and DOJ proceedings to determine if a violation included illegal payments to foreign officials as a precaution against missing any bribery enforcement actions triggered by other US code provisions. The Department of Justice provided us additional enforcement data for the civil and criminal enforcement proceedings for which the DOJ was involved, and we were able to cross-check our data for thoroughness and accuracy using websites that the SEC and DOJ posted that provide detailed histories of their FCPA-related enforcement activities.[14] Finally, we used EDGAR, PACER, Dow Jones' Factiva, Lexis-Nexis' Legal Research and General News categories, and Google News to gather additional information and news releases pertaining to the enforcement actions, including related class action and derivative lawsuits.

IV.A. The time trend of enforcement actions

The DOJ and SEC initiated a total of 195 bribery-related enforcement actions from January 1978 through May 31, 2013. Of these, 52 enforcement actions target private entities, including individuals, closely-held firms with no publicly-traded securities, and one foreign affiliate of a private US accounting firm. The remaining 143 enforcement actions involve bribery by agents working for domestic and foreign publicly traded companies under U.S. territorial jurisdiction, and constitute the sample used in this study. (In tests requiring return data our sample size is reduced to 140 because three actions involve publicly traded firms that lack return data for the relevant event dates.) From 1978 through 2006, the median number of actions per year is one. Enforcement activity increased sharply beginning in 2004, peaking with 22 actions initiated in 2010. As discussed in the introduction, the recent increase in enforcement activity reflects an increased emphasis on bribery-related enforcements by the U.S. Department of Justice.

[13] CCH Wolters Kluwer Securities (Federal) Library (intelliconnect.cch.com) contains the SEC Docket, which is an archival collection of all releases, notices, settlements, orders, opinions, policy statements, reports and studies issued by the Securities and Exchange Commission since 1973, plus selected SEC releases published in the Federal Securities Law Reporter from 1940-1972. PACER (Public Access to Court Electronic Records) is an electronic public access service that allows users to obtain case and docket information from federal appellate, district and bankruptcy courts (see www.pacer.gov).

[14] The SEC's "Spotlight on Foreign Corrupt Practices Act" is available at http://www.sec.gov/spotlight/fcpa/fcpa-cases.shtml and the DOJ's site is at http://www.justice.gov/criminal/fraud/fcpa/cases/a.html.

Of the 107 actions initiated since 2004, 20 actions involve alleged abuses of the United Nations' Oil-for-Food Program in Iraq. Thirteen of these actions pertain solely to activities associated with the UN Oil-for-Food Program, while the other seven include bribery in other countries as well (see the Independent Inquiry Committee into The United Nations Oil-for-Food Programme at http://www.un.org/Depts/oip/Independent.html). The Online Appendix reports results that show that the empirical results throughout this paper are qualitatively similar if we exclude these 20 actions.

IV.B. The sizes, industries, and home countries of bribe paying firms

Table 1 presents the industry and size distributions of the 143 sample firms. We use SIC codes to group firms according to the 19 industry sectors used by Transparency International. The industries are arranged in declining order of Transparency International's Bribe Payer's Index (BPI) Industry Sector Score. The Sector Score is an index that reflects survey respondents' view of the frequency with which firms in each industry pay bribes. It is scaled from 0 to 10, with lower numbers indicating industries in which bribe paying is common practice. According to the Sector Score, bribery is perceived to be least prevalent in the Agriculture sector and most prevalent in Public Works Contracts and Construction.

The industries with the most FCPA bribery enforcement actions are Heavy Manufacturing (53 actions), Pharmaceutical and Healthcare (20), and Oil and Gas (19). Some, but not all, of this heavy representation can be attributed to the large number of firms in these industries. For example, Heavy Manufacturing comprises 15.6% of all public firms in the Compustat database, but accounts for 37.1% of the bribery-related enforcement actions; Oil and Gas comprises 8.7% of all public firms and accounts for 13.3% of the bribery-related enforcement actions. To assess the relative frequency of bribery enforcement actions within each industry, Table 1 reports the ratio of enforcement actions to the number of Compustat-listed firms in the industry. The Arms, Defense, and Military sector has the highest relative frequency (8.6%), followed by Agriculture (4.6%). Six of the 19 industries had no firms targeted for bribery-related enforcement actions. A test of equal proportional frequencies across industries is rejected with $\chi^2 = 229.33$ and p-value < 0.001.

Table 1 also shows that firms targeted for bribery enforcement actions tend to have high equity value, as measured the day before the bribery was revealed. More than half (80 or 55.9%) of the targeted firms reside

in the largest decile of public firms, while only 13 (9.1%) reside in the bottom five deciles. A test of equal proportional frequencies between size-based deciles is rejected with $\chi^2 = 357.91$ and p-value < 0.001.

IV.C. Where do bribes occur?

Appendix A reports on the countries in which bribes were paid. The country with the most bribery enforcement actions is China (28), followed by Nigeria (27), Iraq (24), Indonesia (16), Saudi Arabia (13), India (12), Mexico (12), and Brazil (11). Appendix Table A1 also shows that bribe payments associated with FCPA-related enforcement actions tend to occur in countries with reputations for corruption, as measured by Transparency International's 2011 Corruption Perceptions Index (CPI) and the 2011 World Governance Indicators Control of Corruption (COC) indicator.

IV.D. Related charges of misconduct

In most enforcement actions, the SEC and DOJ file charges for other violations in addition to bribery. For example, violations of the FCPA's books and records (13(b)(2)(A)) and internal controls (13(b)(2)(B)) provisions are included in 110 and 102 of the 143 bribery-related actions, respectively. Most of these violations relate to these firms' efforts to circumvent normal internal control procedures to make bribe payments and to hide the payments in their financial reports. The DOJ brought charges of conspiracy (18 U.S.C. § 371) in 58 actions, aiding and abetting (18 U.S.C. § 2) in 29 actions, money laundering under RICO (18 U.S.C. 1956) in 11 actions, and wire fraud (18 U.S.C. § 1343) in 10 actions. Other related charges include proxy violations, false SEC filings, false statements to the SEC, currency and reporting violations, false income taxes, mail fraud, and bank fraud.

The most important related charges, in terms of their valuation effects and our overall inferences, relate to financial fraud. Thirteen of the 143 enforcement actions have charges of financial fraud comingled with the bribery charges, including 10(b) fraud under the Securities Exchange Act of 1934 and 17(a) fraud under the Securities Act of 1933. Further investigation, including the descriptions of the misconduct that are provided in SEC and DOJ enforcement releases, reveals that in all 13 cases the bribery and financial fraud are virtually incidental to each other. While the charges and release of information about the bribery and fraud are

comingled, the activities themselves generally are not. Furthermore, we find that many of our empirical measures differ significantly between the 13 firms with financial fraud charges and the 130 other firms in the sample (127 of which have returns data available), including the valuation effect of the benefits obtained by the bribe, the share price impact of the revelation of misconduct, the size of the bribe, the reputation loss, and the ex post NPV of the bribe-related benefits. In terms of the sizes of the stock price reactions to news of the misconduct and the sizes of the reputational losses, the 13 cases with comingled fraud charges are similar to the cases of financial fraud examined by Karpoff, Lee, and Martin (2008) and Karpoff, Koester, Lee, and Martin (2017). Our empirical tests therefore report results separately for the subsets of fraud- and non-fraud related enforcement actions.

V. Direct measures of five parameters

V.A. Benefit to firms (X) and the revelation of bribery (ΔV_2)

In this section we use information obtained from enforcement proceedings to estimate X, and an event study to estimate ΔV_2, two of the 12 parameters in our empirical framework presented in Section III. Although there are 143 enforcement actions in our sample, three of these firms do not have share returns data available for dates on which the bribery and related enforcement activity were revealed. We therefore base our main analyses on the remaining 140 cases. X is the value of the bribe-related project to the firm. To measure it, we rely on estimates of the amount of benefit to the firm that are provided in SEC and DOJ administrative proceedings, litigation releases, and press releases. The SEC and DOJ assemble this information to guide the amounts of disgorgement, restitution, and fines the firm will pay under the United States Sentencing Guidelines.[15] These amounts are recorded in terms of their impact on the firm's book values. We transform them into market value measures by multiplying by the firm's market-to-book ratio, and then divide by the firm's market capitalization. Market capitalization and the market-to-book ratio are measured using the fiscal year-end financial statement closest to the end of the period in which the bribes took place and before the public revelation of the bribery.

[15] For an explanation of disgorgement see "What Exactly is Disgorgement?" at the FCPA Blog (http://www.fcpablog.com/blog/2011/3/17/what-exactly-is-disgorgement.html) and United States Sentencing Commission's Guidelines Manual (http://www.ussc.gov/guidelines).

Table 2, Panel A, reports the sample mean and median (book value) benefit obtained, market-to-book ratio, market capitalization, and percentage change in market capitalization, which is our measure of X. The mean measure of X is 3.25% of the firm's market capitalization (significant at the 10% level) and the median is 0.08% (significant at the 1% level). These results indicate that bribe-tainted projects are economically important to the bribing firms, although the distribution of X is skewed. Thirteen of the 140 firms have charges of financial fraud comingled with their bribery charges. The mean X for these 13 firms is 4.25%, compared to 3.15% for the 127 non-fraud cases. The difference is statistically significant using the Wilcoxon signed-rank test, suggesting that fraud-related cases have a higher mean value of X.

When these projects were undertaken investors did not know if the firms paid bribes to obtain them. ΔV_2 represents the change in share values when news of bribery is first publicly revealed. Panel B of Table 2 reports the mean and median one-day market-adjusted share returns upon the initial news that the firm engaged in bribery. Data to calculate abnormal share returns are available for 140 of our 143 sample firms. The mean one-day market-adjusted return for these firms is -3.07%. For the 13 firms with comingled charges of financial fraud, the mean return is -16.25%, compared to -1.72% for the 127 firms without comingled fraud charges. The t-statistic for the difference between these two means is significant at the 10% level, while the Wilcoxon signed-rank test statistic is significant at the 1% level. Hence, the average abnormal return is significantly lower (more negative) for firms that face contemporaneous fraud charges than it is for firms that do not face fraud charges. This indicates that the contemporaneous revelation of financial fraud is one reason that bribery enforcement actions are associated with negative abnormal returns.

Bribery-related enforcement actions usually involve a complex sequence of news reports, lawsuits, enforcement activities, and penalties that relate to the targeted firm's misconduct. These announcements reveal important information about the nature of the bribery, the financial misrepresentation in which the firm engaged to cover up the bribery, any comingled charges of financial fraud, and the penalties imposed on the targeted firm. To capture the full valuation effect of each enforcement action, we calculate one-day market-adjusted returns for all discrete and incremental announcements that pertain to each action and sum them into a compound cumulative abnormal return (CCAR). In addition to the initial revelation of misconduct, the additional announcements include revelations of informal inquiries by regulators, formal investigations, receipt

of Wells Notices, earnings restatements, related private lawsuit filings and settlements, SEC enforcement releases, DOJ releases, and court filings relating to bribery charges. To avoid double-counting, we ignore multiple news stories that convey information that previously was made public in prior press releases or SEC and DOJ proceedings. Counting all such incremental news revelations, there are a total of 767 incremental announcements related to the 140 bribery enforcement actions, an average of 5.48 announcements per action.

As reported in the bottom rows of Panel B of Table 2, the mean CCAR for all 140 firms in the sample is -5.44% ($p < 0.001$) and the median is -1.69% ($p < 0.001$). The magnitude of the loss is significantly larger for enforcement actions that involve financial fraud. For the 13 actions with contemporaneous fraud charges, the mean CCAR is -33.06% ($p < 0.01$) and the median is -21.29% ($p < 0.01$). For the 127 actions without fraud charges, the mean CCAR is -2.61% ($p < 0.1$) and the median is -1.52% ($p < 0.001$). The differences between the fraud and no-fraud samples are statistically significant.

These results indicate that information that a firm is targeted for a bribery-related enforcement action prompts a significant reduction in share value. The loss, however, is much larger when the bribery violation is comingled with financial fraud charges. We use the mean CCAR to measure ΔV_2, although our overall results are similar if we use the one-day initial revelation date return to measure ΔV_2.

For a subset of 62 of the firms in our sample, we obtain direct measures of ΔV_1, which is the change in firm value when the bribery-related contract is awarded. To gather this information, we use SEC and DOJ administrative proceedings, litigation releases, and press releases to identify the business activity that was procured with the aid of a bribe and the time period over which one or more bribes were paid. For 62 of the firms, we are able to identify the initial public announcements of the business activity from searches of the Lexis-Nexis and Factiva databases. Panel C of Table 2 reports the mean and median market-adjusted one-day abnormal return for these 62 initial project award announcements using the CRSP value-weighted portfolio to calculate the market average return. The mean one-day abnormal return is 3.34% with a median of 2.23%. (Results using two and three-day event windows yield similar inferences.) Five of the 62 firms have charges of financial fraud comingled with their bribery charges. For these five firms, the mean one-day abnormal return is 7.84%, compared to 2.94% for the 57 firms without any associated charges for financial fraud. These results indicate that initial news of the bribery-related contract awards prompts meaningful and statistically significant

increases in the sample firms' share values. Because we have direct measures of ΔV_1 for only 62 firms, we use this information to check the validity of our estimate of ΔV_1 that is imputed from the model. As an additional test, we also report on imputed values for X when we use these direct measures of ΔV_1. The results, which are detailed below, are similar using all of these approaches.

V.B. Bribe amounts (B^*)

We compile data on bribery and penalty amounts from the administrative proceedings, litigation releases, and press releases issued by the SEC and DOJ during the enforcement action. As reported in Panel A of Table 3, the mean bribery violation spans an average of 5.36 years, with a median of 5.0 years. The mean bribe amount is $23.43 million with a median of $1.05 million. Expressed as a fraction of the market value of equity at the end of the violation period, the mean bribe-to-market capitalization is 1.00%, with a median of 0.03%.

The mean bribe-to-market capitalization ratio is affected by two extreme observations. First, Page Airways, with a market capitalization of $7.2 million, was accused of paying $2.5 million in bribes for $60 million in aircraft orders in the Middle East, yielding a bribe-to-market capitalization ratio of 34.6% (6.5 standard deviations from the mean value in the sample). Second, International Systems & Controls, with a capitalization of $46.5 million, was accused of paying $23 million in bribes to government officials and members of ruling families in the Middle East to obtain contracts for engineering and construction projects worth $230 million, yielding a bribe-to-market capitalization ratio of 49.5% (9.3 standard deviations from the mean). Winsorizing these two percentages to 12.62% (the third highest bribe-to-market capitalization ratio) reduces the mean bribe-to-market capitalization measure to 0.58%. In deriving our overall inferences we use the mean winsorized bribe-to-market capitalization ratio. However, our results are similar if we drop these two observations or if we use the un-winsorized mean value of 1.00%.

The bribe amounts are relatively large for the subsample of firms with comingled fraud charges. The thirteen firms with fraud charges paid a mean bribe amount of $36.11 million, and their mean bribe-to-market capitalization is 2.75%. Firms without comingled fraud charges paid a mean bribe amount of $22.13 million

and their mean bribe-to-market capitalization is 0.36%. The difference in the winsorized means between the fraud and non-fraud firms is statistically significant at the 10% level.

V.C. Direct costs incurred by firms targeted for enforcement action (C_{direct})

Firms that are targeted for bribery-related enforcement actions face three types of direct costs: (i) fines and penalties; (ii) investigation and legal expenses; and (iii) monitoring expenses. Fines and penalties include all disgorgement, prejudgment interest, and fines ordered by regulators, plus settlements reached in civil class action and derivative lawsuits related to the misconduct. Panel A of Table 3 reports on the incidence and sizes of these monetary penalties. The mean total monetary penalty is $93.5 million, or 1.56% of the targeted firm's market capitalization measured at the end of the violation period. The mean bribe amount is affected by three very large bribe payments: Siemens AG paid bribes totaling $1.79 billion, Montedison S.p.A. paid bribes totaling $398.25 million, and BAE Systems PLC paid bribes totaling $315 million. As a fraction of the firm's market value of equity, however, these three are not large outliers. We express both bribe and penalty amounts as a fraction of market capitalization to reduce distributional skewness and to permit direct comparison of bribe and penalty amounts to ΔV_1 and ΔV_2, which are measured as rates of return.[16]

Consistent with the proposition that fraud charges frequently are associated with egregious misconduct, the mean monetary penalties are much larger when fraud charges are included, $537.1 million, or 6.44% of market capitalization, compared to $48.1 million or 1.06% of market capitalization for non-fraud related bribery. This reflects a small number of very large penalties, however, as the median penalty for fraud-related bribery actions is only $0.53 million. Reflecting the large variance in penalty amounts, the mean difference in penalties between fraud and non-fraud related bribery actions is not statistically significant.

The U.S. Chamber of Commerce claims that firms that are targeted for anti-bribery enforcement actions, "… spend enormous sums on legal fees, forensic accounting, and other investigative costs before they are even confronted with a fine or penalty…" (Weissmann and Smith, 2010, p. 5). To investigate the magnitude of such investigation and legal expenses, we collected data on firms' reports of these expenses by

[16] Calculating the parameter values in terms of dollar amounts rather than as a fraction of equity value yield similar inferences. The distributions of the input values, however, are skewed and the mean values of two of the five directly measured inputs (the bribe amounts and direct costs) are not significantly different from zero.

searching all 10-K, 10-Q and 8-K filings for the period from the initial revelation of bribery to the fiscal year after final resolution of the enforcement action. Forty-eight of the 140 sample firms self-report on these expenses. We use these data to construct an empirical model of a firm's investigation and legal expenses as a function of firm and bribery characteristics, including firm size, the bribe amount, the fraction of bribe-related sales to total firm sales, the geographical extent of the bribery, the number of related charges, and perceptions of the level of corruption in the firm's industry and the country or countries in which the bribe was paid. We use fitted values from this model to forecast the investigation and legal expenses of the 92 firms in our sample that did not report these expenses. Appendix B reports on the model, the data used to estimate it, and the fitted values for firms with missing investigation cost data.[17]

The results from this procedure are summarized in Panel B of Table 3. As a percent of market capitalization, the mean investigation and legal expense is 1.53% with a median of 0.95%. Investigation costs are relatively high for firms with comingled fraud charges. The mean investigation expense is 2.71% for the fraud-related actions compared to 1.41% for non-fraud related actions, a difference that is statistically significant. This difference indicates that internal investigations tend to be more costly when fraud charges are comingled with the bribery charges, and is consistent with the view that fraud charges are associated with relatively complex and costly cases of misconduct.

In addition to (i) fines and penalties and (ii) investigation and legal expenses, 26 of the firms in our sample consented to pay for an independent monitor during probationary periods that range from five months to five years. Monitors are most commonly associated with Deferred Prosecution Agreements, in which the DOJ agrees to drop any criminal charges at the end of the probationary period if the firm does not commit a similar violation (see Alexander and Cohen, 2015). Five of the 26 firms disclosed their monitoring cost in corporate reports. We estimated the monitoring cost for the 21 non-disclosing firms by multiplying the average

[17] Data on investigation and monitoring costs are sparse and challenging to obtain. To ensure that we did not overlook publicly available information on these costs for some firms, we hired several research assistants and engaged the support of the Searle Civil Justice Institute. We also vetted our data and empirical estimates with representatives from the three insurance companies (Lloyds, AIG, and Marsh) that provide bribery-specific policies that insure for investigation and legal expenses incurred as the result of an investigation into the possible violation of the FCPA or U.K. Bribery Act. One of these companies adopted our model for investigation costs to help determine their payout risks. It also is important to note that, as shown below, our other parameter estimates are not highly sensitive to even large changes in our estimates of investigation and monitoring costs.

cost per month for the five disclosing firms by the number of months of independent monitoring required under the firm's Deferred Prosecution Agreement, and divide the total monitoring cost by the firm's market capitalization.

The mean length of the monitoring period for the five known actions is 3.2 years with a median of 3.0 years. The mean cost per month is $0.37 million with a median of $0.28 million. Applying these averages to the 21 unknown expenses and assigning a monitoring cost of zero to the 114 firms that have no required monitoring expenses produces a mean monitoring cost per firm that equals 0.18% of the firm's market capitalization, with a median of 0.0%. The average monitoring cost is similar for the fraud-related and non-fraud subgroups of enforcement actions.[18]

Panel B of Table 3 also reports the total direct cost for all enforcement actions, which is the sum of (i) fines and penalties; (ii) investigation and legal expenses; and (iii) monitoring expenses. The mean total direct cost is 3.27% with a median of 1.21%. The mean direct cost for actions without financial fraud is 2.66% with a median of 1.15%. For firms with comingled fraud charges, the mean total direct cost is 9.31% with a median of 4.46%. The difference in means between the fraud and no-fraud groups is not statistically significant using a parametric t-statistic, but is significant at the 1% level using the Wilcoxon signed rank test. This evidence indicates that firms incur substantial direct costs when they are charged with foreign bribery, particularly when the bribery charges are comingled with charges of fraud.

V.D. Restatement correction ($C_{restate}$)

Many charges of bribery include revelations that the firm altered its financial reports to conceal the bribery. Indeed, in 13 of our cases the affiliated financial misrepresentation is severe enough to attract charges of financial fraud. We expect part of the price reaction when bribery is revealed to reflect investors' judgment that share prices previously were inflated by false financial information. Karpoff, Lee, and Martin (2008) and

[18] Our measure of the monthly monitoring expense is similar to that reported by the General Accountability Office. In Testimony Before the Subcommittee on Commercial and Administrative Law, Committee on the Judiciary, House of Representatives regarding the selection of monitors for Deferred Prosecution and Non-Prosecution Agreements, the General Accountability Office reported that eight firms spent $75.4 million on monitor expenses over a term of 194 months, for an average of $0.389 million per month (GAO Report Number GAO-10-260T, November 19, 2009).

Dyck, Morse, and Zingales (2014) estimate that the restatement correction accounts for a significant portion of the share price decline when firms are discovered to misrepresent their financial statements.

To measure the restatement correction, we calculate the market-adjusted abnormal share returns for all days on which the firm announced a restatement related to the bribery-related enforcement action. For firms that have more than one restatement announcement, we sum all the one-day abnormal returns over all such announcements. This measure backs out the portion of ΔV_2 that can be attributed to news that the firm's financial statements were in error – most frequently as a result of efforts to cover up the bribery. The results are reported in Panel B of Table 3. Averaging over all 140 firms, the mean share value loss on restatement announcements that are associated with the bribery-related enforcement action is 0.78%. The median firm has no restatement events, so the median restatement correction is zero. Among actions without financial fraud charges, the mean restatement correction is 0.52% of market capitalization, and among actions with fraud charges, the mean is 3.30%. This difference indicates that share prices react strongly to restatement announcements when the bribery charges are comingled with fraud charges. This is consistent with our interpretation of the restatement announcements. When fraud charges are involved, the restatements frequently correct extensive reporting violations that go far beyond the bribery. When fraud charges are not involved, the restatements typically reclassify bribe-related expenditures. In many cases, the reclassifications are minor and do not affect the firms' reported earnings.

VI. Probabilities of committing bribery (p_b) and getting caught (p_c)

VI.A. Characteristics of firms facing FCPA enforcement

In this section, we estimate p_b and p_c, the final two inputs needed to extract inferences about the ex ante and ex post value of bribery using the framework developed in Section III. We begin by estimating a logistic model of firm and industry characteristics that are associated with firms that bribe and are caught. Our sample is based on all firms in Compustat over the 36-year period from fiscal year 1975 through 2010.[19] The bribery provisions of the FCPA apply only to firms with foreign sales, so we eliminate firms that have no non-

[19] While the FCPA was signed into law in 1977, enforcement actions cited instances of bribery as early as 1975. Our sample includes enforcement actions initiated through May 2013, but the violation periods for these actions extend only through December 2010.

U.S. sales reported in the Compustat Geographic Segment data for at least one year. We also delete firms with insufficient data on the dependent variables identified below, resulting in a sample of 6,857 firms and 92,866 firm-years. A total of 108 of these firms are in our sample of bribery-related enforcement actions and have sufficient data to estimate the logistic model.[20] These 108 firms paid bribes in 509 firm-years. Thus, the firms penalized for bribery violations comprise 1.58% of the sample of potential bribe paying firms, and these firms paid bribes in 0.55% of all firm-years in our data in which bribery by a firm with foreign sales is possible.

Our objective is to develop a parsimonious empirical model that describes the characteristics of bribe-paying firms. We therefore considered a wide range of potential explanatory variables and explicitly search for a small number that are significantly related to bribe payments in a given firm-year. The variables we considered are drawn from previous studies of the likelihood that firms engage in other types of misconduct, and include firm size, leverage, profitability, asset mix, and measures of governance quality (e.g., see Wang, 2013; Dechow et al., 2012). We also considered variables that reflect characteristics of the firm, industry, and country that are discussed in SEC and DOJ bribery-related enforcement releases. These include industry concentration, the scope and complexity of the firm's foreign operations, the perception of corruption in the firm's industry and in the country in which bribes were paid, and the culture or business strategy of the bribing firm. The variables included in Table 4 reflect the most parsimonious models we estimated.

We use the Herfindahl index based on four-digit SICs to measure industry concentration. To capture the scope and complexity of the firm's foreign operations, we use the fraction of the firm's total sales that comes from foreign sales, the number of geographic segments in which the firm operates, and the average distance from the company's headquarters to its foreign market. This distance variable is calculated from geocoded data using the centroid latitude and longitude coordinates for each reported geographic segment or country reported in Compustat's segment data. To reflect the perception of corruption at the country and industry levels we use the World Bank's Worldwide Governance Indicator (WGI) and Transparency International's Bribe-Payers' Index (BPI). Finally, to measure the company's overall culture or strategy we use

[20] Although there are 143 bribery enforcement actions, 26 include firms that have insufficient Compustat data, and nine involve recidivist firms. Our procedure estimates the probability that a firm commits prosecutable bribery at least once during the sample period, so each recidivist firm is counted only once in our procedure. This leaves a sample of 108 firms.

the organizational theory of Miles and Snow (2003) as implemented by Bentley, Omer and Sharp (2013). In particular, we define the variable *Defender strategy flag* as having a value of one if it is classified as pursuing a "Defender strategy" using Bentley et al.'s (2013) empirical model. Firms pursuing a "Defender strategy" are less aggressive than other firms (classified as "Prospector," "Analyzer," or "Reactor" firms) in pursuing new markets. If bribe paying is associated with aggressive attempts to enter new markets or capture foreign sales, "Defender strategy" firms should be less likely to bribe than other firms.

Table 4 presents the results of this data-fitting exercise. Each model is a logistic regression in which the (untransformed) dependent variable equals one for each firm-year in which a firm engages in bribery. Standard errors clustered by firm are reported below the coefficients. Model 1 reports a preliminary model that includes all predictor variables that, in initial tests, are significantly related to bribe-paying. In Models 2 through 5 we remove the *Intangible-to-total assets* ratio, *Distance to regulator*, *% Foreign sales*, and *Herfindahl Inde*x variables as they provide no explanatory power as indicated by likelihood ratio tests. Model 5 satisfies several goodness-of-fit tests, and we use it to implement our Receiver Operating Characteristic (ROC) analysis, as reported below. In particular, Model 5 displays a low level of multicollinearity among the independent variables, as the maximum variance inflation factor (VIF) is 2.03 for *Return on assets*, with the next highest value of 1.77 for *Gross margin*. A specification link test is consistent with the inference that the model does not suffer from omitted variables.

Although we develop the models in Table 4 as the first step toward estimating p_b and p_c, they also provide insights into the characteristics of firms that engage in bribery and are caught. The likelihood of bribery is positively and significantly related to firm size, gross margin, leverage, R&D, and the number of geographic market segments in which the firm operates. It is negatively and significantly related to return-on-assets, whether the firm follows a "Defender strategy", Transparency International's Bribery Perception Index Industry Sector Score (in which smaller scores indicate a tendency to pay bribes), and the sales-weighted average of the World Bank's World Governance Institute Control of Corruption index for the geographic segments in which sales occur. Bribery is not significantly related to market-to-book, the Herfindahl Index, and the average distance to markets. These results are illustrated by many of the firms in our sample, including HCA Hospital Corporation, General Electric, IBM, Royal Dutch Petroleum, and Siemens AG. These are large

firms that have large profit margins and low returns on book assets, that operate in research-intensive industries perceived to be relatively corrupt, and that operate in many geographic markets that are known for corruption. Additionally, these firms are known for aggressive business strategies that, in Miles and Snow's (2003) classification, are identified as Prospectors, Analyzers, or Reactors, but not Defenders.

VI.B. The probability of bribing (p_b) and getting caught (p_c)

In this section, we use the results from Model (5) in Table 4 to derive estimates of the probability that a firm with foreign sales engaged in bribery at least once during the 1975-2010 period (p_b) and the probability that firms that engaged in bribery are caught (p_c). The challenge in estimating p_b and p_c is that we do not observe the commission of bribery. Rather, we observe only firms that both bribe and are caught. We postulate that p_b and p_c are affected by firm-specific characteristics:

$$p_b = \Pr\{i=1\} = f(Y^b_{jt}) \quad (8)$$

$$p_c = g(Y^c_{jt}) \, . \quad (9)$$

But the empirical tests reported in Table 4 are of the form:

$$p_b \times p_c = h(Y_{jt}), \quad (10)$$

where f(•), g(•), and h(•) are functions of firm-specific characteristics Y^b_{jt}, Y^c_{jt}, and Y_{jt}. Note that estimates of any two of the three dependent variables in Eqs. (8) through (10) imply an estimate of the third.

To isolate p_b and p_c we use parameter estimates from Model 5 in Table 4 to calculate fitted values for all firm-years used to estimate the model. These fitted values are probabilistic signals that a firm engaged in bribery. Firm-years whose fitted values exceed a specified threshold are classified as years in which the firm engaged in bribery, and firm-years whose fitted values fall below the threshold are classified as years in which

the firm did not engage in bribery. Categorizing firm-years in this manner allows us to identify the fraction of firms that engage in bribery (p_b), and then to infer the fraction of firms that are caught (p_c).[21]

Our procedure to this point is similar to that used by Altman (1968) to classify firms as having high bankruptcy risk, and by Dechow et al. (2011) and Beneish, Lee, and Nichols (2013) to classify firms as manipulating earnings. We augment these previous approaches by using ROC analysis to explicitly balance the rates of false positives (innocent firms identified as bribing) and false negatives (bribing firms mistakenly classified as innocent) to set the threshold level.[22]

To begin, we note that the mean and median length of the bribery programs in our sample is five years. A five-year duration coincides with the DOJ's and SEC's claims that they seek to bring enforcement action particularly when the bribery is "ongoing" and "pervasive" (see the U.S. Department of Justice and Securities and Exchange Commission, 2012). One-time or isolated bribery events are less likely to receive enforcement attention from the SEC and DOJ. Following regulators' focus on longer-term bribery programs, we classify a firm as a bribe-payer if its fitted value from Model (5) in Table 4 exceeds the critical threshold for at least five consecutive years. (In Section VIII, we show that the results are not sensitive to this assumption.)

Next, we consider 108 possible threshold levels, corresponding to the 108 firms included in the Model (5) estimates that we know committed bribery. The first threshold level is set sufficiently low to classify all 108 firms correctly as bribe-payers – a 100% true positive, or sensitivity, rate. The problem with using such a low threshold level is that we risk classifying too many innocent firms as bribe-payers. Indeed, if in our data

[21] We are aware of only a few other approaches to isolating Eq. (8) and/or Eq. (9), all of which focus on financial misstatements instead of bribery. Wang (2013) uses a bivariate probit model to estimate Eqs. (8) and (9) directly using a sample of financial frauds, assuming $Y^b_{jt} \neq Y^c_{jt}$ and excluding different predictor variables from Y^b_{jt} and Y^c_{jt}. Wang focuses on the covariates in the equations, however, and does not calculate measures of p_b and p_c. Dyck, Morse, and Zingales (2014) examine the revelation of financial fraud among Arthur Andersen's former auditing clients after Arthur Andersen closed operations following Enron's 2001 financial fraud. They assume that p_c toggles to one for all such clients after switching from Arthur Andersen to new auditors. This allows the probability of committing financial fraud (analogous to our p_b) to be inferred among the former Arthur Andersen clients. By also assuming that all firms commit fraud at the same rate as former Arthur Andersen clients, Dyck et al. (2014) infer that the probability a firm engages in financial fraud in any given year is 15%. A third approach proposed by Zakolyukina (2013) constructs a structural model of a CEO's decision to manipulate earnings. Her model's estimated parameters imply that 66% of CEOs manipulate earnings, and 9% of them are caught.

[22] For applications of ROC analysis, see Green and Swets (1966), Swets (1988), Grzybowski and Younger (1997), Fawcett (2006), Metz (2006), Zou, O'Malley, and Mauri (2007), and Kim and Skinner (2012).

we temporarily assume that all non-prosecuted firms in our sample are innocent, the initial low threshold level generates a false positive rate of 89.9%.[23] We therefore consider successively higher threshold levels, each time exchanging a lower true positives rate for a lower false positives rate.

Figure 2 depicts this tradeoff using a Receiver Operating Characteristic (ROC) curve. The initial low threshold level results in a point far to the upper right on the ROC curve. Raising the threshold level moves us down and to the left on the curve. The optimal tradeoff depends on context. A typical default optimum places equal weight on increases in true positives (also called model sensitivity) and decreases in false positives (also called increases in model specificity) (see Zou, O'Malley, and Mauri, 2007). In Section VIII.B we report on sensitivity tests that examine different weighting schemes, but using this default approach, the optimum in our application occurs where the sensitivity rate is 92.6% (the model accurately classifies 100 of the 108 known bribe-paying firms) and the specificity rate is 78.3% (i.e., the model agrees with regulators' non-actions that 5,282 of the 6,749 firms in the analysis that did not face enforcement action also did not bribe). The area under the ROC curve is 0.854 with a 95% confidence interval of 0.829 to 0.880 – numbers that indicate a very good fit (Swets, 1988).

Table 5 presents a 2 x 2 contingency table of the classifications of all 6,857 firms used to construct the model. The ROC analysis classifies 1,567 firms as bribe-payers for at least one five-year period during the sample period. The 1,567 bribe-payers comprise 22.9% of all 6,857 firms in the analysis, implying that p_b = 22.9%. That is, 22.9% of all Compustat-listed firms with foreign sales engaged in prosecutable bribery at least once from 1975-2010. Among the 1,567 firms that the model classifies as bribe-payers, 100 subsequently were charged with foreign bribery and faced enforcement action. This implies that, among firms with foreign sales that engage in bribery, the probability of getting caught (p_c) is 100/1,566 = 6.4%.

Our crucial assumption in this analysis – similar to the assumptions in Altman (1968) and Dechow et al. (2011) – is that firms that pay bribes and avoid detection have measured characteristics that are similar to the characteristics of firms that pay bribes and are caught. That is, all firms with annual fitted values above the

[23] We do not observe the true false positives – that is, we lack what the ROC literature calls the "gold standard" in setting the optimum threshold level (e.g., see Zhou et al. 2004). We use this temporary assumption as our initial iteration toward an optimal threshold level, but in Section VIII.C demonstrate that our main results are not affected if we adjust this assumption.

critical threshold established by our application of the ROC procedure for any consecutive five-year period actually did engage in bribery, with the only important difference being that some firms attracted enforcement action while others did not. Regulators claim there is little selection bias in the firms they target for enforcement. We acknowledge, however, that the firm characteristics we identify might reflect firms that are targeted for enforcement rather than firms that bribe. To investigate the sensitivity of our results to this or any other assumption that can affect our estimates of p_b and p_c, we calculate alternate values for p_b and p_c using a wide range of alternate assumptions and under two extreme scenarios in which (1) all firms bribe or (2) all bribing firms get caught. Even when the alternate assumptions yield different estimates of p_b and p_c, the estimates of the other parameters in our model are very stable. The sole exception is that, under an extreme assumption that the probability of getting caught approaches 100%, our estimate of the *Ex ante NPV* of bribing becomes negative. Details of these sensitivity tests are reported in Section VIII.A. Section VIII.B reports additional tests that examine how the estimates of p_b and p_c change with alternate weights on false negatives and false positives in the ROC model, and Section VIII.C examines time variation p_b and p_c and an out-of-sample test of the ROC model. Throughout, we find that our estimates of p_b and p_c vary somewhat with alternate modeling assumptions, but estimates of the directly measured and imputed parameters are stable.

VII. Estimates of the imputed parameters

VII.A. Overall average estimates

The empirical results from Sections V and VI provide measures for seven of the 12 parameters in the empirical framework developed in Section III. Table 6 summarizes the mean values of these seven parameters plus the mean values imputed for the remaining five parameters using the five-equation framework in Section III. All values other than p_b and p_c are expressed as a percent of the firm's market value of equity.[24] For the overall sample, the size of the bribe (B^*) is 0.58% of the firm's market capitalization; the value of the benefits received from the bribe-related project is 3.25%; the effect on share value when the firm is caught bribing

[24] We could equivalently report the average dollar value of each parameter. All dollar-based measures, however, are highly correlated with firm size, including the changes in the market value of equity when the contract award and bribery enforcement action are announced. The cross sections of parameter values expressed as a percentage of firm market capitalization are much less skewed than their dollar-based equivalents.

(ΔV_2) is -5.44%; the firm incurs a direct cost (C_{direct}) of 3.27%, and the firm loses 0.78% of market capitalization because of the restatement correction ($C_{restate}$). Using the best-fit model from Section VI, the probability of bribing (p_b) equals 22.85% and the probability of getting caught (p_c) equals 6.38%.

The five remaining parameters are inferred using equations (3) – (7). Although the average value of the project, *X*, is 3.25%, the average *Ex ante NPV* of the project is only 2.35%, where the difference reflects the firm's expected costs of bribing and being caught. Since investors do not know whether the project was obtained using a bribe, the implied change in firm value upon the announcement of the project is 3.05%, which is slightly higher than insiders' *Ex ante NPV*. Together, these results indicate that the business obtained with bribes increase ex ante firm value even considering the expected penalties that a bribe-paying firm could face. Share prices react to news of the project, but because investors do not know whether a bribe was paid, the share price reaction is an upward biased measure of the *Ex ante NPV*.

For firms that are caught, the average *Ex post NPV* negative, -2.39%. This is because firms facing bribery charges and enforcement action pay direct costs that average 3.27% of market capitalization. They also lose 0.78% of value in restatement-related corrections and incur reputational losses that average 1.01%.

VII.B. Bribery comingled with financial fraud

These average estimates obscure an important distinction between most cases of bribery and the subset of cases that have comingled charges of financial fraud. Firms with comingled fraud charges pay larger bribes as a fraction of market capitalization (2.75% vs. 0.36%), pursue bribe-related projects (*X*) that have higher relative value (4.25% vs. 3.15%), and pay higher direct costs when they are caught (9.31% vs. 2.66%). Fraud-related bribery also is associated with a relatively large restatement correction (3.30% vs. 0.52%), consistent with the notion that financial fraud results in relatively large and meaningful financial restatements. The largest difference, however, occurs upon the revelation of the firm's misconduct. For firms that have comingled fraud charges, the average ΔV_2 = -33.06%, compared to ΔV_2 = -2.61% when there are no comingled fraud charges.

An important reason for the disparity in ΔV_2 is indicated in the bottom row of Table 6. The average reputation loss ($C_{reputation}$) when fraud charges are not included is negative, -0.81%. This implies that, on

average, there is no reputation loss when firms face bribery charges but do not face comingled financial fraud charges. Indeed, the point estimate implies that there is a reputation benefit, although this estimate is not statistically significant. For firms with comingled fraud charges, however, the mean reputation loss is 18.79%. A large reputation loss is consistent with previous findings that the revelation of financial misrepresentation and fraud is associated with large reputational losses (Karpoff, Lee, and Martin, 2008; Dyck, Morse, and Zingales, 2014). These reputational losses are the capitalized value of higher future costs and lower future revenues, as the firm's investors and other counterparties change the terms of contract with which they are willing to do business with the firm (e.g., see Graham, Li, and Qiu, 2008; Murphy, Shrieves, and Tibbs, 2009; and Deng, Willis, and Xu, 2014).

Previous research finds evidence of large reputation losses for a wide range of misconduct, including consumer fraud, false advertising, product recalls, air safety disasters, investigations of IPO underwriters, defense procurement fraud, and opportunistic behavior by venture capital firms.[25] Other types of misconduct, however, are associated with negligible reputation losses, including environmental violations (Jones and Rubin 2001; Karpoff, Lott, and Wehrly 2005) and frauds of unrelated parties (Alexander 1999; Murphy, Shrieves, and Tibbs 2009). Our findings indicate that, in its impact on firm reputation, bribery is more like an environmental violation and less like consumer fraud. That is, while the revelation of bribery is costly to the firm, it does not undermine the firm's trustworthiness with its counterparties. It is only when the bribe is accompanied by financial fraud that the reputation loss tends to be large. This indicates that the reputation loss is due to the financial fraud, not bribery. This finding contradicts the inferences drawn by Sampath, Gardberg, and Rahman (2011) and Gardberg, Sampath, and Rahman (2012). Unlike these prior papers, our measure of the reputation loss explicitly controls for other costs that can explain the negative stock price reaction when investors learn about bribery, including legal penalties, other direct costs, and the confounding effect of financial fraud. Our result also is inconsistent with the conclusions in Serafeim (2013), who infers a reputation loss from surveys taken of the affected firm's employees.

[25] For examples, see Peltzman (1981), Mitchell and Maloney (1989), Barber and Darrough (1996), Beatty, Bunsis, and Hand (1998), Karpoff, Lee, and Vendrzyk (1999), and Atanasov, Ivanov, and Litvak (2012).

Because the costs associated with comingled fraud charges are large, the presence or absence of fraud charges has a large effect on the ex post value of the bribe-related project. For firms that do not also face comingled fraud charges, the *Ex post NPV* is positive, 0.42% of equity value, implying that the penalties upon getting caught are not sufficiently large to make the ex post value of the project negative. For firms that do face comingled fraud charges, however, the *Ex post NPV* is -29.89%. This is because the penalties associated with financial fraud are substantially higher than for bribery alone.

VII.C. Estimation with a direct measure of ΔV_1

Panel C of Table 3 reports a direct measure of ΔV_1 using one-day market-adjusted stock price reactions to the initial announcements of the projects that subsequently were revealed to involve bribes. Information on these announcements is available for only 62 firms in the sample. Nonetheless, the mean 3.34% is close to the mean imputed value of 3.05% for the overall sample. This serves as a validity check for our estimates in Table 6.

Panel B of Table 6 reports on the results of an alternative procedure in which we use the directly measured values of ΔV_1 for the subset of 62 firms and impute the values for X. While this approach is available for only a subset of our sample, it has the advantage of using a market-based measure (ΔV_1) in place of a measure of X that relies on regulators' determination of the firm's benefit from bribing.

The results yield inferences that are similar to those for the overall sample. Both sets of estimates indicate that the bribes that attract FCPA enforcement action are associated with valuable projects, as X is upward of 3% of market capitalization. The ex ante NPV of the projects, even considering bribery and enforcement-related costs, is positive, while the average ex post NPV for firms that are caught is negative. In both sets of estimates, there are sharp differences between the bribery-only cases and the cases that involve comingled fraud charges. The costs are much larger for firms with comingled fraud charges. In particular, the reputational loss is negligible for firms without comingled fraud charges and is very large for firms with comingled fraud charges.

VII.D. The division of bribe-related benefits

Our estimates can address a debate over the division of gains from bribe-related economic activity. In general, we should expect the surplus to accrue to the owners of the scarce resource.[26] One view is that the foreign officials who allocate contracts are in the best position to capture most of the gains. In the extreme case, the bribed officials are the link in the vertical production chain with monopoly power, so they can extract the full surplus.

The results in Table 6, however, do not support this view. In Panel A, the average bribe amount is 0.58% of firm capitalization while our measure of the underlying project value (X) is 3.25% of firm capitalization. This implies that the bribe recipients receive, on average, 17.8% of the underlying project value. When financial fraud is involved, bribe recipients capture a much larger fraction, 64.7%, of the project value. This is consistent with our finding that financial fraud charges tend to be comingled with bribery charges when the underlying project is particularly valuable.

VII.E. Optimal penalties

Our analysis does not address the question of whether foreign bribery imposes social costs nor whether public policy should seek to discourage it (e.g., see Shleifer and Vishny, 1993; Rose-Ackerman, 2010). However, our results shed light on whether the penalties for foreign bribery are sufficiently large to discourage it. The results tell us only about the average benefits and costs to bribe-paying firms that are caught, whereas what matters for deterrence are the marginal benefits and costs. Nevertheless, these estimates indicate that, on average, bribery occurs because it is expected to increase firm value. Using the average estimates from Table 6, Panel A and assuming no change in the total penalties, the probability of getting caught would have to

[26] Rose-Ackerman (1975) and Lui (1985) consider different market conditions that affect the gains to bribe recipients and bribe payers. We expect the division of the surplus to depend on heterogeneity among potential bribe payers, expectations regarding project performance, and whether all bidders pay bribes or only the winning bidder. If all (homogeneous) bidders pay bribes and the project is awarded randomly among bribe paying firms, for example, risk-neutral firms each would offer bribes equal to the project value divided by the number of bidding firms.

increase from 6.4% to 52.8% to drive the average *Ex ante NPV* to zero.[27] Such a large increase in enforcement effort would exceed even the increases recently promised by the U.S. Department of Justice (Breuer, 2011).

Alternatively, penalties for firms that are caught could be increased. Assuming the probability of getting caught remains at 6.4%, average penalties would have to increase by 8.3 times to drive the average *Ex ante NPV* to zero. Note that much of the current average penalty results from investigation costs, the restatement effect, and lost reputation. The SEC and DOJ have direct leverage over only fines, penalties, and monitoring costs, which for our overall sample average only 1.74% of market capitalization (see Panel B of Table 3). Assuming that the average investigation cost, restatement effect, and reputation loss remain the same, to achieve an 8.3 times increase in total costs, the SEC and DOJ would have to increase fines, penalties, and monitoring costs from 1.74% to 38.5% of the firm's market capitalization. That is, fines, penalties, and monitoring costs would have to increase by 22.1 times over their historical averages to drive the *Ex ante NPV* of bribery to zero. If the firm avoids charges of financial fraud (and knows that it will avoid such charges on an ex ante basis), the penalties required to make the *Ex ante NPV* of bribery equal to zero would be even larger.

VIII. Sensitivity tests

VIII.A. Tests of the sensitivity of parameter values to alternate estimates of p_b and p_c

Our specific estimates of p_b and p_c may foster reasonable debate, so in this section we examine the sensitivity of our estimates of p_b and p_c to alternate assumptions in our ROC analysis, and the sensitivity of our overall inferences to changes in p_b and p_c. We find that our specific estimates of p_b and p_c are somewhat sensitive to alternate assumptions in the ROC analysis. But inferences regarding the other 10 parameters in our model are robust to even very large changes in p_b and p_c.

Table 7 reports the results of tests that examine the sensitivity of p_b and p_c to alternate assumptions in their estimation, and the effects of changes in p_b and p_c on our other empirical estimates. Panel A of Table 7 reports results for the overall sample, and Panels B and C report results for the subsamples of cases without

[27] The 52.8% number is found by setting *Ex ante NPV* = 0 and solving for p_c.

and with comingled financial fraud charges. Each row summarizes our results using a different assumption to calculate p_b and p_c.

Our baseline estimates (in Tables 5 and 6) classify a firm as a bribe-payer if its fitted value from Model 5 in Table 4 exceeds the maximum threshold level for five consecutive years, and selects the threshold level to maximize the area under the ROC curve in Figure 2. These baseline results are summarized in the highlighted row in Panel A of Table 7. In the top row, we classify a firm as a bribe-payer if its fitted value from Model 5 in Table 4 exceeds the maximum threshold level that generates a sensitivity rate of 100% for any single year of the sample period. This is the threshold level that assures that all 108 (known) bribe-paying firms used in the ROC analysis are classified as bribe-payers. The implied value of p_b is 82.32%, with p_c = 1.91%. In the second row, we assume that a firm is classified as a bribe payer if its fitted value from Model 5 in Table 4 exceeds the maximum threshold level in any single year of the sample period, but let the threshold level be determined by the ROC analysis (to maximize the area under the corresponding ROC curve). The resulting model fit improves, as the area under the ROC curve increases from 0.590 to 0.778, implying p_b = 32.29% and p_c = 4.25%. These latter values are not much different from our baseline estimates reported in Table 5 (p_b = 22.85% and p_c = 6.38%).

Additional rows summarize the results when the decision rule is to classify a firm as a bribe-payer if its fitted value exceeds the threshold level for any 2, 3, 4, or 5 years, or for any 2-5 consecutive years. When applying optimum ROC analysis (i.e., not requiring the sensitivity rate to equal 100%), the estimates of p_b and p_c are stable across these assumptions. The estimate of p_b ranges from 22.85% to 32.29%, while p_c ranges from 4.25% to 6.38%. If we arbitrarily assume low thresholds, the estimate of p_b rises and the estimate of p_c declines. (Because the known incidence of firms that are prosecuted for bribery, we know the product, p_b x p_c. Adjustments that increase p_b therefore automatically imply a decrease in p_c, and vice versa.) Even inducing large variation in p_b and p_c has little effect on the estimated values for the *Ex ante NPV*, *Ex post NPV*, ΔV_1, C, and $C_{reputation}$. In all cases, our qualitative conclusions are unaffected.

In the bottom two rows of Panel A we make extreme assumptions that p_b = 1 (all firms bribe), or that p_c = 1 (all bribing firms get caught). Even with such extreme assumptions, our inferences about *Ex ante NPV*,

Ex post NPV, ΔV_1, C, and $C_{reputation}$ are not materially affected. The sole exception is that the *Ex ante NPV* is negative if we assume that p_c = 100% (i.e., all bribing firms get caught).

Panel B of Table 8 reports on sensitivity tests for the firms in the bribery enforcement sample that do not have comingled fraud charges, and Panel C contains results for the firms with comingled fraud charges. As with the overall sample, we find that even large variations in p_b and p_c do not have substantive impacts on our main empirical estimates. Again, an exception occurs when we make the extreme assumption that p_c = 100% and induce a negative *Ex ante NPV* for bribe-related projects.

Why the imputed parameter estimates are so stable to changes in p_b and p_c? There are two main reasons. First, the product p_b x p_c is fixed because we know from our sample which firms both bribe and are caught, and acts as a constraint on the effects of perturbations in p_b or p_c. Second, the main drivers of many of our results turn out to be inputs that are measured somewhat reliably, including regulators' estimates of the value of the bribe-related project to the bribing firm (X), the stock price reaction to news that the firm bribed and faces enforcement action (ΔV_2), and the direct costs to firms that face enforcement action (C_{direct}).

VIII.B. Alternate weighting for Type I and Type II errors in the ROC analysis

A potential criticism of our application of ROC analysis is that we assign equal weight to gains in specificity and sensitivity. From a cost standpoint, however, it is entirely possible that a gain in specificity could be more or less important than a gain in sensitivity. For example, policymakers might willingly trade off a one percentage point increase in false accusations of bribery (Type II errors) to reduce the Type I error rate by two percentage points. Appendix C presents a detailed analysis of a wide range of tradeoffs between Type I and Type II errors in our ROC analysis. We find that p_b and p_c are somewhat sensitive to alternative weighting schemes. For example, if we consider gains in the specificity rate to be twice as important as gains in the sensitivity rate (i.e., the marginal cost of a false positive is twice the marginal cost of a false negative, or an error cost ratio of 2:1), the resulting estimates are p_b = 18.3% and p_c = 7.5%. Note that, because we know the unconditional probability that a firm commits bribery and is caught, any change in estimation procedure that results in an increase in p_b necessarily causes a decrease in p_c, and vice versa.

Virtually all other adjustments to our modeling assumptions can be recast as changing the weights on sensitivity and specificity in the ROC analysis. For example, suppose that, in setting the optimal threshold level in the ROC analysis, we initially assume that the SEC and DOJ catch only 10% of bribe-paying firms (that is, our beginning assumption is that p_c = 10%). This has the same effect as weighting gains in sensitivity more heavily than gains in specificity, and results in a higher estimate of p_b and a lower estimate of p_c. Again, however, and as demonstrated in Table 7, it takes much larger deviations in p_b and p_c from our base scenario to generate a material effect on our estimates of the other 10 parameters. This implies that our qualitative conclusions are not highly sensitive to our specific estimates of p_b and p_c – as long as we avoid extreme values such as p_c ~= 1.0. This is for two reasons. First, our data provide a solid anchor for the product p_b x p_c because we have the universe of firms that both have a long-term program of bribery and are caught. Second, we have good data on the parameter inputs that have the largest effects on the imputed parameters and on our inferences. These include data on the bribe amounts, total benefits obtained, fines, penalties, and share price reaction to news of bribery enforcement activities. As a result, the data and five-equation framework yield robust estimates of the imputed parameters.

VIII.C. Out of sample model fit and parameter stability

Our estimates of p_b and p_c are within-sample. For an out-of-sample test, we collect data on 45 new bribery enforcement actions initiated after the end of our sample period in May 2013 through December 2016. The ROC model we use in our base-case estimates (based on Model 5 in Table 4) accurately identifies 43 of these 45 firms as bribe-paying firms, a specification rate of 95.6%. This provides strong out-of-sample evidence the ROC model performs well.[28]

To examine the stability of the estimates p_b and p_c over time, we split the sample into various subsamples, e.g., pre- and post 2004, or pre- and post- 2007, and use the ROC procedure to calculate p_b and p_c in each sub-period. As reported in the Online Appendix, the results are generally similar in each subperiod as for the overall sample. There are some differences in magnitudes, however. Compared to the early cases, later

[28] We do not have complete data on these additional 45 firms, including information about the bribe amounts and values of the bribe-related projects, so we do not include them in our estimation sample.

enforcement actions involve bribes paid for more valuable and profitable projects, as our estimates of the ex ante NPV and ex post NPV are higher in later periods.

For an alternate stability test, we use the ROC procedure to estimate p_b and p_c for each year of the sample using only bribery-related enforcement actions available through that year. As summarized in Appendix Figure D1, the resulting estimate of the probability of bribery (p_b) ranges from a low of 13.8% in 2001 to a high of 33.1% in 1984, and the estimate of the probability that a bribing firm is caught ranges from a low of 6.1% in 1984 to a high of 10.7% in 2001. To repeat, however, the estimates of the other ten parameters in our empirical framework are qualitatively unaffected by even larger changes in p_b and p_c than these ranges.

IX. Conclusion

U.S. anti-bribery laws and their enforcement incentivize firms to engage in costly risk management and compliance efforts, and are targets of frequent legislative and regulatory reform efforts. We introduced this paper by posing ten questions about the prevalence of bribery, firms' incentives to bribe, and the probability and costs of getting caught. Our direct answers to these questions indicate that: (i) 22.9% of firms in the Compustat database with foreign sales engaged in at least one prolonged program of foreign bribery during the 1975-2010 period, and (ii) 6.4% of firms that we identify as likely bribe-payers were caught and faced enforcement action. For firms that do not face comingled fraud charges: (iii) Bribes were paid for projects with values that average of 3.15% of market capitalization; (iv) Bribe amounts average 0.36% of market capitalization but only 17.8% of the value of the bribery-related project; (v) Firms facing enforcement action for bribery incur direct costs that average 2.66% of market capitalization, but experience negligible reputation losses; (vi) The ex ante net present value of projects that are obtained with bribes averages 2.64% of market capitalization; (vii) The ex post value of these projects for firms that are caught averages 0.42% of market capitalization, indicating that (viii) the penalties are insufficient to provide substantial deterrence. (ix) The announcement of projects that subsequently are revealed to involve bribery corresponds to an average 3.03% increase in market capitalization; and (x) The announcement that a firm paid bribes and is subject to FCPA enforcement is associated with a 2.61% decrease in market capitalization.

These estimates yield insight into a large number of questions about why firms bribe, how extensive foreign bribery is, the size of the market reaction to news of bribe-related projects and news that a firm faces enforcement action for bribery, and the size and nature of firms' costs from such enforcement. We infer that firms pay bribes for valuable projects and that the likelihood and cost of facing enforcement action just for bribery are small enough to make the ex post value of the project non-negative even for firms that are caught.

For firms that face enforcement action for a comingled combination of bribery and financial fraud charges, the bribe amounts and enforcement costs are larger and measures of the ex post value of the bribe-related projects are significantly negative. A key reason fraud-related firms face higher costs is that they experience large reputation losses, and the driving force behind these losses appears to be the financial fraud, not the bribery per se. Hence, our findings regarding financial fraud are similar to those in Karpoff et al. (2017). Bribery by itself, in contrast, has a small impact on firm reputation. In this regard, bribery is more like an environmental violation and less like consumer or financial fraud. Bribery charges do not by themselves "… lead to irreparable economic hardship and reputational damage that may adversely affect the overall stability and competitiveness of any business," as is claimed by critics of anti-bribery enforcement activities.[29] At times, firms that are targeted by bribery enforcement actions experience large direct costs, especially in the form of large regulatory fines and penalties. On average, however, the bribery charges do not harm the firm's business relationships with its customers, suppliers, or investors. That is, the firm's counterparties tend to care if the firm's financial statements are misrepresented. But they do not, in general, alter their willingness to do business with the firm when it is caught bribing.

We do not address the question of whether public policy should seek to discourage bribery, as is discussed by Shleifer and Vishny (1993), Rose-Ackerman (2010), and others. But our results suggest that the current enforcement regime imposes insufficient expected penalties to offset firms' economic incentive to bribe. To achieve a sufficiently high level of expected penalties to make bribery unattractive on an ex ante basis, our estimates indicate that the probability of getting caught or the total costs imposed on firms that face anti-bribery enforcement action would have to be increased substantially over historical levels.

[29] See PricewaterhouseCooper, Anti-Corruption, www.pwc.com.br/en/forensics/anti-corruption.jhtml.

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Figure 1. The framework used to impute the ex ante and ex post NPV of bribe-related projects

This figure illustrates the relations between seven measured or estimated parameters and five imputed parameters that reflect the value of bribe-related projects. The directly measured parameters are: (i) the gross value of the bribe-related project (X), (ii) the stock price reaction when investors learn the firm faces bribery charges (ΔV_2), (iii) the bribe amount (B^*), (iv) the direct costs of being caught (C_{direct}), and (v) the restatement cost ($C_{restate}$). The estimated parameters are (vi) the ex ante probability that the project was obtained with the help of a bribe (p_b), and (vii) the probability that a bribe-paying firm is caught (p_c). The imputed parameters are the change in market capitalization when the bribe-related project is announced (ΔV_1), total cost to firms that are caught bribing (C), the portion of the total cost that is due to lost reputation ($C_{reputation}$), the *Ex ante NPV* of the project to the firm considering the cost of the bribe and the chance the firm might get caught, and the *Ex post NPV* of the project for firms that are caught ($= X - B - C$). The total cost to bribing firms that are caught C equals $C_{direct} + C_{restate} + C_{reputation}$, where $C_{reputation}$ is the reputation loss experienced by a firm that is caught.

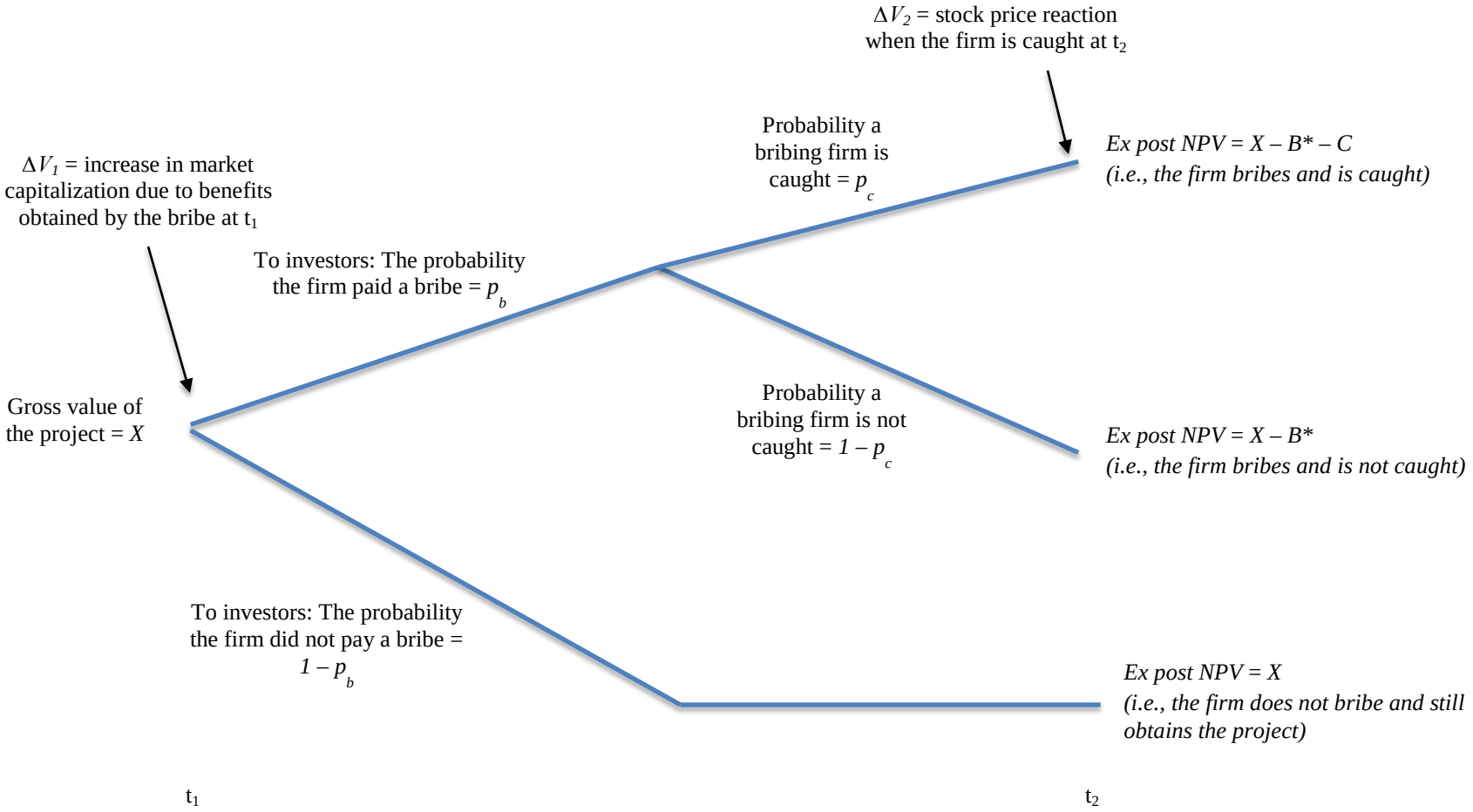

Figure 2. Receiver Operating Characteristic (ROC) curve for the bribery prediction model

The ROC curve illustrates the tradeoff between sensitivity and specificity in selecting a threshold value from our bribery prediction model (Model 5 in Table 4), where sensitivity measures the rate at which the model identifies true positives and specificity measures the rate at which the model identifies true negatives. A perfect model threshold would locate at the upper left corner of the chart, at which specificity = 1 and sensitivity = 1. The default optimal threshold value, in which gains in sensitivity and specificity are weighted equally, is the one that maximizes the average of the sensitivity and specificity rates, which equals the largest area under the curve. In our application, this area equals (0.926 + 0.783) / 2 = 0.854.

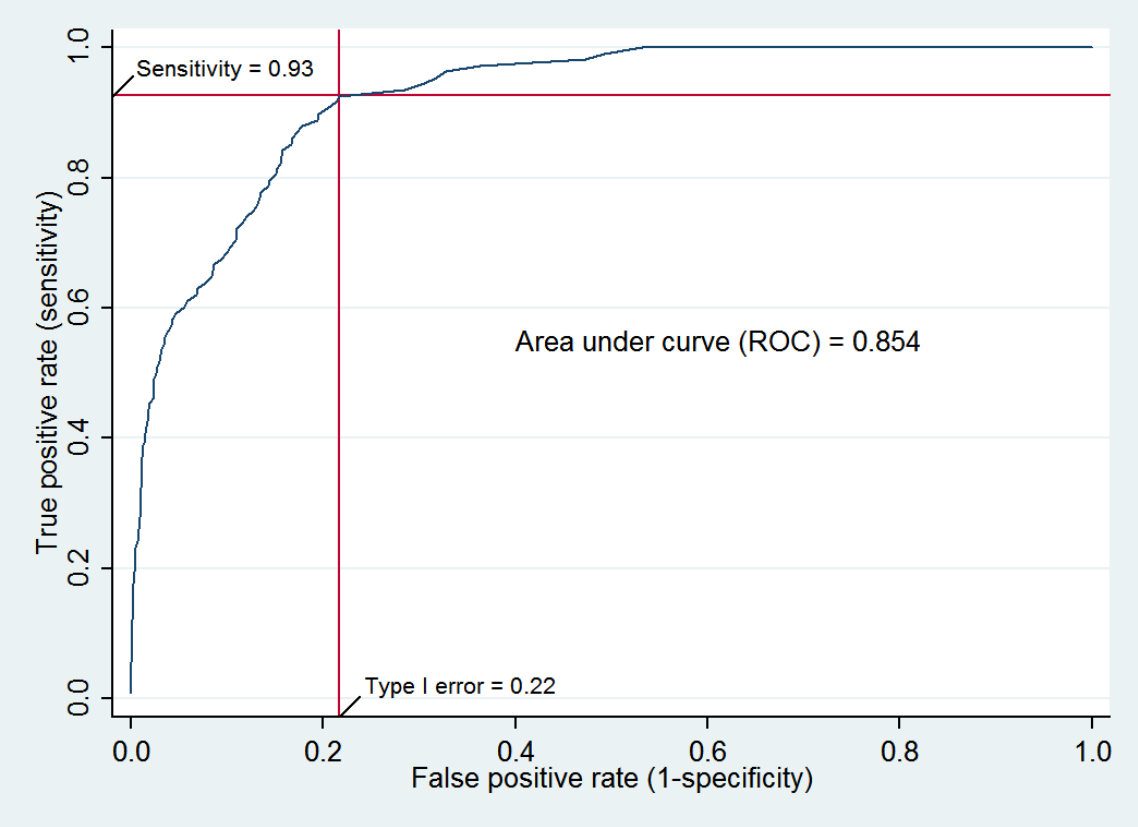

Table 1. Distribution of bribery-related enforcement actions by industry sector and firm size

Size-based distribution of the publicly traded firms targeted by all 143 enforcement actions for foreign bribery initiated by the SEC and/or DOJ from 1978 through May 2013 partitioned by Transparency International's (TI) industry sectors and size-based deciles. Transparency International's *Bribe Payers Index Industry Sector Score* is based on survey responses and measures the perceived likelihood that firms in the industry pay bribes to obtain or retain business in foreign countries. The *Sector Score* is scaled from 0-10, with higher scores indicating a lower perceived likelihood that firms in the industry bribe. The average *Sector Score* is 6.6. *Firms in the sector* is the number of firms in the Compustat database in each industry sector from 1977 to 2012. Equity *Size-based deciles* are calculated using market capitalization from Compustat in the last fiscal year before the initial public revelation of the bribery. A Pearson's chi-squared test of independence between sectors and sized-based deciles is rejected with $\chi^2 = 191.57$ and p-value < 0.001. Tests of proportional frequencies between size-based deciles is rejected with $\chi^2 = 357.91$ and p-value < 0.001 while tests on the equality of proportions between total firms and enforcement actions within each decile are rejected in the 10th decile ($z = -12.64$, $p < 0.001$) only. Tests of proportional frequencies between industry sectors is rejected with $\chi^2 = 229.33$ and p-value < 0.001 while tests on the equality of proportions between total firms and enforcement actions within an industry are rejected in the Heavy manufacturing ($z = -4.24$, $p < 0.001$) industry only.

	Bribe Payers Index Sector	Firms in the industry sector		No. of bribery actions			Sized-based deciles:							
							Larger firms							Smaller firms
Industry sector	**Score**	**Count**	**% of all firms**	**Count**	**% of all actions**	**Ratio of actions to #firms**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3 – 1**
Agriculture	7.1	87	0.4%	4	2.8%	4.60%	1	1	1		1			
Light manufacturing	7.1	594	2.6%	1	0.7%	0.17%	1							
Civilian aerospace	7.0	70	0.3%	0	0.0%	0.00%								
Information technology	7.0	3,046	13.2%	10	7.0%	0.33%	6	1			1	2		
Banking and finance	6.9	4,131	17.9%	5	3.5%	0.12%	5							
Forestry	6.9	71	0.3%	0	0.0%	0.00%								
Consumer services	6.8	1,851	8.0%	1	0.7%	0.05%								1
Telecommunications	6.7	688	3.0%	5	3.5%	0.73%	2	1	1					1
Transportation and storage	6.7	512	2.2%	6	4.2%	1.17%		3		1	1			1
Fisheries	6.6	0	0.0%	0	0.0%	0.00%								
Arms, defense and military	6.6	93	0.4%	8	5.6%	8.60%	5	1		2				
Heavy manufacturing	6.5	3,594	15.6%	53	37.1%	1.47%	30	9	6	4	2	1	1	
Pharmaceutical and healthcare	6.4	1,965	8.5%	20	14.0%	1.02%	12	2	1	2	1	1		1
Power generation and transmission	6.4	151	0.7%	0	0.0%	0.00%								
Mining	6.3	2,069	9.0%	0	0.0%	0.00%								
Oil and gas	6.2	2,001	8.7%	19	13.3%	0.95%	12	2	1	2	1	1		
Real estate, property, legal & business services	6.1	1,367	5.9%	3	2.1%	0.22%	1		1					1
Utilities	6.1	203	0.9%	0	0.0%	0.00%								
Public works contracts & construction	5.3	531	2.3%	8	5.6%	1.51%	5			1		1	1	
Total		23,024	100%	143	100%	0.62%	80	20	11	12	7	6	2	5

Table 2. Benefits obtained and abnormal returns for FCPA enforcement announcements

This table reports on the benefit obtained by the firms from the bribes paid and the market-adjusted stock returns of the targeted companies for key dates on which information was publicly revealed about the bribery, related misconduct, and the enforcement activities surrounding enforcement actions under the Foreign Corrupt Practices Act from 1978 through May 2013. Market returns are measured using the CRSP value weighted index. Panel A reports on the reported benefit obtained by the firm in regulatory proceedings documents, the market-to-book ratio and market capitalization of the firms prior to public revelation of the bribery activity, and the estimate of the benefits obtained in terms of market capitalization. Panel B reports on one day and cumulative one day market-adjusted returns for 140 of the 143 sample firms for which returns are available for dates on which the bribery and related enforcement activity were revealed. Enforcement-related events include announcements of the initial trigger event as identified by the SEC and DOJ, announcements of an informal inquiry and formal investigation, receipt of a Wells Notice, earnings restatements, related private lawsuits, and SEC and DOJ enforcement releases. The compound cumulative market-adjusted return is the geometric sum of all one-day market-adjusted returns for all relevant event dates. In each panel, we report means and medians for all firms and for the subset of firms that have comingled charges of financial fraud and firms that did not. Asterisks next to means represent statistical significance based on parametric t-tests and, for differences, mean-comparison tests assuming unequal variances. Asterisks next to medians represent statistical significance based on sign rank tests and Wilcoxon rank-sum test for differences. ***, **, * indicate significance at the 0.001, 0.01, and 0.1 levels.

	All bribery actions	**Actions without financial fraud**	**Actions with financial fraud**	**Difference**
Panel A – Value of the bribe-related project (X)				
N	140	127	13	
Book value of the benefit ($mm)				
Mean	29.21	28.24	38.65	-10.41
Median	2.89	3.05	2.56	0.49
Market-to-Book Ratio				
Mean	1.78	1.77	1.87	-0.09
Median	1.27	1.30	1.01	0.30
Market Capitalization ($mm)				
Mean	25,597.92	26,581.14	15,992.58	10,588.56
Median	5,373.06	5,637.40	492.42	5,144.98*
*X (= Benefit * Market-to-Book Ratio / Market Capitalization)*				
Mean	3.25%*	3.15%*	4.25%*	-1.10%
Median	0.08%***	0.07%***	0.57%***	-0.50%**
Panel B – Enforcement announcement abnormal returns (ΔV_2)				
N	140	127	13	
Initial revelation date				
Mean	-3.07%***	-1.72%**	-16.25%**	14.54%*
Median	-0.53%***	-0.34%***	-11.99%**	11.65%***
Compound cumulative abnormal return				
Events	767	575	192	
Mean	-5.44%***	-2.61%*	-33.06%**	30.45%**
Median	-1.69%***	-1.52%***	-21.29%**	19.77%***
Panel C – Contract announcement abnormal returns (ΔV_1)				
Initial revelation date				
N	62	57	5	
Mean	3.34%***	2.94%***	7.84%	-4.90%
Median	2.23%***	2.25%***	1.14%*	1.12%

Table 3. Summary measures of bribe amounts, penalties, and direct costs to firms

Panel A – Bribe amounts and penalties

This panel reports summary statistics on bribery violation periods, market capitalization, bribe amounts and monetary penalties imposed on 140 firms with sufficient data that were targeted for bribery-related enforcement action by the SEC and DOJ from 1978 through May 2013. The violation period is the length of the period in which the bribery activity occurred, as identified in SEC and DOJ enforcement releases. Market capitalization is measured at the close of trading the day before the initial revelation of the misconduct. The size of the bribe is identified in SEC and DOJ enforcement releases. The Winsorized (at 98%) ratio of the bribe to market capitalization changes two outlier values of 49.46% and 36.40% to 12.62%, which is the third highest estimate from all enforcement actions. Total monetary penalties include fines and penalties assessed by regulators on the firm, and related private class and derivative action settlements. Penalty amounts may change for 37 enforcement actions for which proceedings were ongoing as of May 31, 2013. Asterisks next to the mean and median in the Difference column represent the statistical significance of a mean-comparison test assuming unequal variances and a Wilcoxon rank sum test, where ***, **, * indicate significance at the 0.001, 0.01, and 0.1 levels.

		All bribery actions (140)	Actions without financial fraud charges (127)	Actions with financial fraud charges (13)	Difference
Period of violation (years)	Mean	5.36	5.34	5.58	-0.24
	Median	5.00	4.50	5.49	-0.99
Market capitalization ($mm)	Mean	25,597.92	26,581.14	15,992.58	10,588.56
	Median	5,373.06	5,637.40	492.42	5,144.98 *
Size of bribe ($mm)	Mean	23.43	22.13	36.11	-13.98
	Median	1.05	0.98	4.29	-3.31 *
% of market cap	Mean	1.00%	0.36%	7.27%	-6.91% ***
	Median	0.03%	0.02%	0.68%	-0.66% **
Winsorized % of market cap	Mean	0.58%	0.36%	2.75%	-2.39% ***
	Median	0.03%	0.02%	0.68%	-0.66% **
Total firm monetary penalties ($mm)	Mean	93.51	48.10	537.10	-489.00 ***
	Median	5.53	5.86	0.53	5.33
% of market cap	Mean	1.56%	1.06%	6.44%	-5.38% ***
	Median	0.08%	0.07%	0.73%	-.066%

Table 3. Summary measures of bribe amounts, penalties, and direct costs to firms (continued)

Panel B – Summaries of empirically observable bribery and cost measures

This panel reports the mean and median values of the measures used to make inferences from Equations (3) – (7) presented in Section III of the paper. *Bribe/Market cap* is the Winsorized mean value from Panel A of the size of the bribe payments divided by the market capitalization of the firm measured at the close of trading the day before the initial revelation of the misconduct, and is used to measure the bribe amount *B*. Total direct costs (C_{direct}) equals the sum of fine and penalties, investigation expense, and monitoring expense. *Fines and penalties* are the total fines and disgorgement levied upon the firm by regulatory agencies, plus class action settlements paid by the firm (net of D&O insurance proceeds), divided by the firm's market capitalization. The *Investigation expense and Monitoring expense* are the observed values where available and otherwise the predicted values from the models described in Appendix A and Table A2. The *Restatement effect* is the sum of the one-day market-adjusted stock returns on days in which related restatements were announced. The difference column reports the difference in the means and medians between the actions with and without financial fraud charges. Significance levels are based on a t-test (for differences, we assume unequal variances between groups), and a Wilcoxon rank sum test, where ***, **, * indicate significance at the 0.001, 0.01, and 0.1 levels.

	All bribery actions (N=140)		**Actions without financial fraud charges (N=127)**		**Actions with financial fraud charges (N=13)**		**Difference**	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Bribe/Market cap	0.58% ***	0.03% ***	0.36% **	0.02% ***	2.75% *	0.68% ***	-2.39% *	-0.66% **
Direct costs:								
Fines and penalties	1.56% **	0.08% ***	1.06% ***	0.07% ***	6.44%	0.73% **	-5.38%	-0.66%
Investigation expense	1.53% ***	0.95% ***	1.41% ***	0.90% ***	2.71% ***	2.28% ***	-1.30% *	-1.38% **
Monitoring expense	0.18% **	0.00% ***	0.18% **	0.00% ***	0.16%	0.00%	0.02%	0.00%
Total direct costs	3.27% ***	1.21% ***	2.66% ***	1.15% ***	9.31% *	4.46% ***	-6.66%	-3.31% ***
Restatement correction	0.78% *	0.00%	0.52%	0.00%	3.30% *	0.00%	-2.78%	0.00%

Table 4. Estimating the likelihood of a bribe occurring in a firm-year

This table presents the results of logit models used to predict the likelihood that a firm pays a bribe in a given firm-year. Data are drawn from all firms identified by Compustat as having foreign sales during at least one five-year period from 1975 through 2010, which correspond to the years in which the bribes occurred according to regulatory enforcement actions initiated under the Foreign Corrupt Practices Act from 1978 through May 2013. The dependent variable equals one for each fiscal firm-year in which a bribe occurred and zero otherwise. *Log(market cap $mm)* is the natural logarithm of market capitalization in millions of dollars. *Net margin* is net income divided by total sales. *Return on assets* is net income divided by total assets. *Leverage ratio* is total liabilities divided by total assets. *Market-to-book ratio* is the market value of equity plus total assets less shareholders' equity, divided by total assets. *R&D-to-sales ratio* is the ratio of research & development expense divided by total sales, or zero if missing. *Herfindahl Index* is calculated as the sum of the square of firms' industry market shares of total sales using 4-digit SIC Codes to define industries. *Distance to markets* is the log-transformed weighted average distance from the firms' headquarters to the centroid of the geographic segment reported in Compustat, weighted by the proportion of segment sales to total sales. *Geographic segments* is the log-transformed number of reported geographic segments of sales. *BPI Industry Sector Score* is Transparency International's 2011 Bribe Payers Index for the firm's industry sector determined by mapping the firms' SICs from Compustat into Transparency International's industry sectors. The *Sector Score* is scaled from 0-10, where a maximum score of 10 corresponds to sectors populated with transparent firms who never bribe and a 0 corresponds to sectors whose secretive firms are viewed as bribing at every opportunity. *WGI Control of Corruption* is the geographic segment sales-weighted average of World Bank's Worldwide Governance Indicators Control of Corruption index, which captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. It ranges from approximately -2.5 to 2.5 and increases with the perception of corruption-free governance. *Miles & Snow "Defender" strategy flag* is a dichotomous variable that takes the value of one if the firm's business strategy places it in the "Defender" category based upon the method of calculation used in Bentley, Omer and Sharp (2013) and zero otherwise. *% Foreign sales* is the percent of foreign sales outside the United States. *Distance to regulator* is the distance in miles from the firms' headquarters to the closest regulator involved in the enforcement action. *Intangibles-to-total assets* is self-explanatory. Gross margin, return on assets, leverage ratio, market-to-book ratio, R&D-to-sales ratio and intangibles-to-total-assets ratios are Winsorized at the 0.01 and 0.99 percentiles. p-values for tests of significance based on firm clustered robust standard errors are reported below the coefficients, where ***, **, * indicate significance at the 0.001, 0.01, and 0.1 levels.

Table 4. Estimating the likelihood of a bribe occurring in a firm-year (continued)

	(1)	(2)	(3)	(4)	(5)
Log(Market cap $mm)	0.3995***	0.4022***	0.4050***	0.4032***	0.4016***
	0.000	0.000	0.000	0.000	0.000
Gross margin	0.8206*	0.8200*	0.8333*	0.8313*	0.8191*
	0.013	0.013	0.012	0.012	0.013
Return on assets	-1.0779*	-1.1015*	-1.1311*	-1.1347*	-1.1038*
	0.091	0.079	0.068	0.066	0.064
Leverage ratio	0.7122*	0.6994*	0.6772	0.6791	0.6918*
	0.084	0.093	0.111	0.110	0.099
Market-to-book ratio	-0.0443	-0.0460	-0.0468	-0.0465	-0.0468
	0.446	0.420	0.412	0.416	0.414
R&D-to-sales ratio	0.0752*	0.0759*	0.0774*	0.0763*	0.0767*
	0.027	0.027	0.031	0.033	0.033
Distance to markets	0.3036	0.3098	0.2864	0.2771	0.2804
	0.181	0.168	0.229	0.238	0.227
# Geographic segments	0.7517***	0.7616***	0.7664***	0.7508***	0.7551***
	0.000	0.000	0.000	0.000	0.000
BPI Industry Sector Score	-0.9186**	-0.9181**	-0.9224**	-0.9186**	-0.9175**
	0.003	0.003	0.003	0.003	0.003
WGI Control of Corruption	-0.4169*	-0.4206*	-0.4167*	-0.4182*	-0.4183*
	0.019	0.018	0.017	0.016	0.016
Defender strategy flag	-1.4996*	-1.5088*	-1.5066*	-1.5055*	-1.5068*
	0.038	0.037	0.037	0.038	0.038
Herfindahl Index (4-digit sic)	0.1072	0.1388	0.1351	0.1383	
	0.836	0.787	0.792	0.786	
% Foreign sales	-0.0610	-0.0622	-0.0502		
	0.541	0.534	0.608		
Distance to regulator	0.0221	0.0207			
	0.729	0.743			
Intangibles-to-total assets	0.3399				
	0.533				
Constant	-5.4500*	-5.4867*	-5.2181	-5.1715	-5.1764
	0.074	0.071	0.115	0.118	0.118
Observations	92,866	92,866	92,866	92,866	92,866
Firms	6,857	6,857	6,857	6,857	6,857
Pseudo R^2	0.163	0.162	0.162	0.162	0.162
Log-likelihood	-2,644.49	-2,645.24	-2,645.63	-2,646.14	-2,646.31
χ^2	268.89	201.41	200.20	197.82	187.33
p-value	0.000	0.000	0.000	0.000	0.000

Table 5. Contingency analysis used to estimate probabilities of committing a bribe (p_b) and getting caught (p_c)

Panel A is a 2 x 2 contingency table that categorizes the firms in Compustat that have foreign sales in any five-year period from 1975 through 2010 along two dimensions: whether our calibrated ROC model classifies the firm as having committed bribery at least once during the period ("Did not bribe" or "Bribed"), and whether the firm actually faced enforcement action for bribery ("Not caught" of "Caught"). Firms are classified as having bribed if their fitted values using Model (5) from Table 4 exceed the optimal probability threshold cutoff as determined by the ROC analysis shown in Figure 2 for at least once five-year consecutive period. The resulting estimate of the probability that a firm in the sample committed prosecutable bribery at least once during the sample period (p_b) equals 1,567/6,857 = 22.85%, and our estimate of the probability that a bribing firm is caught (p_c) equals 100/1,567 = 6.38%. Panel B summarizes several model statistics.

Panel A – Contingency table

		As identified by SEC/DOJ enforcement actions:		
		Not caught	Caught	Total
As classified by the ROC model:	Did not bribe	5,282	8	5,290
	Bribed	1,467	100	1,567
	Total	6,749	108	6,857

p_b = 1,567 ÷ 6,857 = 22.85%

p_c = 100 ÷ 1,567 = 6.38%

Panel B – ROC model summary

Total number of firms:	6,857
Total enforcement actions	108
Threshold cutoff value	0.004952
ROC	0.854
Sensitivity	92.59%
Specificity	78.26%
Probability of bribing (p_b)	22.85%
Probability of getting caught (p_c)	6.38%

Table 6. Summary of directly measured, estimated, and imputed parameter values

This table summarizes the mean and median estimates for the 12 parameters summarized in Equations (3) – (7) using inputs from Tables 2, 3, and 5. Results are presented for the total sample (n=140), firms that do not have comingled charges of financial fraud (n=127), and firms that have comingled fraud charges (n=13). Panel A presents our main results. Panel B presents results for a subsample of 62 firms for which we have data on the announcements of the projects for which bribes subsequently were revealed. In Panel B we directly measure $\Delta V1$ and impute the value of X. Each cell reports the mean (in the top row for each parameter) and median (in the bottom row for each parameter) value of the parameter from the cross section of firms in the sample. ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, using a two-tailed t-test (in the top row for each parameter) and nonparametric Wilcoxon rank-sum test (in the bottom row for each parameter). Estimated values of p_b and p_c are the same for all firms.

Panel A – All observations

Parameter	Description	Source	All firms (140)	Without fraud (127)	With fraud (13)	Difference
Directly measured inputs:						
X	Gross value of the project	Table 2A	3.25%	3.15%	4.25%	-1.10%
			0.08% ***	0.07% ***	0.57% ***	-0.50% **
ΔV_2	Change in share price	Table 2B	-5.44% ***	-2.61% **	-33.06% ***	30.45% ***
	when bribery is revealed		-1.69% ***	-1.52% ***	-21.29% ***	19.77% ***
B	Bribe/Market cap	Table 3B	0.58% ***	0.36% ***	2.75% **	-2.39% *
			0.03% ***	0.02% ***	0.68% ***	-0.65% ***
C_{direct}	Direct cost/Market cap	Table 3B	3.27% ***	2.66% ***	9.31% *	-6.66%
			1.21% ***	1.15% ***	4.46% ***	-3.31% ***
$C_{restate}$	Restatement effect	Table 3B	0.78% **	0.52%	3.30% *	-2.78%
			0.00%	0.00%	0.00%	0.00%
Estimated parameters:						
p_b	Probability of bribing	Table 5	22.85%	22.85%	22.85%	
p_c	Probability of getting caught	Table 5	6.38%	6.38%	6.38%	
Analytically derived (imputed) parameters:						
Ex ante NPV	$= X - B - p_c C$	Eq. (3)	2.35%	2.64%	-0.50%	3.13%
			-0.01%	0.01%	-1.34% *	1.35% ***
Ex post NPV	$= X - B - C$	Eq. (4)	-2.39%	0.42%	-29.89% **	30.32% **
			-0.85% ***	-0.58% **	-13.38% **	12.81% ***
ΔV_1	$= X - P_b(B + P_c C)$	Eq. (5)	3.05%	3.03%	3.17%	-0.13%
			0.05% ***	0.05% ***	0.16%	-0.11%
C	$= X - B - (\Delta V_1 + \Delta V_2)$	Eq. (6)	5.06% ***	2.37% *	31.40% ***	-29.03% **
			1.47% ***	1.21% ***	14.87% ***	-13.67% ***
$C_{reputation}$	$= C - (C_{direct} + C_{restate})$	Eq. (7)	1.01%	-0.81%	18.79% **	-19.60% **
			-0.61%	-0.79%	9.93% **	-10.72% ***

Table 6. Summary of directly measured, estimated, and imputed parameter values (continued)

Panel B – 62 observations for which ΔV_1 is observed and X is imputed

Parameter	Description	Source	All firms (140)	Without fraud (127)	With fraud (13)	Difference
Directly measured inputs:						
ΔV_2	Change in share price	Table 2B	-7.11% ***	-3.15% ***	-52.26% **	49.11% *
	when bribery is revealed		-2.29% ***	-1.99% ***	-48.94% **	46.95% ***
ΔV_1	Change in share price	Table 2C	3.34% ***	2.94% ***	7.84%	-4.90%
	when project is announced		2.23% ***	2.25% ***	1.14% **	1.12%
B	Bribe/Market cap	Table 3B	0.51% **	0.30% ***	2.95%	-2.65%
			0.03% ***	0.04% ***	0.02% **	0.02%
C_{direct}	Direct cost/Market cap	Table 3B	3.98% ***	2.83% ***	17.08%	-14.25%
			1.38% ***	1.20% ***	5.91% **	-4.71% *
$C_{restate}$	Restatement effect	Table 3B	0.89% *	0.53%	5.04%	-4.51%
			0.00%	0.00%	0.00%	0.00%
Estimated parameters:						
P_b	Probability of bribing	Table 5	22.85%	22.85%	22.85%	
P_c	Probability of getting caught	Table 5	6.38%	6.38%	6.38%	
Analytically derived (imputed) parameters:						
Ex ante NPV	$= X - B - p_c C$	Eq. (3)	2.61% ***	2.57% ***	3.07%	-0.51%
			1.89% ***	1.90% ***	1.12%	0.78%
Ex post NPV	$= X - B - C$	Eq. (4)	-3.77% *	-0.20%	-44.42% *	44.21% *
			0.10%	0.20%	-29.70% *	29.89% ***
X	$= \Delta V_1 + P_b(B + P_c C)$	Eq. (5)	3.56% ***	3.06% ***	9.26%	-6.20%
			2.54% ***	2.53% ***	4.06% **	-1.53%
C	$= X - B - (\Delta V_1 + \Delta V_2)$	Eq. (6)	6.81% ***	2.96% ***	50.73% *	-47.77% *
			1.95% ***	1.72% ***	48.02% **	-46.30% ***
$C_{reputation}$	$= C - (C_{direct} + C_{restate})$	Eq. (7)	1.94%	-0.40%	28.61% **	-29.01% **
			0.20%	0.06%	29.93% *	-29.87% ***

Table 7. Sensitivity analysis for p_b and p_c

This table reports on alternate assumptions that yield different measures of the probability of bribery (p_b) and the probability of getting caught (p_c). Each row reports the empirical estimates of the ex ante NPV, ex post NPV, change in firm value when the bribery-related contract is awarded (ΔV_1), total cost of being caught bribing (C), and the portion of the total cost that comes from lost reputation using a different assumption to generate estimates for p_b and p_c. For example, the first row reports results assuming that (i) a firm is classified as a bribing firm if its fitted value from Model 5 in Table 4 exceeds the threshold value in any year of the analysis, and (ii) the threshold value is set to establish a sensitivity (true positive) rate of 100%. The second row makes assumption (i) but allows the ROC analysis to establish the threshold value. The bottom two rows report results assuming that (a) all firms engage in bribery, p_b = 100%, implying p_c = 108 / 6,857 = 1.58%; and (b) all firms get caught p_c = 100%, implying p_b = 108 / 6,857 = 1.58%. Panel A presents the effects using all 140 firms with sufficient return data. Panel B present results for the 127 enforcement actions without comingled charges of financial fraud, and Panel C reports results for the 13 enforcement actions with comingled charges of financial fraud. The yellow highlighted rows indicate our baseline estimates that are emphasized in the paper.

Panel A – All Enforcement Actions

Protocol	Cutoff	ROC	Sensitivity	p_b	p_c	*Ex ante NPV*	*Ex post NPV*	ΔV_1	C	*Reputation loss*
Any year > cutoff	0.001060	0.590	100.00%	82.32%	1.91%	2.57%	-2.75%	2.69%	5.42%	1.37%
(optimal ROC level)	0.006502	0.778	87.04%	32.29%	4.25%	2.45%	-2.44%	3.00%	5.12%	1.06%
Any 2 years > cutoff	0.001063	0.628	100.00%	74.87%	2.10%	2.56%	-2.71%	2.73%	5.38%	1.33%
(optimal ROC level)	0.006502	0.801	87.04%	27.81%	4.93%	2.42%	-2.42%	3.02%	5.09%	1.04%
Any 3 years > cutoff	0.001063	0.661	100.00%	68.40%	2.30%	2.55%	-2.67%	2.77%	5.34%	1.29%
(optimal ROC level)	0.006251	0.817	87.96%	25.55%	5.42%	2.40%	-2.41%	3.03%	5.08%	1.03%
Any 4 years > cutoff	0.001063	0.688	100.00%	63.06%	2.50%	2.54%	-2.64%	2.80%	5.31%	1.26%
(optimal ROC level)	0.005675	0.830	89.91%	24.95%	5.67%	2.38%	-2.40%	3.04%	5.07%	1.02%
Any 5 years > cutoff	0.001063	0.718	100.00%	57.17%	2.76%	2.53%	-2.60%	2.84%	5.27%	1.22%
(optimal ROC level)	0.004952	0.845	92.59%	24.13%	5.90%	2.37%	-2.40%	3.04%	5.07%	1.02%
2 Consecutive years > cutoff	0.001063	0.635	100.00%	73.43%	2.14%	2.56%	-2.70%	2.74%	5.37%	1.32%
(optimal ROC level)	0.005675	0.805	89.81%	29.78%	4.75%	2.43%	-2.43%	3.01%	5.10%	1.05%
3 Consecutive years > cutoff	0.001063	0.672	100.00%	66.05%	2.38%	2.54%	-2.65%	2.79%	5.33%	1.28%
(optimal ROC level)	0.005675	0.826	89.81%	25.61%	5.52%	2.39%	-2.41%	3.03%	5.08%	1.03%
4 Consecutive years > cutoff	0.001063	0.701	100.00%	60.48%	2.60%	2.53%	-2.62%	2.82%	5.29%	1.24%
(optimal ROC level)	0.004952	0.839	92.59%	25.84%	5.64%	2.38%	-2.41%	3.03%	5.08%	1.03%
5 Consecutive years > cutoff	0.001063	0.734	100.00%	54.03%	2.91%	2.52%	-2.58%	2.86%	5.25%	1.20%
(optimal ROC level)	**0.004952**	**0.854**	**92.59%**	**22.85%**	**6.38%**	**2.35%**	**-2.39%**	**3.05%**	**5.06%**	**1.01%**
All firms bribe			1.58%	100.00%	1.58%	2.58%	-2.86%	2.58%	5.53%	1.48%
All firms get caught			100.00%	1.58%	100.00%	-2.27%	-2.27%	3.17%	4.94%	0.89%

Table 7. Sensitivity analysis for p_b and p_c (continued)

Panel B – Enforcement actions without financial fraud

Protocol	Cutoff	ROC	Sensitivity	p_b	p_c	*Ex-ante NPV*	*Ex post NPV*	ΔV_1	*C*	*Reputation loss*
Any year > cutoff	0.001060	0.590	100.00%	82.32%	1.91%	2.74%	0.20%	2.81%	2.59%	-0.59%
(optimal ROC level)	0.006502	0.778	87.04%	32.29%	4.25%	2.69%	0.39%	3.00%	2.40%	-0.77%
Any 2 years > cutoff	0.001063	0.628	100.00%	74.87%	2.10%	2.74%	0.23%	2.84%	2.56%	-0.61%
(optimal ROC level)	0.006502	0.801	87.04%	27.81%	4.93%	2.67%	0.41%	3.02%	2.38%	-0.79%
Any 3 years > cutoff	0.001063	0.661	100.00%	68.40%	2.30%	2.73%	0.25%	2.86%	2.54%	-0.64%
(optimal ROC level)	0.006251	0.817	87.96%	25.55%	5.42%	2.66%	0.41%	3.03%	2.38%	-0.80%
Any 4 years > cutoff	0.001063	0.688	100.00%	63.06%	2.50%	2.73%	0.27%	2.88%	2.52%	-0.66%
(optimal ROC level)	0.005675	0.830	89.91%	24.95%	5.67%	2.66%	0.42%	3.03%	2.37%	-0.80%
Any 5 years > cutoff	0.001063	0.718	100.00%	57.17%	2.76%	2.72%	0.29%	2.91%	2.50%	-0.68%
(optimal ROC level)	0.004952	0.845	92.59%	24.13%	5.90%	2.65%	0.42%	3.03%	2.37%	-0.80%
2 Consecutive years > cutoff	0.001063	0.635	100.00%	73.43%	2.14%	2.74%	0.23%	2.85%	2.56%	-0.62%
(optimal ROC level)	0.005675	0.805	89.81%	29.78%	4.75%	2.68%	0.40%	3.01%	2.39%	-0.78%
3 Consecutive years > cutoff	0.001063	0.672	100.00%	66.05%	2.38%	2.73%	0.26%	2.87%	2.53%	-0.65%
(optimal ROC level)	0.005675	0.826	89.81%	25.61%	5.52%	2.66%	0.41%	3.03%	2.38%	-0.80%
4 Consecutive years > cutoff	0.001063	0.701	100.00%	60.48%	2.60%	2.73%	0.28%	2.89%	2.51%	-0.67%
(optimal ROC level)	0.004952	0.839	92.59%	25.84%	5.64%	2.66%	0.41%	3.02%	2.38%	-0.80%
5 Consecutive years > cutoff	0.001063	0.734	100.00%	54.03%	2.91%	2.72%	0.31%	2.92%	2.49%	-0.69%
(optimal ROC level)	**0.004952**	**0.854**	**92.59%**	**22.85%**	**6.38%**	**2.64%**	**0.42%**	**3.03%**	**2.37%**	**-0.81%**
All firms bribe			1.58%	100.00%	1.58%	2.75%	0.14%	2.75%	2.65%	-0.52%
All firms get caught			100.00%	1.58%	100.00%	0.50%	0.50%	3.11%	2.29%	-0.88%

Table 7. Sensitivity analysis for p_b and p_c (continued)

Panel C – Enforcement actions with financial fraud

Protocol	Cutoff	ROC	Sensitivity	p_b	p_c	*Ex-ante NPV*	*Ex post NPV*	ΔV_1	*C*	*Reputation loss*
Any year > cutoff	0.001060	0.590	100.00%	82.32%	1.91%	0.88%	-31.59%	1.47%	33.10%	20.49%
(optimal ROC level)	0.006502	0.778	87.04%	32.29%	4.25%	0.16%	-30.13%	2.93%	31.64%	19.03%
Any 2 years > cutoff	0.001063	0.628	100.00%	74.87%	2.10%	0.82%	-31.38%	1.68%	32.89%	20.28%
(optimal ROC level)	0.006502	0.801	87.04%	27.81%	4.93%	-0.05%	-30.01%	3.06%	31.51%	18.91%
Any 3 years > cutoff	0.001063	0.661	100.00%	68.40%	2.30%	0.76%	-31.20%	1.86%	32.71%	20.10%
(optimal ROC level)	0.006251	0.817	87.96%	25.55%	5.42%	-0.20%	-29.95%	3.12%	31.45%	18.85%
Any 4 years > cutoff	0.001063	0.688	100.00%	63.06%	2.50%	0.69%	-31.05%	2.01%	32.56%	19.95%
(optimal ROC level)	0.005675	0.830	89.91%	24.95%	5.67%	-0.28%	-29.94%	3.12%	31.45%	18.84%
Any 5 years > cutoff	0.001063	0.718	100.00%	57.17%	2.76%	0.61%	-30.89%	2.17%	32.40%	19.79%
(optimal ROC level)	0.004952	0.845	92.59%	24.13%	5.90%	-0.35%	-29.92%	3.14%	31.43%	18.82%
2 Consecutive years > cutoff	0.001063	0.635	100.00%	73.43%	2.14%	0.80%	-31.34%	1.72%	32.85%	20.24%
(optimal ROC level)	0.005675	0.805	89.81%	29.78%	4.75%	0.01%	-30.07%	2.99%	31.58%	18.97%
3 Consecutive years > cutoff	0.001063	0.672	100.00%	66.05%	2.38%	0.73%	-31.14%	1.93%	32.64%	20.04%
(optimal ROC level)	0.005675	0.826	89.81%	25.61%	5.52%	-0.23%	-29.96%	3.11%	31.47%	18.86%
4 Consecutive years > cutoff	0.001063	0.701	100.00%	60.48%	2.60%	0.66%	-30.98%	2.08%	32.49%	19.88%
(optimal ROC level)	0.004952	0.839	92.59%	25.84%	5.64%	-0.27%	-29.98%	3.09%	31.49%	18.88%
5 Consecutive years > cutoff	0.001063	0.734	100.00%	54.03%	2.91%	0.57%	-30.80%	2.26%	32.31%	19.70%
(optimal ROC level)	**0.004952**	**0.854**	**92.59%**	**22.85%**	**6.38%**	**-0.50%**	**-29.89%**	**3.17%**	**31.40%**	**18.79%**
All firms bribe			1.58%	100.00%	1.58%	0.98%	-32.09%	0.98%	33.59%	20.99%
All firms get caught			100.00%	1.58%	100.00%	-29.34%	-29.34%	3.73%	30.85%	18.24%

Appendices for "Foreign Bribery: Incentives and Enforcement"

Appendix A: Countries in which bribes were paid

Appendix Table A1 reports on frequencies of bribe payments in 117 countries identified in the 143 enforcement actions for foreign bribery initiated from 1978 through May 2013 against publicly traded firms, which constitutes our sample. N represents the number of different enforcement action in which each country is named. The total across countries (434) exceeds the total enforcement actions (143) because many actions involve charges of bribery in more than one country. As an example, Dimon, Inc. (now known as Alliance One International, Inc.) paid more than $3 million in bribes to Kyrgyzstan government officials and more than $1.2 million to government officials of the Thailand Tobacco Monopoly to obtain sales contracts. These different bribes were grouped into a single enforcement action that targeted Dimon, Inc.

The table also reports two measures of the culture of bribery in each country. The first is Transparency International's 2011 Corruption Perceptions Index (CPI). The CPI is measured for 178 countries on a scale of 1 (most corrupt) to 10 (least corrupt) and is based on a survey of country analysts and business people. For example, China's CPI of 3.6 ranks it the 71st highest in perceived corruption. Singapore's CPI of 9.2 reflects a perception that it is the least corrupt country among the 117 countries in the sample. The second measure reported in Appendix Table A1 is the 2011 World Governance Indicators Control of Corruption (COC) indicator. The COC captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests, and ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance. The COC ranks The Netherlands, Luxembourg, and Norway as the least corrupt among the countries that appear in our sample. Reported with each measure is our rank of the country's score from 1 (most corrupt) to 117 (least corrupt). Bribes were paid in three countries that are not included in the TI or WGI indicators, so we assign values from related countries. Antigua and Turks & Caicos each received the UK index values because they were part of the British Commonwealth at the time of the bribe. Cook Islands received New Zealand's index values and rankings because it is an associated state of New Zealand.

Bribe payments associated with FCPA-related enforcement actions tend to occur in countries with a reputation for corruption. For example, the mean CPI for all countries named in bribery enforcement actions is 3.9, which is slightly lower than the mean CPI for all countries of 4.2. Weighting by the number of times each country appears in the sample, the weighted mean CPI is 3.5 for countries connected with bribery enforcement actions.

Appendix Table A1. Countries in which bribes were paid

		Transparency International		World Governance Indicators	
Country	**N**	**CPI**	**Rank**	**COC**	**Rank**
China	28	3.6	71	-0.7	40
Nigeria	27	2.4	24	-1.1	12
Iraq	24	1.8	5	-1.2	9
Indonesia	16	3.0	54	-0.7	39
Saudi Arabia	13	4.4	83	-0.3	63
India	12	3.1	57	-0.6	48
Mexico	12	3.0	49	-0.4	60
Brazil	11	3.8	72	0.2	83
Argentina	10	3.0	52	-0.4	55
Egypt	10	2.9	43	-0.7	38
Greece	8	3.4	66	-0.2	73
Russia	8	2.4	23	-1.1	17
Thailand	8	3.4	64	-0.4	58
Iran	7	2.7	39	-0.9	26
Kazakhstan	7	2.7	38	-1.0	19
United Arab Emirates	7	6.8	103	1.1	101
Venezuela	7	1.9	6	-1.2	8
Angola	6	2.0	8	-1.4	4
Malaysia	6	4.3	81	0.0	76
Poland	6	5.5	96	0.5	92
Turkey	6	4.2	80	0.1	81
Cote D'Ivoire	5	2.2	15	-1.1	16
Ecuador	5	2.7	34	-0.8	29
Italy	5	3.9	74	0.0	75
Korea (South)	5	5.4	95	0.5	90
Bangladesh	4	2.7	35	-1.0	20
Colombia	4	3.4	68	-0.3	62
France	4	7.0	104	1.5	107
Gabon	4	3.0	50	-0.8	33
Niger	4	2.5	29	-0.7	42
Romania	4	3.6	70	-0.2	70
Taiwan	4	6.1	100	0.9	97
Vietnam	4	2.9	44	-0.6	43
Algeria	3	2.9	47	-0.6	49
Azerbaijan	3	2.4	18	-1.1	13
Bahrain	3	5.1	93	0.2	85
Chile	3	7.2	107	1.6	110
Croatia	3	4.0	78	0.0	78
Czech Republic	3	4.4	82	0.3	88
Israel	3	5.8	98	0.7	94
Montenegro	3	4.0	76	-0.2	68
Nicaragua	3	2.5	28	-0.8	35
Oman	3	4.8	89	0.1	80
Pakistan	3	2.5	26	-1.0	20
Panama	3	3.3	61	-0.4	61
Philippines	3	2.6	33	-0.8	32
Qatar	3	7.2	106	1.0	99
Serbia	3	3.3	62	-0.2	69
Uzbekistan	3	1.6	3	-1.3	5
Benin	2	3.0	48	-0.7	41
Bolivia	2	2.8	42	-0.5	52
Bulgaria	2	3.3	63	-0.2	72
Canada	2	8.7	114	2.0	113
Congo Republic	2	2.2	13	-1.1	15
Costa Rica	2	4.8	88	0.6	93
FYR Macedonia	2	3.9	75	0.0	74

Appendix Table A1. Countries in which bribes were paid (continued)

		Transparency International		World Governance Indicators	
Country	**N**	**CPI**	**Rank**	**COC**	**Rank**
Germany	2	8.0	112	1.7	112
Ghana	2	3.9	73	0.1	82
Honduras	2	2.6	32	-0.8	30
Hungary	2	4.6	85	0.3	89
Kuwait	2	4.6	86	0.1	79
Liberia	2	3.2	59	-0.4	53
Libya	2	2.0	9	-1.3	6
Luxembourg	2	8.5	113	2.2	115
Mali	2	2.8	41	-0.6	46
Mauritania	2	2.4	21	-0.6	47
Netherlands	2	8.9	115	2.2	115
Portugal	2	6.1	99	1.1	102
Senegal	2	2.9	45	-0.6	44
Singapore	2	9.2	117	2.1	114
Spain	2	6.2	101	1.1	100
Syria	2	2.6	30	-1.0	24
Trinidad and Tobago	2	3.2	58	-0.3	64
Turkmenistan	2	1.6	2	-1.5	3
Uganda	2	2.4	22	-0.9	28
Yemen	2	2.1	10	-1.2	10
Antigua	1	4.9	90	1.3	104
Austria	1	7.8	110	1.4	105
Belarus	1	2.4	20	-0.7	36
Belgium	1	7.5	108	1.6	111
Bosnia and Herzegovina	1	3.2	60	-0.3	66
Brunei	1	5.2	94	0.8	96
Burkina Faso	1	3.0	56	-0.4	57
Cape Verde	1	5.5	97	0.8	95
Cyprus	1	6.3	102	1.0	98
Dominican Republic	1	2.6	31	-0.8	31
Equatorial Guinea	1	1.9	7	-1.5	2
Gambia	1	3.5	69	-0.5	51
Guatemala	1	2.7	40	-0.5	50
Guinea	1	2.1	11	-1.2	11
Guinea-Bissau	1	2.2	14	-1.1	18
Haiti	1	1.8	4	-1.3	7
Japan	1	8.0	111	1.5	106
Jordan	1	4.5	84	0.0	77
Kenya	1	2.2	16	-0.9	25
Kyrgyzstan	1	2.1	12	-1.1	14
Latvia	1	4.2	79	0.2	84
Lebanon	1	2.5	27	-0.9	26
Lithuania	1	4.8	87	0.3	86
Madagascar	1	3.0	55	-0.3	64
Malawi	1	3.0	53	-0.4	56
Moldova	1	2.9	46	-0.6	44
Mongolia	1	2.7	36	-0.7	37
Morocco	1	3.4	67	-0.3	67
Mozambique	1	2.7	37	-0.4	54
Myanmar	1	1.5	1	-1.7	1
Norway	1	9.0	116	2.2	115
Peru	1	3.4	65	-0.2	70
Rwanda	1	5.0	92	0.5	90
Sao Tome and Principe	1	3.0	51	-0.4	59
Sierra Leone	1	2.5	25	-0.8	33
Slovakia	1	4.0	77	0.3	86
Togo	1	2.4	19	-1.0	22
Turks and Caicos Islands	1	4.9	90	1.5	108
Ukraine	1	2.3	17	-1.0	23
United Kingdom	1	7.8	109	1.5	108
Uruguay	1	7.0	105	1.3	103
Average (total)	(117)	3.9		-0.1	
Weighted average (total)	(434)	3.5		-0.4	

Appendix B: Estimation of investigation costs

This appendix reports on the procedure for estimating firms' internal investigations costs and legal expenses prompted by allegations of foreign bribery. Only some firms report these expenses because the expenses frequently do not meet the materiality requirements of 10-Q and 10-K periodic reports. A few firms have reported investigation and legal expenses in response to media requests or analyst questions regarding an ongoing investigation. We are able to identify these expenses for 48 of the 143 firms in our sample by examining all available periodic reports from the beginning of the violation period through the end of the fiscal year following the concluding regulatory proceeding and searching Lexis-Nexis and Factiva for any press announcements related to the phrase "FCPA investigation expense" and its derivatives. These expenses are summarized in Panel A of Table B1. The mean investigation expense is $64.78 million with a median of $9.78 million. These self-reported expenses undoubtedly reflect reporting biases. For example, the expenses may include allocated expenses that are not directly related to the firm's bribery-related legal expenses, such as ongoing FCPA education initiatives. The reported expenses also may underreport the costs of managers' time in dealing with the bribery charges. It is also is not clear whether the subset of firms that report their direct legal expenses have higher or lower expenses compared to firms that do not report these expenses. Nonetheless, the numbers from these firms provide a rough estimate of their legal expenses due to their bribery-related charges. Among these 48 firms, the mean reported legal expense equals 1.53% of the firm's market capitalization, the median is 0.87% and the range is from 0.01% to 13.63%. Removing the outlier of 13.63%, firms incur legal and investigation costs related to its bribery investigation that average 1.15% of the firm's market capitalization.

Panel B of Table B1 reports the results of an OLS regression of these firms' investigation costs using data from these 48 enforcement actions. We finalized our selection of predictor variables after consulting with all three insurance companies that provide guidance or underwrite insurance policies that cover the costs of investigations for foreign bribery under either the FCPA or the U.K. Bribery Act. As mentioned in the paper, one of these three companies has adopted our model as an input in pricing its foreign bribery insurance products.

The model indicates that the investigation cost is negatively related to natural logarithm of market capitalization and the average TI Corruption Perception Index of the countries in which the bribes occurred (smaller values relate to greater corruption). The investigation cost is positively related to the natural logarithm of the total size of the bribes paid, the fraction of the firm's sales that are attributable to the bribe payments, and the natural logarithm of the number of countries involved in the bribery investigation. The investigation cost is not significantly related to the number of unique charges brought by regulators or the TI Bribe Payer Industry Sector Score. The model R-squared is 46.8%.

We use censored predicted estimates from the regression to predict the investigation costs for all firms in the sample and report the results in Panel C of Table B1. The predicted values for all 143 enforcement actions are slightly larger than those observed for the 48 firms with hard data. In the last line of Panel C we

report the estimates used in our economic model. These estimates use actual values for the 48 firms with reported amounts, and fitted values for the remaining 95 firms for which we cannot find reported expenses. The mean of the predicted investigation expense is 1.53% of market capitalization, the median is 0.95%, and the range is 0.01% to 13.63%. The mean estimated investigation expense is equal to the mean for the 48 observed values, while the median is 8 basis points higher. Whether we use the subset of firms for which we have direct data, or include estimates from all other firms, the results in Table B1 indicate that, on average, firms that are targeted for bribery enforcement actions spend in the neighborhood of 1.5% of market capitalization on internal investigation and legal expenses when they face enforcement action for foreign bribery.

Appendix Table B1. Estimates of internal investigation expenses incurred by firms for bribery violations

Panel A reports summary measures of the total investigation costs for 48 firms in the bribery sample that report on investigation costs in 10-K or other reports filed with the SEC, or through a public release. Panel B reports on a cross sectional OLS regression using data from these 48 firms in which the dependent variable is the investigation cost as a percent of the firm's market capitalization, with p-values based on robust standard errors. Panel C presents summary measures of the investigation costs using three different scenarios: (i) actual values using the 48 firms with data on investigation costs, (ii) actual values for the 48 firms supplemented by forecast investigation costs for the other 95 sample firms using the model reported in Panel B, and (iii) actual values for the 48 firms with known investigation costs supplemented by forecast investigation costs for the other 92 sample firms that have returns data available to calculate other model parameters

Panel A – Investigation cost as a percent of market capitalization for 48 firms with data ($mil)

	N	Mean	Median	Minimum	Maximum
Market capitalization	48	16,167.87	1,347.59	11.17	146,793.30
Investigation cost	48	64.78	9.78	0.38	1,200.00
% of market capitalization	48	1.53%	0.87%	0.01%	13.63%

Panel B – OLS regression estimates of investigation cost using data from 48 firms with reported values

Parameter	Estimate	Prob > |t|
Intercept	-0.0033	0.909
Log(market capitalization)	-0.0060	0.002
Log(bribe amount)	0.0025	0.032
% sales influenced to total sales	0.0659	0.009
Log(number of countries involved)	0.0040	0.037
Number of unique charges	0.0007	0.380
TI Bribe Payer Industry Sector Score	0.0058	0.187
TI Corruption Perception Index	-0.0076	0.056
N	48	
F (7, 40)	8.08	0.000
R-squared	46.82	

Panel C – Average investigation cost using forecasted values for firms without directly reported values

Investigation cost	N	Mean	Median	Min	Max
Actual %	48	1.53%	0.87%	0.01%	13.63%
Predicted %	143	1.55%	0.93%	0.01%	13.63%
Predicted %	140	1.53%	0.95%	0.01%	13.63%

Appendix C: Alternate weighting for Type I and Type II errors in the ROC analysis

A potential concern about the ROC analysis is that it assigns equal weight to gains in specificity and sensitivity. From a cost standpoint, however, it is entirely possible that a gain in specificity (which is the decrease in Type II errors from false positives in identifying firms that bribe) could be more or less important than a gain in sensitivity (which is the decrease in Type I errors from false negatives). For example, policymakers might be willing to accept a one percentage point increase in the rate at which firms are falsely accused of bribery (Type II errors) only if doing so decreases the Type I error rate by at least two percentage points. To examine asymmetric benefits in specificity and sensitivity, we recalculate p_b and p_c for every threshold level that results in one fewer firm in our sample being correctly classified as engaging in bribery. We start by setting the sensitivity to 100% (all 108 known-bribers are classified as paying bribes), then to 107/108 = 99.1%, then to 106/108 = 98.1%, and so on. For each threshold level, we calculate the tradeoff between sensitivity and specificity. This allows us to calculate estimates for p_b and p_c for any weighting scheme in the tradeoff between sensitivity and specificity.

The results are reported in Appendix Table A3. Our best estimates for p_b and p_c – in which we assume that gains in sensitivity and specificity are equally important – are highlighted in Row 9 of the table. But suppose we consider gains in the specificity rate to be twice as important as gains in the sensitivity rate (i.e., the marginal cost of a false positive is twice the marginal cost of a false negative, or an error cost ratio of 2:1). Favoring specificity over sensitivity implies a higher cutoff value in the ROC analysis that classifies fewer firms as bribe-payers. The weighted optimal tradeoff is indicated by Row 15, and the resulting estimates are p_b = 18.3% and p_c = 7.5%. For an error cost ratio of 4:1, the optimal tradeoff is indicated by Row 49, implying p_b = 4.3% and p_c = 20.6%.

These results indicate that p_b and p_c are somewhat sensitive to alternative assumptions about the relative importance of Type I and Type II errors when classifying firms as bribe-payers. As indicated in Table 7, however, even large deviations in p_b and p_c from our base scenario have small effects on the other model parameters. That is, our results are qualitatively unaffected by adjustments to the ROC analysis that place different weights on gains in sensitivity and specificity.

Appendix Table C1: Sensitivity of p_b and p_c to alternate weights on gains in sensitivity and specificity

Thisxxx table reports the implied values for the probability that a Compustat-listed firm with foreign sales engaged in a program of prosecutable bribery for five consecutive years at least once during the 1975-2010 period (p_b) and the probability that such a firm is caught and faces enforcement action under the Foreign Corrupt Practices Act (p_c). Each row corresponds to a different cutoff value, using Model 5 in Table 4, that accurately classifies the stated fraction of known bribe-paying firms (the Sensitivity) and the associated values for p_b and p_c. For example, the yellow-highlighted row (Row 9) indicates that the minimum cutoff value for accurately classifying 92.6% of the 108 known bribe-paying firms used to estimate Model 5 is 0.0050. Applying this cutoff value, the implied value of p_b = 22.85% and p_c = 6.38%. Increasing the cutoff value and decreasing the model sensitivity can be optimal if gains from specificity are valued more than gains in sensitivity. For example, setting the gains in specificity at 2 times the value of the marginal gain in sensitivity results in the outcome summarized by Row 15, with an implied value for p_b = 18.26% and p_c = 7.51%.

		ROC						
Row	Cutoff value	Area	Std Err	Sensitivity	Specificity	p_b	p_c	
1	0.0011	0.734	0.0030	1.000	0.467	54.03%	2.91%	
2	0.0013	0.750	0.0055	0.991	0.509	49.91%	3.13%	
3	0.0014	0.756	0.0072	0.981	0.531	47.73%	3.24%	
4	0.0023	0.803	0.0085	0.972	0.634	37.55%	4.08%	
5	0.0026	0.813	0.0096	0.963	0.663	34.69%	4.37%	
6	0.0029	0.821	0.0105	0.954	0.688	32.19%	4.67%	
7	0.0031	0.820	0.0114	0.944	0.696	31.46%	4.73%	
8	0.0032	0.818	0.0122	0.935	0.701	30.89%	4.77%	
9	0.0050	0.854	0.0129	0.926	0.783	22.85%	6.38%	<= Error cost ratio = 1/1 (Base case)
10	0.0052	0.853	0.0136	0.917	0.789	22.21%	6.50%	
11	0.0054	0.851	0.0142	0.907	0.795	21.57%	6.63%	
12	0.0057	0.851	0.0148	0.898	0.805	20.65%	6.85%	
13	0.0058	0.848	0.0154	0.889	0.808	20.30%	6.90%	
14	0.0063	0.850	0.0159	0.880	0.821	18.97%	7.30%	
15	0.0065	0.849	0.0164	0.870	0.828	18.26%	7.51%	<= Error cost ratio = 2/1
16	0.0066	0.847	0.0169	0.861	0.832	17.86%	7.59%	
17	0.0067	0.843	0.0173	0.852	0.835	17.62%	7.62%	
18	0.0069	0.841	0.0177	0.843	0.839	17.15%	7.74%	
19	0.0070	0.837	0.0182	0.833	0.841	16.99%	7.73%	
20	0.0073	0.835	0.0185	0.824	0.845	16.51%	7.86%	
21	0.0073	0.831	0.0189	0.815	0.847	16.36%	7.84%	
22	0.0074	0.828	0.0193	0.806	0.850	16.04%	7.91%	
23	0.0076	0.825	0.0196	0.796	0.854	15.63%	8.02%	
24	0.0078	0.823	0.0199	0.787	0.860	15.04%	8.24%	
25	0.0082	0.822	0.0202	0.778	0.865	14.47%	8.47%	
26	0.0085	0.818	0.0205	0.769	0.868	14.19%	8.53%	
27	0.0087	0.816	0.0208	0.759	0.873	13.74%	8.70%	
28	0.0089	0.812	0.0210	0.750	0.875	13.52%	8.74%	
29	0.0094	0.810	0.0213	0.741	0.879	13.08%	8.92%	
30	0.0097	0.808	0.0215	0.731	0.885	12.51%	9.21%	
31	0.0101	0.806	0.0217	0.722	0.891	11.91%	9.55%	
32	0.0102	0.802	0.0219	0.713	0.892	11.75%	9.55%	
33	0.0102	0.798	0.0222	0.704	0.892	11.74%	9.44%	

34	0.0104	0.794	0.0223	0.694	0.893	11.58%	9.45%	
35	0.0111	0.793	0.0225	0.685	0.901	10.85%	9.95%	
36	0.0116	0.791	0.0227	0.676	0.907	10.22%	10.41%	
37	0.0124	0.790	0.0229	0.667	0.914	9.52%	11.03%	
38	0.0127	0.786	0.0230	0.657	0.915	9.36%	11.06%	
39	0.0127	0.782	0.0231	0.648	0.916	9.33%	10.94%	
40	0.0138	0.782	0.0233	0.639	0.924	8.46%	11.90%	
41	0.0146	0.781	0.0234	0.630	0.932	7.73%	12.83%	
42	0.0147	0.776	0.0235	0.620	0.932	7.67%	12.74%	
43	0.0169	0.777	0.0236	0.611	0.942	6.68%	14.41%	
44	0.0173	0.773	0.0237	0.602	0.944	6.43%	14.74%	
45	0.0194	0.772	0.0238	0.593	0.952	5.63%	16.58%	
46	0.0202	0.770	0.0239	0.583	0.956	5.25%	17.50%	
47	0.0202	0.765	0.0239	0.574	0.956	5.24%	17.27%	
48	0.0222	0.763	0.0240	0.565	0.961	4.70%	18.94%	
49	0.0238	0.761	0.0240	0.556	0.966	4.26%	20.55%	<= Error cost = 3/1 and 4/1
50	0.0238	0.756	0.0241	0.546	0.966	4.24%	20.27%	
51	0.0253	0.752	0.0241	0.537	0.968	4.01%	21.09%	
52	0.0256	0.748	0.0242	0.528	0.969	3.91%	21.27%	
53	0.0265	0.744	0.0242	0.519	0.970	3.73%	21.88%	
54	0.0274	0.741	0.0242	0.509	0.973	3.46%	23.21%	
55	0.0287	0.738	0.0242	0.500	0.975	3.22%	24.43%	<= Error cost = 5/1, 6/1, 7/1 and 8/1
56	0.0289	0.733	0.0242	0.491	0.976	3.18%	24.31%	
57	0.0295	0.729	0.0242	0.481	0.976	3.09%	24.53%	
58	0.0296	0.724	0.0241	0.472	0.976	3.08%	24.17%	
59	0.0303	0.720	0.0241	0.463	0.977	3.03%	24.04%	
60	0.0335	0.717	0.0241	0.454	0.980	2.67%	26.78%	
61	0.0347	0.713	0.0240	0.444	0.982	2.48%	28.24%	<= Error cost = 9/1 and 10/1
62	0.0355	0.709	0.0240	0.435	0.982	2.42%	28.31%	
63	0.0357	0.704	0.0239	0.426	0.983	2.36%	28.40%	
64	0.0370	0.700	0.0238	0.417	0.984	2.26%	29.03%	
65	0.0376	0.696	0.0238	0.407	0.984	2.17%	29.53%	
66	0.0386	0.692	0.0237	0.398	0.985	2.09%	30.07%	
67	0.0428	0.688	0.0236	0.389	0.987	1.90%	32.31%	
68	0.0456	0.684	0.0235	0.380	0.988	1.81%	33.06%	
69	0.0460	0.679	0.0234	0.370	0.988	1.75%	33.33%	
70	0.0465	0.675	0.0232	0.361	0.989	1.69%	33.62%	
71	0.0466	0.670	0.0231	0.352	0.989	1.68%	33.04%	
72	0.0469	0.666	0.0229	0.343	0.989	1.65%	32.74%	
73	0.0473	0.661	0.0228	0.333	0.989	1.62%	32.43%	
74	0.0494	0.657	0.0226	0.324	0.990	1.53%	33.33%	
75	0.0499	0.652	0.0225	0.315	0.990	1.49%	33.33%	
76	0.0511	0.648	0.0223	0.306	0.990	1.44%	33.33%	
77	0.0517	0.643	0.0221	0.296	0.990	1.43%	32.65%	
78	0.0518	0.639	0.0219	0.287	0.990	1.41%	31.96%	

79	0.0521	0.634	0.0217	0.278	0.990	1.40%	31.25%
80	0.0522	0.629	0.0214	0.269	0.990	1.39%	30.53%
81	0.0524	0.625	0.0212	0.259	0.990	1.37%	29.79%
82	0.0588	0.621	0.0209	0.250	0.993	1.12%	35.06%
83	0.0624	0.617	0.0207	0.241	0.994	1.01%	37.68%
84	0.0733	0.614	0.0204	0.231	0.996	0.80%	45.45%
85	0.0735	0.609	0.0201	0.222	0.996	0.79%	44.44%
86	0.0753	0.604	0.0198	0.213	0.996	0.76%	44.23%
87	0.0755	0.600	0.0195	0.204	0.996	0.74%	43.14%
88	0.0787	0.595	0.0191	0.194	0.996	0.70%	43.75%
89	0.0845	0.591	0.0188	0.185	0.997	0.61%	47.62%
90	0.0900	0.587	0.0184	0.176	0.997	0.54%	51.35%
91	0.0923	0.582	0.0180	0.167	0.997	0.53%	50.00%
92	0.0975	0.578	0.0176	0.157	0.998	0.47%	53.13%
93	0.1002	0.573	0.0172	0.148	0.998	0.44%	53.33%
94	0.1033	0.568	0.0167	0.139	0.998	0.41%	53.57%
95	0.1059	0.564	0.0162	0.130	0.998	0.38%	53.85%
96	0.1116	0.559	0.0157	0.120	0.999	0.34%	56.52%
97	0.1126	0.555	0.0152	0.111	0.999	0.29%	60.00%
98	0.1138	0.550	0.0146	0.102	0.999	0.28%	57.89%
99	0.1142	0.546	0.0140	0.093	0.999	0.26%	55.56%
100	0.1151	0.541	0.0134	0.083	0.999	0.25%	52.94%
101	0.1196	0.537	0.0127	0.074	0.999	0.22%	53.33%
102	0.1242	0.532	0.0119	0.065	0.999	0.18%	58.33%
103	0.1342	0.527	0.0111	0.056	0.999	0.15%	60.00%
104	0.1433	0.523	0.0102	0.046	1.000	0.10%	71.43%
105	0.1631	0.518	0.0091	0.037	1.000	0.07%	80.00%
106	0.2085	0.514	0.0079	0.028	1.000	0.04%	100.0%<= Error cost = 100/1
107	0.2389	0.509	0.0065	0.019	1.000	0.03%	100.0%
108	0.2446	0.505	0.0046	0.009	1.000	0.01%	100.00%

Appendix Figure D1: Time series variation in estimates of p_b and p_c

Annual estimates of p_b and p_c are calculated using the Receiver Operating Characteristics (ROC) approach and using all enforcement actions available up through each year from 1980 through 2010. (Our sample includes all bribery-related enforcement actions initiated through May 2013, but the latest year in which the targeted bribery occurred is 2010. So we implement the ROC analysis using data through 2010.)