

Why Do Firms Pay Bribes?

Evidence on the Demand and Supply Sides of Corruption
in Developing Countries

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Abstract

This paper empirically examines the demand and supply sides of bribery using World Bank Enterprise Survey data on 18,005 firms in 75 developing countries. It assesses the determinants of firms' bribe paying behavior and examine how bribe behavior affects two main sectors where corruption is rampant: taxation and government contracts. The paper shows that corruption in tax administration tends to be mainly a demand-side phenomenon. Paying a bribe requested by a public official is associated with a 16

percent increase in the share firms' sales not reported for tax purposes. In public procurement, the results suggest, on the contrary, that corruption is a supply-side phenomenon, with bribe transactions generally initiated by firms to secure public contracts. Firms supplying a bribe without a previous request by officials is associated with a 17 percent increase in the bribe paid to secure a government contract, more than three times the effect observed on the demand side of bribery.

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Why Do Firms Pay Bribes? Evidence on the Demand and Supply Sides of Corruption in Developing Countries

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I Introduction

Corruption exists everywhere, in the private and public sectors, in wealthy and in poor countries, but takes root especially in countries with weak incentives and poor monitoring, transparency and accountability of public agents. In such weak institutional environment, officials are able misuse their public office for their own private benefit and extract illicit rents. While some firms or individuals could be seen as innocent victims of corrupt officials, forced to make payoffs to pursue their legitimate activities, considering the problem only from the receiving end of the graft transaction – the demand side – does not present a complete view of the problem. Since both parties in a bribery transaction (giver and taker) can gain from the transaction, bribery deals could often be initiated from the supply side, the party who gives the bribe. To gain public contracts, some firms will be willing to offer kickbacks, or informal payments in exchange of lower domestic or international taxes or to access specific public services. Some local firms or large multinationals will make proposals which "officials in poor countries will find hard to resist" (Myint, 2000, p. 33).¹ These two distinct sides of corruption transactions and firms' behavior have been recognized in the OECD Anti-Bribery Convention² which refers to as "active bribery" the act of offering, promising or giving a bribe to a public official to obtain a trading advantage, and "passive bribery" the act of complying with a demand for a bribe to avoid being excluded from trade (refer also as a "facilitation payment" by international legislations).

In this paper, we examine both the supply and demand sides of corruption transactions to assess the systematic differences associated with these bribe-paying behaviors. We examine the determinants of firms' bribe behavior to identify the characteristics of firms actively or passively paying bribes. We assess how bribe behavior affects firms' benefits from bribery in two main sectors where corruption activities are rampant: taxation and government contracts.

The economic literature on corruption has especially focused on the demand side of corruption, in which bribes result from extortion by public officials who, wielding excessive power over businesses and behaving as monopolists, extract rents through price discrimination (Shleifer and Vishny, 1993; Bliss and Tella, 1997; Svensson, 2003; Bai et al., 2019).³ In this perspective, firms, confronting red tape costs, are forced to either

¹As stated by Klitgaard (1988, p. 4), "True, there are both saints who resist all temptations and honest officials who resist most. But when bribes are large, the chances of being caught small, and the penalties if caught meager, many officials will succumb."

²The OECD "Convention on Combating Bribery of Foreign Public Officials in International Business Transactions", adopted in 1997 and which took force in 1999, is the first and only international anti-corruption instrument focused on the "supply side" of the bribery transaction (i.e. the person or entity offering, promising, or giving a bribe). <http://www.oecd.org/corruption-integrity/explore/oecd-standards/anti-bribery-convention/>

³In Bliss and Tella (1997), politicians and bureaucrats, possessing a monopoly power over resources (e.g., regulations, financial resources, public contracts) and some discretion in their decisions, devise

participate in these illicit activities with self-serving officials, move to another jurisdiction, exit the market, or operate in the informal sector.⁴ The supply side of corruption has been relatively less explored. In this perspective, rather than being passive respondents to requests, harassment and threats by officials, some firms may actively seek favors, offering bribes and other informal gifts as a strategy to obtain privileges or circumvent regulations (Tanzi, 1998; Myint, 2000; Delavallade, 2012; Ufere et al., 2012; Dixit, 2016).⁵

We use firm-level data from the WBES covering 18,005 firms in 75 developing countries. We exploit the presence of information on bribe requests from public officials in various interactions between firms and government,⁶ as well as reported bribe payments by firms, to identify the demand and supply sides of corruption. In addition to these distinct bribe-paying behaviors, we categorize non-bribe paying firms into two groups: "incorruptible" are firms non-complying to requests for bribes by officials, and "non-payers" are firms which neither experienced a request for a bribe nor paid a bribe. We show that firms' bribe behavior categories are associated with specific firm characteristics. Demand and supply-side bribe payers tend to be firms facing greater informal competition than non-bribe payers. In particular, demand-side bribe payers (passive bribery) tend to be firms with larger capital investments and higher profits and are less likely to have government ownership. Supply-side bribe payers (active bribery) are more likely to be exporting firms with a larger share of foreign ownership as well as larger investments and capital stock value.

With regard to the association between bribing behavior and benefits of illicit transactions, we find that corruption in tax administration tends to be mainly a demand-side phenomenon. Paying a bribe requested by a public official (passive bribery) is associated with a 16 % increase in the share of sales not reported for tax purposes. However, firms supplying a bribe without previous request by officials (active bribery) is not significantly associated with the share of sales not reported for tax purposes. A potential explanation is that otherwise, a firm offering an unsolicited bribe to tax officials would tend to signal

regulations and endeavor to increase rent from corruption. In Svensson (2003), model of bargaining with rent maximizing bureaucrats in Uganda, public officials act as price (bribe) discriminators, where bribes are a function of individual firm ability to move. Similarly, in Bai et al. (2019), government officials in Vietnam choose a percentage of a firm's revenues to extract as bribes, trading off higher bribe income against the increase in the firm's incentive to move jurisdiction.

⁴Djankov et al. (2002), for instance, find that stricter regulation of the entry of new firms in the market is associated with sharply higher levels of corruption and a greater relative size of the unofficial economy in a cross-section of countries (McChesney, 1987; De Soto, 1989; LaPorta et al., 1998).

⁵Delavallade (2012) show that bribing officials to obtain favors is more often to gain a competitive advantage or for tax evasion purposes. Ufere et al. (2012) document the systematic supply side of corruption among young enterprises in Nigeria. The authors describe entrepreneurs in Nigeria as "merchants of bribery," willfully and actively engaged in a deliberate process of generating bribes for private gain. The literature on "cooperative" corruption vs "coercive" corruption has also focused on the supply side of corruption; especially also the grease the wheel hypothesis (Leff, 1964; Lui, 1985; Lien, 1986; Cadot, 1987; Méon and Weill, 2010).

⁶Tax inspectorate, public agencies for labor and social security, fire and building safety, sanitation/epidemiology, environmental issues, and municipal police.

undeclared revenues, opening the door to penalties or informal payments required by tax officials. Furthermore, our findings suggest that the magnitude of the relationship between the demand side bribe payments and tax evasion is twice as large as found in previous studies not differentiating between bribe behavior categories (Ufere et al., 2012; Gauthier and Goyette, 2014; Alm et al., 2016).⁷

In public procurement, our results suggest on the contrary that corruption tends to be mainly a supply-side phenomenon, with bribe transactions generally initiated by firms in order to secure public contracts. Firms supplying a bribe without previous request by officials (active bribery) is associated with a 17% increase in the bribe paid to secure a government contract, more than four times the effect observed on the demand side of bribery (passive bribery). The relationship between bribe levels and public contract is also twice as large as the one found by D'Souza and Kaufmann (2013) who did not differentiate between bribe-behavior types.

This paper contributes to the burgeoning literature on corruption at the firm-level by identifying empirically who initiates the act of corruption in different settings, the demand and the supply sides, using a large sample of firms in developing countries.⁸ Given the informal nature of corruption, it is very difficult to document and study the contracts between the initiator and the receiver of a corrupt deal. As suggested by Tanzi (1998), identifying whether an act of corruption is briber-initiated or bribee-initiated (i.e. active or passive) has important implications for anti-corruption policies. As far as we know, our paper is the first to examine empirically who initiates corruption in different contexts and across countries. Clarke and Xu (2004) discuss supply and demand of corruption by bribe takers and payers, using WBES data but do not separate the two sources of bribery. More recently, Freund et al. (2015), similarly make use of WBES data, examining how delays in services and time spent with officials relate to bribe solicitation, concentrating on bribe requests by public officials rather than the actual payment of bribes by firms and without differentiating between the demand and supply sides. We examine the extent to which both sides emerge distinctly and are present in certain types of transactions with public officials, particularly taxation and public procurement.

Our findings are qualitatively robust to various methodologies, specifications, and

⁷In Uganda, Gauthier and Goyette (2014) show that negotiation takes place over bribes and tax payments, where the amount of bribe offered is positively associated with a tax rebate. Using a sample of 32 mainly developed and transition economies, Alm et al. (2016) find that rent extraction by tax officials drives firms' tax evasion.

⁸The literature on graft activities at the micro-level mainly stems from studies conducted in the early 1990s using firm- and individual-level survey data. Using the World Bank's Regional Program on Enterprise Development (RPED) 1995 Cameroon survey, Gauthier and Gersovitz (1997) report that business owners are eager to discuss issues related to tax evasion, fiscal privileges, and bribes, with 58% of firms reporting bribe payments made to the tax administration. Using the 1998 Uganda survey, Svensson (2003) shows that a large majority of businesses are bribe payers, and that firms that interact more frequently with state officials are more likely to be requested to pay bribes, while those that are more profitable are extracted larger bribes.

robustness checks. We examine our main specification using ordinary least squares, two-, and three-stage least squares methods. We run a series of falsification tests and also assess the effect of outliers and verify that there is no selection bias.

We deal with various endogeneity issues that may arise from omitted variable bias, measurement error bias and reverse causality, using most approaches suggested in the literature. Despite multiple methodologies, we acknowledge that we cannot establish causation, and that endogeneity issues may not be entirely addressed due to the inherent complexity of corruption related behaviors. Still, the association between firm's bribe behavior categories vary systematically between types of firms' expected benefits. The association between the demand side of bribes and tax evasion is consistently positive and significant across specifications, while there is no association observed with the supply side of bribery. The results are consistent with a world where tax officials' bribe requests are the main driver of tax evasion and support the argument that to increase tax revenues one must ensure first an honest tax administration. Furthermore, the association between the supply and demand sides of bribery and government contracts is consistently positive and significant, but the magnitude of the association is at least three times greater on the supply side than on the demand side. The results are consistent with a world where business firms actively offering bribes to procurement officials in exchange of government contracts is the main driver of procurement corruption and support the development of measures to sanction offering, promising or giving a bribe.

The remainder of this paper is organized as follow. Section II introduces our analytical perspective, the data, and the setting. Section III presents the econometric methodology. Section IV discusses the findings. Section V assesses the robustness of the findings and Section VI offers concluding remarks.

II Perspective, data, and setting

The analytical perspective developed in this paper focuses on a two-way relationship between businesses and public officials of the demand and supply sides of corruption. We emphasize that illicit transactions can be initiated by either side and that there is a potential mutual benefit to such deals. While the quality of the institutional setting of a country, the nature of business, the characteristics and incentives of public officials, and resources all indubitably condition the prevalence of bribery, not every firm will participate in such illegal activities. Heterogeneity in the behavior of firms – with some paying bribes and others not – could be due to an environment of discretion of public officials, with bureaucrats selecting firms that will pay (Svensson, 2003). However, such heterogeneity might also be associated with specific behavior on the part of business owners and managers, with some firms pursuing bribe allocation as a profit maximizing strategy to survive, or to gain or preserve market shares (Delavallade, 2012; Ufere et al.,

2012). A firm could, for instance, purposively offer a bribe to public officials to obtain government contracts or licenses, to avoid costly regulations, or to reduce tax payments.

While demand-side bribery is viewed as taking place when government officials request bribes from business owners and managers, which may involve the tacit use of threats, delays, and intimidation (Bliss and Tella, 1997; Tanzi, 1998). Supply-side bribery is instead seen as a proactive choice initiated purposively by a business owner or manager to maximize profits. Here, firms supply bribes without coercion by a public official (Vogl, 1998; Powpaka, 2002; Ufere et al., 2012). Business owners and managers voluntarily pursue illegal payments as a tactic to secure public contracts, obtain regulatory actions and concessions, licenses and services, reduce customs and tariffs, hide tax evasion, or counterbalance a competitive disadvantage (Delavallade, 2012; Ufere et al., 2012; Dixit, 2016).

On the demand side of corruption, the endogenous harassment theory suggests that firms' profitability could be correlated with bribe payments (Kaufmann and Wei, 1999; Svensson, 2003). Under this hypothesis, public servants use observable information such as investments, size, or profitability to determine businesses' willingness to pay for services and identify endogenously demand incentive-compatible bribes that depend on these characteristics. Various features of the bribe-taker and payer environment will influence the capacity of public servants to demand bribes. In particular, weaker monitoring and accountability, greater discretion on the part of the officials, and lesser competition among public agencies will encourage a bribe culture, and consequently demand behavior (Rose-Ackerman, 2013).

On the supply side, firms' incentives to engage in bribery could be associated with the phenomenon of state capture (Stigler, 1971; Becker, 1983; Grossman and Helpman, 1994; Auriol, 2006). Capture generally refers to the "strategy enacted by individuals, firms, or interest groups to affect or shape institutions for private or collective benefits" (Hellman et al., 2003).⁹ Faccio (2006) finds that incentives for firms to engage in capture include gaining government contracts and accessing rationed government goods (e.g., permits, import/export licenses, reduced taxation, relaxed regulatory oversight). Auriol (2006) shows that a capture strategy yields greater returns (sales, market share, and profitability) to firms in the procurement sector.

Our focus in this paper is on the relationship between bribery and specific privileges, such as tax reductions or obtaining public contracts. We do not assess grand corruption, where the whole legislative process is captured by specific firms or industries. Our strategy allows to identify active (supply) and passive (demand) corruption in bribery transactions, as well as firms declining to participate in graft transactions. Supply side

⁹Hellman et al. (2003) observe that firm managers in transition economies of Eastern Europe invest effort and bribes to gain privileged access to key decision makers in government to derive the benefits of capture.

(active) bribers are firms that purposefully engage in such informal dealings as a way of reducing their regulatory burden, obtaining a public market or an exclusive license, or gaining an advantage over competitors. Demand side (passive) bribers are firms that accept to participate in the bribe transaction process with public officials, potentially due to threats or vulnerability that lead to being targeted by officials and that force the illicit payment. Some firms will not, however, abide by these informal rules and despite requests (or threats) by public officials, will not accept to pay bribes, potentially for ethical or moral reasons. We identify such firms as "incorruptible" and use the latter, in particular, for a falsification test.

Businesses might expect various advantages from these informal transactions. In this paper, we focus empirically on two types of benefits that could be associated with informal payments to officials: (i) reduced tax and customs obligations, and (ii) securing public contracts.

II.1 Data

The data used in this paper come from the WBES, a collection of a firm-level surveys of a representative sample of business environments mainly in developing and transition countries. Questionnaires cover a wide range of business environment topics such as infrastructure, competition, access to finance, as well as crime and corruption.¹⁰ We use the standardized questionnaires and dataset over the period 2002-2006 from which we exclude advanced economies.¹¹

The survey data contain rich details on bribes and benefits expected for firms and allow controlling for a large set of observable determinants of corruption. To construct our four categories of firms' bribe behavior, we make use of two questions relating to bribe transactions. First, we determine if a request for a bribe was made by public officials. To measure the incidence of a bribe request from an official, we rely on a set of questions in the survey asking firms whether a gift or informal payment was expected/requested in inspections and mandatory meetings with public officials from the following agencies: tax inspectorate, labor and social security, fire and building safety, sanitation/epidemiology, municipal police and environmental.¹² We aggregate these self-reported answers by firms

¹⁰The surveys are conducted using common guidelines in design and implementation, and a standardized module with identical questions allows for cross-country comparisons. Sample data are stratified using random sampling with replacement along strata for firm size, business sector, and geographic region within a country.

¹¹While a more recent standardized dataset is available for the period 2007-2016, these surveys do not provide information on interactions with public officials from different agencies, which are essential for our identification of graft demand and supply. Furthermore, they do not include information on the proportion of sales reported for tax purposes, which we use to measure tax evasion.

¹²The question is as follows: "Was a gift or informal payment ever expected/requested in inspections and mandatory meetings with officials of each of the following agencies in the context of regulation of your business?: (i) tax inspectorate, (ii) labor and social security, (iii) fire and building safety, (iv) sanitation/epidemiology, (v) municipal police, and (vi) environmental."

into a dummy of bribe request. Second, we assess if a bribe has likely been paid by the firm. We measure the likelihood for a firm of paying a bribe using as a proxy the perception of a respondent about the percentage of annual sales other firms in the same line of business pay in bribes to "get things done".¹³

To the extent that this self-reported estimate is a good proxy for firm's likelihood to pay bribes and correlates with actual bribe payments, it allows accounting for incidence of bribe payment.¹⁴ Within our sample, 33% of the firms declare having been expected/requested by government officials to make an informal payment in at least one of their dealings with public officials and 41% of the firms report positive informal payments to public officials to "get things done".

Using these two dichotomic variables – bribe request and bribe payment– we divide firms' bribe payment behavior into four categories, as presented in Table 1. Bribe-paying firms are separated into those reporting providing bribes in presence of a request by public officials, labeled as "demand side" bribe payers. Firms that report bribe payments without having received a request labeled as "supply side" bribe payers. We similarly divide the non-paying firms into two categories, those that received a bribe solicitation and did not acquiesce, labeled as "incorruptible," and those that report neither receiving nor paying bribes, labeled as "non-bribe payers."

Table 1: Firms' bribe payment behavior

		Bribe paid	
		Yes	No
Bribe requested	Yes	Demand side	Incorruptible
	No	Supply side	Non bribe payers

More formally, the demand side of corruption is captured by a dummy variable, *Demand*, which takes the value of 1 if a firm reports spending a positive share of its annual sales to

¹³The question is as follows: "We've heard that establishments are sometimes required to make gifts or informal payments to public officials to get things done with regard to customs, taxes, licenses, regulations, services, etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?"

¹⁴Despite that the question is asked indirectly, like most research on bribery, we interpret the answer as if they reflected respondents' own experience of corruption instead of the average experience of firms in their sector, as the question reads. Asking sensitive questions indirectly is often thought to help decrease under-reporting by allowing managers to admit to paying bribes without incriminating themselves. Using indirect wording in questions about bribery is now standard practice in firm-level surveys. Despite the literal wording of the question which refers to firms like in theirs in their sector, indirect questions about corruption have been interpreted as reflecting respondent's own experience of corruption. [Svensson \(2003\)](#) for instance looked for correlates between the probability of firms reporting a positive amount of bribes and firm's own characteristics using an indirect question asking Ugandan firms to estimate how much bribes firms similar to theirs "typically pay each year". Similarly, [Alm et al. \(2016\)](#) and [Freund et al. \(2015\)](#) makes use of these questions.

make gifts or informal payments to public officials to "get things done" and reports that gifts or informal payments were expected/requested in interactions with public officials. The dummy variable takes the value of 0 under two circumstances: (i) if the firm does not pay a bribe, or ii) if a firm pays a positive amount in bribes but reports that bribes were not expected/requested in its interactions with public officials.

The supply side of corruption is captured by a dummy variable, *Supply*, which takes the value of 1 if a firm reports spending a positive share of its annual sales to make gifts or informal payments to public officials to "get things done" and reports that gifts or informal payments were not expected/requested in interactions with public officials. The dummy variable takes the value of 0 under the following circumstances: (i) the firm does not pay a bribe to public officials, or ii) a firm paid a positive amount of bribes and reports it was requested to do so.

Non-bribe paying firms are also divided into two categories based on the presence or absence of bribe requests from public officials. The dummy variable for "Incorruptible" firms takes the value of 1 if the firm reports not paying bribes when a bribe was expected/requested in at least one of the interactions with public officials. The dummy takes the value 0 when (i) the firm pays a bribe, or ii) a firm does not pay a bribe and reports that no bribes were requested in interactions with public officials. Finally, the dummy for "Non-bribe payers" takes the value of 1 if the firm reports not paying bribes when no bribes were requested during interactions with public officials and 0 otherwise. These categories of bribe paying behavior will be our key explanatory variables.

We examine two types of transactions where firms might benefit from complying with a bribe request or from offering a bribe to public officials: tax evasion and obtaining government contracts. With regard to tax evasion, the WBES asked firms to report the percentage of the total sales reported for tax purposes.¹⁵ The proxy for tax evasion, or the proportion of sales not reported for tax purposes, is obtained by subtracting sales reported for tax purposes from 100%. Regarding corruption in procurement, in the WBES, firms were asked to report the share of the contract value paid informally to secure government contracts.¹⁶ These two types of benefits from graft activities will be our key dependent variables.

Table 2 presents information on firms' bribe behavior types and potential benefits associated with graft activities observed in our sample using the mean of each variable. Demand side bribe payers - i.e. firms paying a bribe in the context of a request by government officials - represent 24% of the sample. Another 17% of firms are supply

¹⁵The question is as follows: "Recognizing the difficulties many business establishments face in fully complying with taxes and regulations, what percent of total annual sales would you estimate the typical firm in this establishment's line of business declares for tax purposes?" While this question and other sensitive questions on corruption are phrased indirectly, answers are usually interpreted as an admission of the behavior by the firm itself, as we do here (Hellman et al., 2003; Fisman and Svensson, 2007).

¹⁶The question is as follows: "When establishments in your industry do business with the government, how much of the contract value is typically expected in gifts or informal payments to secure the contract?"

side bribe payers – bribing public officials without being requested to do so. Finally, incorruptible firms account for 9% of the sample and non-bribe payers for 50%.

With regard to the benefits associated with graft activities, we observe that bribe paying firms, either demand side or supply side bribers, are more likely to evade taxes, and pay a bribe to secure government contracts. On average, among the group of demand side bribe-paying firms 24.2% of sales are not reported for tax purposes and 5.1% of contract values are paid in bribes to secure government contracts. Among supply-side bribe paying firms, 28.7% of sales are not reported for tax purposes, while they pay 5.2% of contract values in bribes. In contrast, on average, only 13.8% of sales are not reported for tax purposes among incorruptible firms and only 1.3% of contract values are reported as bribes to secure government contracts. Among non-bribe payers, tax evasion represents on average 18.1% of sales, and only 0.6% of contract values are reported as bribes to secure government contracts.

Table 2: Bribe-paying firm categories and benefits (tax evasion and government contracts)

		Bribe paid	Bribe payment behavior	Percentage of firms	Tax evasion (% of sales)	Bribing for contracts (% of contract value)	
		Prop (%)					
Bribe requested	Yes	[33.31]	Yes	Demand side	24	24.17	5.14
			No	Incorruptibles	9	13.82	1.27
	No	[66.69]	Yes	Supply side	17	28.67	5.15
			No	Non bribe payers	50	18.12	0.62

Table 3 presents summary statistics on key variables. On average, 20.9% of establishments’ annual sales in the sample are not reported for tax purposes 4.3% of contract value are spent as grafts to secure government contracts, while graft value represent on average 4.5% of annual sales. The average firm size is 145 employees with average sales equal to 130,180 US dollars. About 15% of firms’ sales are exported and foreign and government shares represent 10.8 and 3.7% respectively. The use of modern technology in business is captured by a dummy variable, which takes the value of 1 if a firm uses e-mails and a website to interact with clients and suppliers. In the sample, about 44% of firms use such technologies. Finally, anti-competitive or informal practices is captured by a five-point scale where 4 indicates that the informal sector and related practices represent a very severe obstacle to operations and growth, while 0 indicates the absence of any such obstacles. An average value of 1.03 in our sample indicates that informal competition is a relatively minor obstacle to firms’ operations and growth overall.

Table 3: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	Obs
Tax evasion (% of sales not reported for tax purposes)	20.92	30.94	0	100	16726
Bribing for government contracts (% of contract value)	4.34	6.30	0	100	15549
Firms paying a bribe to public officials (%)	41	0.49	0	1	18005
Firms facing a request for a bribe (%)	33	0.47	0	1	18005
Average bribe paid(% of sales)	4.54	5.47	0	100	18005
Exports (% of sales value)	15.01	30.60	0	100	18005
Foreign share (% of the firm)	10.75	29.03	0	100	18005
Government/State share (% of the firm)	3.67	17.73	0	100	18005
Number of employees	145	524	1	19047	18005
Sales (in USD)	130180	4738728	0	5.67E+08	18005
Use of e-mails and website (%)	44	49	0	100	18005
Degree of anti-competitive or informal practice	1.03	1.28	0	4	18005
Percentage of working capital financed by banks	61.57	38.77	0	100	18005

III Empirical strategy

III.1 Baseline regressions

The hypothesis we aim to test is whether firms' bribe-paying behaviors, in particular the demand and supply sides of corruption, affect firms' potential benefits derived from graft activities, particularly tax evasion and securing government contracts. Our baseline econometric specification is as follows:

$$Benefits_{ict} = \alpha_0 + \alpha_1 Demand_{ict} + \alpha_2 Supply_{ict} + X_{ict} + \delta_c + \mu_s + \eta_t + \epsilon_{ict} \quad (1)$$

where the dependent variables, $Benefits_{ict}$, refer to gains associated with informal payments to officials for firm i in country c at the period t . As described above, we focus on two types of benefits from corruption activities: tax evasion, and securing government contracts. Our main independent variables include, Demand and Supply, which are dummy variables of the demand-side and supply-side of bribery, as defined above.

The analysis includes a set of firm individual characteristics X_{ict} . These include the percentage of firms owned by foreign or governmental interests, and the percentage of the establishment's sales exported directly or indirectly. We account for firm size by including four dummy variables that capture their size distribution.¹⁷ Microenterprises are identified as firms having between 1 and 10 permanent employees, small firms between 11-50, medium firms between 51- 200 employees, and large firms with more than 200. We control for firms' performance by including the natural logarithm of the total sales

¹⁷All findings remain the same when using continuous variables for firm size (total number of permanent employees).

in US dollars. The impact of the informal sector is captured by a variable measuring the degree to which anti-competitive or informal practices are an obstacle to the operation and growth of business. Firms access to finance is captured by the share of working capital financed by commercial banks. There is a general consensus in the literature that the likelihood of firms being involved in illegal activities depends on the quality of institutions.¹⁸ We account for deterrence factors by including the number of days spent in inspections with the tax inspectorate. Moreover, we include country fixed effects, which account for the quality of institutions and help to minimize potential omitted variable bias at the macroeconomic level. Finally, the empirical analysis includes a set of sector and year fixed effects accounting for specific sector and year characteristics that might affect corruption behaviors and potential gains from such activities.

III.2 Accounting for endogeneity issues

The baseline estimations on the impacts of the demand and the supply sides of corruption on firms' behaviors might be biased due to potential endogeneity issues that may arise from measurement error, omitted variable and reverse causality. We address some of these concerns by employing an instrumental variable method (2SLS) and a structural equation model estimated using a three-stage least-squares (3SLS) estimator. Both approaches are described below.

Instrumental variables method

We employ two instruments: (i) the proportion of firms by country-location-sector-size cluster facing a demand for a bribe, and (ii) the proportion of firms by country-location-sector-size cluster offering a bribe to public officials. The instrumental variable method relies on the approach developed by [Aterido et al. \(2011\)](#), based on both the stylized fact that the constraints firms face in the business environment depend on their size, and the literature on social conformity effects. The underlying intuition of the literature on social conformity is that members of a given group behave alike because they have similar unobservable characteristics or face comparable institutional environments.¹⁹ In this line, we argue that if the demand for a bribe (offering a bribe) is the social norm among a specific group of firms, an establishment belonging to this group will be more likely to face a demand for a bribe from public officials and might continue this norm when moving to another cluster (offer a bribe to public officials).

The way the proportions are calculated and matched to firms is of particular importance to adequately address the endogeneity problem. More specifically, it is necessary to take into account the fact that firms may change size over the period. To this end

¹⁸See [Mauro \(1995\)](#), [Allingham and Sandmo \(1972\)](#) for extensive discussion.

¹⁹See [Fortin et al. \(2007\)](#), [Myles and Naylor \(1996\)](#), [Gordon \(1989\)](#) for more extensive discussion on social conformity effects.

we use the oldest and most recent information on the number of employees in the data to capture change in size over time, i.e., at $t - 3$ and t . We follow a two-step approach similar to that of [Aterido et al. \(2011\)](#). First, we compute the average size of each firm. Based on average size, we calculate for each country-location-sector-size cluster two proportions: (i) the share of firms facing a bribe demand, and (ii) the share of firms offering a bribe. Next, because the bribery environment may differ for firms that changed size over time, we match the proportions based on initial size. A matching based on current size may leave endogeneity unaddressed, as other characteristics of the current cluster could affect a specific firm's tax evasion decision through channels other than its own decision to pay a bribe. We consequently match proportions based on initial size, arguing that the owner/manager of a firm continues to practice, in her current situation, the social norms relative to bribery activities that characterized her earlier situation. We thus assume that such norms remain constant over time in a country-location-sector-size cluster, which allows us to use the information on conditions faced, for instance, by microenterprises at t to measure conditions faced by microenterprises at $t - 3$.

All the estimates include country, sector, and year fixed effects to control for omitted variables bias, namely the norm and culture of corruption, and the quality of institutions at the country, location, and sector level. Moreover, long-term relationships between firms and public officials may generate a serial correlation over time through repeated interactions, which are in part captured by year fixed effects.²⁰

Three-stage least squares method

As an alternative identification strategy, we employ a simultaneous equation model using the three-stage least squares method (3SLS). This approach has the advantage of employing a structural model in which an equation is specified for each endogenous variable, which allows to exploit the cross-equation correlation of errors. The structural model is specified as follows:

$$Benefits_{ict} = \alpha_0 + \alpha_1 Demand_{ict} + \alpha_2 Supply_{ict} + \alpha_3 X_{ict} + \epsilon_{ict}, \quad (2)$$

$$Demand_{ict} = \beta_0 + \beta_1 Benefits_{ict} + \beta_2 Z_{ict} + \beta_3 X_{ict} + v_{ict}, \quad (3)$$

$$Supply_{ict} = \gamma_0 + \gamma_1 Benefits_{ict} + \gamma_2 W_{ict} + \gamma_3 X_{ict} + \vartheta_{ict} \quad (4)$$

where X_{ict} is the set of firm individual characteristics described previously. Z_{ict} and W_{ict} refer to the instrumental variables employed in the previous section, i.e., the proportion of firms facing a demand for a bribe and offering a bribe to public officials in each country-location-sector-size cluster respectively.

²⁰Given that we have two instruments for two endogenous variables, we are not able to test for over-identifying restrictions (Sargan-Hansen test) in our initial estimations. However, in the analysis below, we check the robustness of the findings using an additional instrumental variable.

IV Results

IV.1 The determinants of bribery behaviors

Before examining the role of the demand and supply sides of corruption on firms' tax benefits and public contracts, we first assess the determinants of firms' bribe payment behaviors. We run four simple probit models of the bribe payment behaviors described in Table 1 in order to identify which firms are most likely to be demand-side bribe payers, supply-side bribe payers, incorruptible, or non-payers. For each bribe behavior category, we run 2 specifications. In the second specification, we add controls for capital investment, profits, and capital stocks, which are not available for all firms, thus significantly reducing the sample size. These models explain a non-negligible share of the variable, with pseudo R^2 ranging from 0.12 to 0.36.

The results presented in Table 1 highlight a number of interesting correlations relative to the determinants of bribery behaviors. In particular, bribe payers, either on the demand or supply sides, tend to face significantly greater informal obstacles to growth from informal competition, have larger capital investments and to be more frequently using modern technologies such as emails and web sites. Demand-side bribe payers in particular are significantly more likely to be small or medium size firms, that have faced more days of inspections by tax inspectors, while being less likely to have government ownership. With regard to firms' indicator of wealth, there is evidence that firms functioning with their own working capital, with higher profits and investments are easier targets for bribe requests on the part of public officials, as these variables are positively associated with the likelihood to have been asked and having paid a bribe. These later results corroborate earlier findings in the literature (Svensson, 2003; Clarke and Xu, 2004). Supply-side bribe payers are more likely to be larger exporting firms with a greater share of foreign ownership and larger capital stock value. They also tend to have spent less days of inspections with tax administration.

With regard to incorruptible firms, the likelihood of a firm facing a bribe request and not paying a bribe is negatively correlated with its size, larger firms being less likely to be incorruptible. The likelihood of being an incorruptible firm also decreases with government ownership. Concerning firms' indicator of wealth, there is evidence that these firms function more with bank financed working capital.

Finally, as for non-bribe payers, firms reporting not having received a bribe request and not having paid bribes are significantly more likely to have a larger share of government ownership and less likely to have a foreign share of ownership. Non-payers are also less likely to face informal competition and are furthermore face significantly less days of inspections by tax inspectors. These non-bribe payers are also more likely to have lower investments, lower profits, and capital value.

Table 4: Likelihood to be a demand-side bribe payer, supply-side bribe payer, incorruptible and non bribe payer. Probit model marginal effects

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bribe demand		Bribe supply		Incorruptibles		Non bribe payer	
Informal Competition	0.119*** (0.0180)	0.163*** (0.0404)	0.0145 (0.0155)	0.102*** (0.0189)	-0.0137 (0.0144)	-0.0432 (0.0418)	-0.0868*** (0.0161)	-0.132*** (0.0227)
Working capital financed by banks	-0.00149*** (0.000517)	-0.00129 (0.00175)	-0.000700 (0.000537)	-0.00146 (0.00128)	0.000929* (0.000537)	0.00226 (0.00224)	0.000754* (0.000422)	0.000858 (0.00126)
Exporter	0.000712* (0.000402)	0.000261 (0.00180)	0.00104** (0.000531)	0.000255 (0.000742)	-0.000687 (0.000716)	-0.000927 (0.000913)	-0.00115** (0.000541)	-0.000282 (0.000770)
Foreign share	-0.000132 (0.000477)	0.00179 (0.00129)	-6.52e-05 (0.000539)	0.00179*** (0.000601)	-0.000396 (0.000763)	-0.00126 (0.00213)	0.000311 (0.000482)	-0.00199** (0.000845)
Government share	-0.00348*** (0.00126)	-0.00324** (0.00149)	-0.000558 (0.000862)	-0.00270 (0.00258)	-0.00150* (0.000774)	-0.00403*** (0.00129)	0.00427*** (0.000919)	0.00527** (0.00225)
Ln. Sales	-0.00540 (0.0168)	-0.267*** (0.0942)	0.00236 (0.0135)	-0.130* (0.0705)	-0.00221 (0.0164)	-0.221*** (0.0844)	0.00334 (0.0198)	0.254*** (0.0759)
Use of e-mails and website	0.0864*** (0.0306)	-0.0909 (0.109)	0.0670* (0.0375)	0.139 (0.131)	-0.0488 (0.0331)	0.121 (0.114)	-0.0384 (0.0294)	-0.101 (0.112)
Days spent in inspections	0.00594*** (0.00184)	0.00689 (0.00544)	-0.00371** (0.00168)	-0.000785 (0.00116)	0.00184 (0.00160)	0.00237 (0.00157)	-0.00344* (0.00189)	-0.00430 (0.00394)
Microenterprise	0.106 (0.0902)	-0.746*** (0.262)	0.0259 (0.132)	-0.253* (0.140)	0.0160 (0.0866)	-0.536 (0.347)	-0.0973 (0.139)	0.573*** (0.203)
Small	0.147** (0.0729)	-0.336* (0.186)	-0.00874 (0.104)	-0.0921* (0.0546)	-0.0665 (0.0681)	-0.339* (0.198)	-0.0447 (0.114)	0.302** (0.142)
Medium	0.105** (0.0531)	-0.144 (0.124)	-0.0459 (0.0752)	-0.0793 (0.0657)	-0.0448 (0.0626)	-0.396*** (0.0938)	-0.0363 (0.0782)	0.224*** (0.0607)
Ln. Investment in capital		0.0447* (0.0229)		0.0489*** (0.0178)		0.0407 (0.0332)		-0.0674*** (0.0211)
Ln. Profits		0.155* (0.0874)		0.0611 (0.0471)		0.156 (0.0985)		-0.137** (0.0655)
Ln. Stock of capital		-1.33e-07 (6.16e-07)		4.08e-07*** (6.02e-08)		-4.53e-06 (4.71e-06)		-4.31e-07*** (8.43e-08)
Observations	17,456	1,769	15,279	2,282	17,116	1,939	15,550	2,251
Pseudo R^2	0.277	0.282	0.171	0.157	0.183	0.123	0.362	0.219

Notes. All regressions include country, sector, and year fixed effects. Robust standard errors clustered at the country level in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

IV.2 Baseline results

Having examined the characteristics of firms belonging to the various types of bribe payment behavior, we now turn to our main question of examining how these bribe behaviors affect firms' benefits in two main sectors where corruption is observed, taxation and government contracts. Our baseline specification of the relationship between firms' benefits and the demand and the supply sides of corruption is first estimated using the Ordinary Least Squares (OLS). Results are presented in Table 5, columns (1) and (4). We observe that both the demand and supply sides of corruption are positively correlated with firms' tax evasion and for bribing to secure government contracts. However, in both cases, the magnitude of the correlation is higher for the demand side of corruption compared to the supply side. The coefficients are statistically significant at the 1% and 5% levels. These results should, however, be interpreted with caution as they are purely correlation and do not attempt to address various potential endogeneity issues that will be discussed in the next section.

With regard to the control variables, access to bank financing is negatively correlated with both tax evasion and bribing for government contracts. Both foreign and government shares are negatively correlated with sales not reported for tax purposes. On firms' performance and size effects, sales are negatively associated with sales not reported for tax purposes, while the latter is significantly higher for microenterprises relative to large

ones. Similarly, bribing to secure government contracts is significantly higher for microenterprises and small firms and firms facing greater informal competition. Finally, the number of days spent in inspections with the tax inspectorate is not associated with tax evasion and bribing for contracts.

IV.3 Main results

We now turn to our main using the instrumental variable method and the structural model. Examining the relationship between tax evasion and firms' bribe behavior using the IV model (Table 5, column 2), we observe that the demand side of corruption increases the share of sales not reported for tax purposes by 16.4%. The coefficient is economically and statistically significant at the 5% level. However, there is no evidence that offering a bribe affects firms' tax evasion. The coefficient is positive but not statistically significant. The weak identification test reported in the same column confirms that the instruments are relevant as the null hypothesis of weak identification is rejected given the F-statistic of 15.06, which is above the usual thresholds. Hence, tax evasion appears to be a demand-side phenomenon of bribery. This result could be interpreted, for instance, as a situation where custom and tax inspectors, identifying undeclared taxes, make bribe requests, or alternatively request a bribe and allow some tax evasion. No evidence is found however of an incentive for firms to initiate a bribe transaction in the context of tax evasion, which would likely signal to the authorities undeclared income.

With regard to bribing for government contracts, we find that both the demand and supply sides of corruption increase the size of the bribe to secure a government contract (Table 5, column 5). However, the magnitude of the effects is at least three times higher for the supply side of corruption compared to the demand side. Offering a bribe to public officials increases the share of contract value paid in bribes to secure government contracts by 15.7 %, compared to just 4.3% for the demand side of corruption. As before, the null hypothesis of weak identification is rejected with an F-statistic at 8.33 above the corresponding thresholds. Due to data availability limitations, we cannot test the effect of demand or supply on the size of a governmental contract nor on the probability of obtaining such contract. There are at least three potential non-exclusive explanations for the relative impact of supply and demand on the size of the bribe paid to secure a government contract. First, firms offering a bribe actively seek to gain a competitive advantage over other firms and may be willing to pay more. Second, firms offering a larger bribe may secure larger contracts. Third, when firms act as first-movers and initiate the act of corruption in the context of government procurement, public officials may find themselves in an advantageous position and bargain a larger bribe.²¹ Unfortunately, the

²¹A public official could, for instance, threaten to report the firm, which could mean a large fine and no contract if the firm refuses to pay a large bribe. In a case where a public official initiates the illicit transaction, the firm could also threaten to report the official, but this would limit the firm's success in

data do not allow to test these various hypotheses.

The findings from the structural model reported in Table 5, columns (3) and (6) validate those from the IV model, both quantitatively and qualitatively. Facing a demand for a bribe increases sales not reported for tax purposes, while there is no evidence that the supply side of corruption affects tax evasion. Bribing for contracts is affected by the demand and supply sides of corruption. However, as observed previously, the magnitude of the effects is at least three times higher for the supply side of corruption compared to the demand side.

Table 5: Impacts of the demand and the supply side of corruption

Dependent variables:	Tax Evasion			Bribing for government contracts		
	(1) (OLS)	(2) (2SLS)	(3) (3SLS)	(4) (OLS)	(5) (2SLS)	(6) (3SLS)
Demand side of corruption	7.494*** (1.231)	15.93** (7.489)	15.93** (7.254)	3.964*** (0.452)	4.038* (2.146)	4.038* (2.121)
Supply side of corruption	2.963** (1.313)	10.72 (21.60)	10.72 (14.23)	3.418*** (0.540)	17.03** (7.058)	17.03*** (5.380)
Informal Competition	0.513 (0.333)	0.169 (0.507)	0.169 (0.343)	0.114** (0.0515)	-0.0211 (0.142)	-0.0211 (0.114)
Working capital financed by banks	-0.0226** (0.01000)	-0.0186 (0.0121)	-0.0186** (0.00729)	-0.00458** (0.00215)	-0.00106 (0.00336)	-0.00106 (0.00224)
Exportation	0.0167 (0.0126)	0.0147 (0.0128)	0.0147* (0.00864)	-0.00409* (0.00240)	-0.00704** (0.00341)	-0.00704*** (0.00253)
Foreign share	-0.0297*** (0.0105)	-0.0321*** (0.00875)	-0.0321*** (0.00835)	-0.000212 (0.00183)	0.00161 (0.00275)	0.00161 (0.00245)
Government share	-0.0244** (0.0102)	-0.0148 (0.0140)	-0.0148 (0.0150)	0.00230 (0.00233)	0.00408 (0.00421)	0.00408 (0.00424)
Ln. Sales	-1.061*** (0.231)	-0.928*** (0.201)	-0.928** (0.166)	-0.0100 (0.0558)	-0.0392 (0.0802)	-0.0392 (0.0468)
Microenterprise	2.753** (1.224)	2.512** (1.072)	2.512** (1.136)	0.604** (0.264)	0.558 (0.415)	0.558* (0.315)
Small	0.511 (0.912)	0.858 (0.897)	0.858 (0.974)	0.667*** (0.224)	0.503 (0.336)	0.503* (0.266)
Medium	0.474 (1.005)	0.743 (0.964)	0.743 (0.839)	0.0867 (0.163)	0.119 (0.271)	0.119 (0.229)
Use of e-mails and website	-0.753 (0.610)	-1.193* (0.680)	-1.193** (0.596)	0.147 (0.149)	-0.00509 (0.214)	-0.00509 (0.181)
Days spent in inspections	-0.0247 (0.0245)	-0.0380 (0.0325)	-0.0380 (0.0274)	-0.00398 (0.00619)	0.00252 (0.00796)	0.00252 (0.00780)
Weak identification test (F statistics)						
Observations	16,726	14,804	14,804	15,551	13,757	13,757

Notes. All regressions include firms' individual characteristics described above, country, sector, and year fixed effects. Robust standard errors clustered at the country level in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

securing the contract.

V Robustness checks

Thus far, both the instrumental variable method and the structural model have shown that the demand side of corruption appears to be the driver of firms' tax evasion, while the bribe supply strategy seems to be geared toward securing government contracts. In what follows, we perform a variety of sensitivity analyses to check the robustness of the findings, examining potential selection bias issues, conducting falsification tests, identifying potential outliers, and cluster fixed effects, and alternative methodology using a propensity score matching method.

V.1 Potential selection bias issues

Assessing illegal activities such as bribery is challenging as the survey responses may suffer from desirability bias. Some firms might decide to reveal their tax evasion and bribery behaviors while others may intentionally decide not to respond to such sensitive questions. The missing bribery and tax evasion data raise questions about potential selection bias issues, particularly if the group of responders and non-responders are statistically different in their observable characteristics. Although we do not have information on why some firms did not respond to corruption and tax evasion questions, we can check whether the groups of responders and non-responders differ in terms of their observable characteristics. Table .8 in appendix reports a set of regressions using individual characteristics of firms as dependent variables. The approach follows [Svensson \(2003\)](#), where the regressor is a dummy variable taking the value of 1 if a firm has missing data on corruption. We extend the analysis by using a dummy variable taking the value of 1 if a firm has missing information on tax evasion and bribing for contracts. Moreover, we consider two additional dummy variables that account for the combination of missing data on (i) corruption and tax evasion, and (ii) corruption and bribing for government contracts. All regressions include country, sector, and year fixed effects given that some missing data on corruption and tax evasion seems to be specific to the country, the sector, and the year of the survey. As seen in panel A, there is no strong evidence that responders and non-responders are statistically different in their observable characteristics. A limited number of variables are barely significant at the 10% level and not robust across specifications. Panel B of Table .8 considers three additional key characteristics of firms: capital stock, investments, and profits.²² The findings show that responders and non-responders do not differ significantly relative to any of these aspects. Thus, there is no observable evidence that potential selection bias drives our results.

²²We did not employ these variables in our main analysis because of missing data.

V.2 Incorruptible firms

We now conduct a falsification test to assess the validity of the identification of the demand and supply sides of corruption. We identified four types of bribe payment behavior in firms' interactions with public officials, including incorruptible and non-paying firms. As mentioned earlier, incorruptible firms are those that report not paying a positive bribe when faced with such a request from public officials, while non-payers are firms that neither paid a positive bribe nor were requested to do so. If the demand and supply sides of corruption are correctly identified, we should expect that being an incorruptible or a non-paying firm should not have an effect on sales not reported for tax purposes and bribing for government contracts.

We then include incorruptible firms in the estimations of firms' benefits. As being incorruptible is considered here as an additional endogenous dummy variable, we employ the same identification strategy as above. Recall that the instruments are built as the proportion of firms facing a demand for a bribe, those offering a bribe, and incorruptible firms in the same country-location-sector-size cluster. In the second step, these proportions are matched using the initial size of the firms.

Results from the IV model and the structural model are presented in table 6, columns (1) and (2). As expected, we find no evidence that being an incorruptible firm affects sales not reported for tax purposes and bribing for government contracts. As for the demand and supply sides of corruption, the results are qualitatively similar to those obtained previously.

V.3 Falsification tests

We run another series of tests to check whether being an incorruptible or a non-bribe paying firm is in any way related to at least one of the two transactions under study. The specification is similar to the one described above. In particular, we run two separate regressions using the demand and supply side of corruption as explanatory variables and two dummy variables for incorruptible and non-paying firms. As previously, we use the lagged incorruptible and non-bribe paying firms within country-location-sector-size cluster, as instruments in the identification strategy. Results, in Table 6, columns (3) to (5) clearly show that neither type of firm (incorruptible and non-bribe payer) is positively correlated to tax evasion and the size of the bribe to secure government contracts. This result is reassuring for at least two reasons. First, one concern relative to incorruptible and non-paying firms is whether they reveal their true type or conceal bribe payments. It is unlikely, however, that a manager or a firm owner would admit to being fraudulent in one dimension, say tax evasion, but not admit to being fraudulent in another, say bribe payment. We can thus interpret these results as a cross-verification test. The non-significance of the coefficients of interest for incorruptible and non-paying

firms in most columns of panel A and B implies there is no systematic correlation between potentially concealed tax evasion and procurement corruption for these firms. Based on the assumption that coherent individuals should either hide or expose all their fraudulent behaviors at once, we argue that this lends much credibility to the incorruptible firms variable. Moreover, given this reassurance, this test shows that the demand and supply side variables are indeed capturing relevant information about the effect of the origin of grafts on transactions with public officials.

V.4 Cluster fixed effects

We might be concerned that determinants of demand-side and supply-side of corruption vary at the cluster level. In that case, our instruments might not satisfy the exclusion restriction. Given that our instruments are clustered at the country-location-sector-size level, it is impossible to include fixed effects accounting for specific characteristics at the cluster level due to multicollinearity issues.

To minimize potential bias arising from specific characteristics at the group level which might affect simultaneously bribery activities and the three types of benefits associated with informal payments, we run additional robustness checks considering alternatives set of cluster fixed effects at the (i) sector-size (ii) sector-country, and (iii) country-size levels. Two main reasons motivate the choice of the clusters. First, due to the aforementioned reason we need to control for cluster fixed effects close to the one considered in the identification strategy. Second, we rely on the literature on constraints facing firms of different size, especially [Aterido et al. \(2011\)](#), showing that bribery activities vary across firm size groups. Table 6, columns (6) and (7) reports estimates 2SLS and 3SLS controlling for sector-size cluster fixed effects in addition to country and year fixed effects. Columns (8) and (11) present regression findings including respectively sector-country and country-size cluster fixed effects. In addition to cluster fixed effects, Panel B also includes year fixed effects, while Panel C considers year and sector fixed effects. All regressions include firms' individual characteristics described above. As can be seen, results are qualitatively consistent with the main findings both in terms of magnitude of the effects and statistical significance levels.²³ The F-statistics of the weak identification tests allow rejecting the null assumption of weak identification.

V.5 Potential outliers

Although we employed different identification strategies to minimize potential error measurement bias, we cannot exclude bias arising from conceivable outliers. In particular, the findings might be driven by outliers from bribery and tax evasion activities. This section

²³First stage coefficients are not reported but in line with the previous findings. The table is available upon request.

aims to assess whether the findings are sensitive to such outliers using the methodology developed by [Weber \(2010\)](#). This approach, an improved version of that proposed by [Hadi \(1992\)](#), allows to identify outliers in the multivariate data. We first explore outliers relative to tax evasion and bribing behavior, and then re-estimate the relationship between the demand and supply sides of corruption and potential gains, measured by tax evasion and bribing for contracts. Columns (12) to (13) of [Table 6](#) suggest that our findings are robust to potential outliers. The demand side of corruption remains the determinant of firms' tax evasion, while offering a bribe to public officials continues to be the main channel through which firms' secure government contracts. The weak identification tests allow to reject the null hypothesis of weak identification. The associated F-statistics are all above the usual thresholds. First and three stage least squares estimates for the demand and the supply sides of corruption also corroborate the main findings. The instruments are strongly correlated with the endogenous variables. Furthermore, there is no evidence that the benefits considered in this paper affect the demand or the supply side of corruption.

Table 6: Robustness check - Tax evasion and bribing for government contract

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel A: Tax evasion													
Demand side of corruption	16.29** (7.406)	16.00** (7.151)				16.91** (7.809)	16.91** (7.474)	20.97** (9.847)	20.97** (9.406)	15.20*** (5.814)	15.20*** (4.963)	16.40** (7.077)	16.40** (6.992)
Supply side of corruption	9.941 (21.29)	-1.214 (9.984)				11.02 (22.71)	11.02 (15.08)	16.72 (29.40)	16.72 (20.89)	25.20 (22.29)	25.20 (15.46)	19.73 (22.64)	19.73 (15.57)
Incorruptibles	4.442 (20.53)	14.92 (15.52)	4.186 (19.87)		16.92 (20.96)								
Non bribe payer				10.67 (10.85)	12.74 (11.95)								
Weak identification test (F statistics)	8.841	14.730	31.640	66.170	14.017	13.095	14.805	6.943	14.805	12.851	14.805	15.009	13.736
Observations	14,730	14,730	14,795	14,768	14,736	14,805	14,805	14,805	14,805	14,805	14,805	14,805	14,805
Panel B: Bribing for government contracts													
Demand side of corruption	3.531* (2.049)	3.448* (2.000)				3.815* (2.267)	3.815* (2.176)	4.895 (4.483)	4.784 (4.181)	5.391*** (1.527)	5.391*** (1.412)	5.041** (2.270)	5.041** (2.060)
Supply side of corruption	15.70** (6.523)	15.57*** (5.046)				16.87** (7.477)	16.87*** (5.740)	26.10 (19.44)	27.96* (14.58)	17.43*** (7.606)	17.43*** (4.989)	18.23*** (8.421)	18.23*** (5.794)
Incorruptibles	-2.992 (4.965)	-4.071 (4.651)	-1.944 (3.039)		-4.867 (3.839)								
Non bribe payer				-2.750* (1.559)	-3.123* (1.703)								
Weak identification test (F statistics)	5.190	13.693	30.679	60.736	14.220	6.796	13.757	2.390	13.757	8.838	13,757	7.307	12,820
Observations	13,693	13,693	13,748	13,723	13,696	13,757	13,757	13,757	13,757	13,757	13,757	13,757	13,757

Notes. All regressions use IV and 3SLS models and include firms' individual characteristics. Columns (1) and (2) report estimates with incorruptible firms. Columns (3) to (5) present results from falsification tests. Columns (6) to (11) reports estimates including sector-size, location-sector-country, and country-size clusters fixed effects, respectively. Columns (12) and (13) report results with tests for potential outliers. All regressions include country, sector, and year fixed effects. Robust standard errors clustered at the country level in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

V.6 Alternative identification strategy: Propensity score matching method

Finally, an alternative identification strategy consists in using propensity score matching. The method uses observable similarities between treated and untreated establishments to create a control group that can be used to identify the effects of bribery on fiscal benefits, and public contract procurement. We generate two treated groups for each of variables of interests i.e., the demand and supply side of corruption. The first treated group includes firms with a positive expected likelihood to pay bribes following a request (demand side) while the second group contains firms with a positive probability to pay bribes to public officials without such request (supply side). The rest of the firms are part of the untreated groups and have an expected probability to face a demand or a supply of graft equal to zero.

For each firm, the potential outcome is defined by Y_{iD} , where D is the binary treatment variable which takes 1 for each firm in a treated group, and 0 for the untreated establishments. The Average Treatment effect on the Treated (ATT) can be written as

$$ATT = E[(Y_{i1} - Y_{i0})|D = 1] = E[Y_{i1}|D = 1] - E[Y_{i0}|D = 1]$$

The latter captures the average effect for a firm to be involved in bribery activities (demand or supply) on fiscal benefits, regulations delays, and public contract procurement.

Employing the propensity score matching method requires to address three main issues. First, the outcomes for treated firms are not observed when they are untreated i.e., when $Y_{i0}|D = 1$. This shortcoming might be addressed using the outcomes on untreated firms. Nevertheless, this alternative is inappropriate because of potential self-selection issue given that the treatment might not be completely random. We address the potential problem of selection using a variety propensity score matching to establish control groups for comparison with treated groups. Employing PSM requires two main assumptions for validity. Second, we need to assume that conditional on the observables, the outcome is independent of the treatment variable, i.e., $Y_{i1}, Y_{i0} \perp X$, the so-called "conditional independence". However, the large number of covariates in X makes it difficult to implement matching on each component of X . We address this issue following [Rosenbaum and Rubin \(1983\)](#). The approach consists in using the matching on the probabilities of facing a demand or supply of corruption conditional on the observables covariates X (propensity scores). Third, we need to ensure that the "common support assumption" or "overlap condition" holds. This assumption ensures that firms with same observable characteristics X have a positive probability of being in both treated and untreated group ([Heckman et al., 1998](#)).

Figures 1 and 2 below show the common support between treated and untreated estab-

ishments. Both distributions overlap providing thereby close matches across the entire range of propensity score. The overlap condition suggests that firms having a positive probability of being treated but in reality are not can be used to form the control group allowing therefore the identification of the treatment effects.

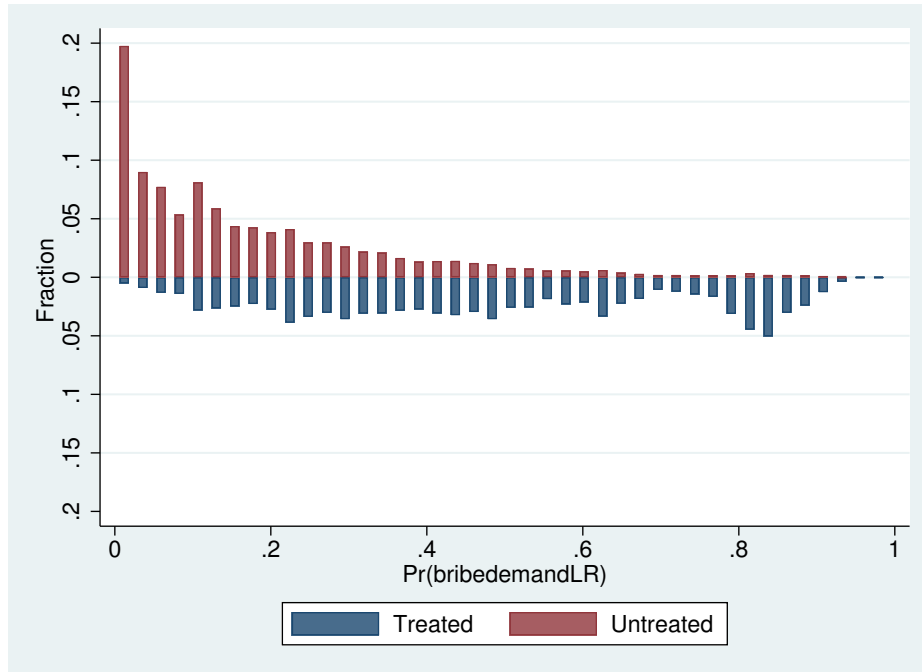


Figure 1: Common support - Demand side of corruption

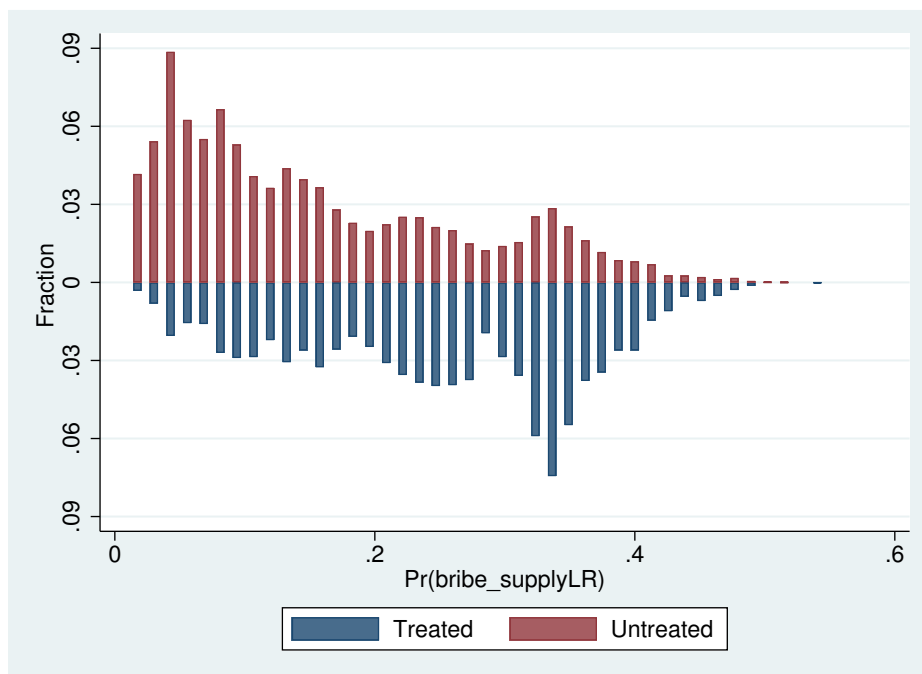


Figure 2: Common support - Supply side of corruption

We estimate the propensity score using a probit model with the treatment variables (i.e. expected probability of demand or supply of corruption) as the dependent variable.

We include all the control variables discussed above. The propensity scores computed allow matching treated firms with untreated ones. We employ four different matching strategies which are: the Nearest Neighbor (NN), Radius, Gaussian Kernel, and Local Linear regression. The NN method matches each treated firm with the N firms in the control group (we use N=1 and N=3) that have the closest propensity score. However, as highlighted by [Caliendo and Kopeinig \(2008\)](#) NN matching faces the risk of bad matches if the closest neighbor is far away. Also, the NN matching technique generates a trade-off between bias and variance ([Smith and Todd, 2005](#)) as the similarity of the propensity score between treated and untreated firms reduce the bias in the comparison but increases the variance. The Radius matching technique addresses this issue by imposing a tolerance level on the maximum propensity score distance (caliper). The technique prevents bad matching and hence increases the quality of matching. However, as discussed in [Smith and Todd \(2005\)](#), a potential drawback of radius matching is the choice of the tolerance level. We use the standard deviation of the propensity score as the tolerance level. Finally, we address the previous issues by using two non-parametric matching estimators: Kernel, and Local Linear regression techniques. These techniques use weighted averages of all control group observations to create a counterfactual for the treatment observations. One major advantage of these non-parametric approaches is to use more information, hence provide lower variance. These methods allow dealing with the tradeoff between efficiency and bias depending on what matching technique is used for finite samples.²⁴

Table 4, columns (1) et (3) presented estimates from a probit model of the likelihood to be a demand and supply side bribe payer. As observed earlier, informal competition, the number of days spent in inspections, the share of sales exported, the use of modern technology, and being a small or a medium size firm increase the likelihood to be a demand side bribe paying firm. On the contrary, the share of the government and working capital financed by commercial banks decrease the probability to be a demand side briber. As for the supply side of bribery, the likelihood for firms to offer bribes to public officials increases with the magnitude of informal sector while it declines with number of days spent in inspections.

The results of the probit model allows generating the propensity scores and matching each firm using the methodology described above. Table 7 reports average treatment effect for fiscal benefits and public contract procurement respectively. Regarding fiscal benefits, the difference in tax evasion between demand side and supply side bribe payers is systematically statistically significant whatever the matching methodology. On the supply side, we find no strong evidence that offering bribes to public officials affects fiscal benefits. The findings are in line with what we find previously and confirm thereby the robustness of the latter. The findings on public contract procurement are also confirmed for both the demand and the supply sides. Overall, we can conclude that our findings

²⁴See [Caliendo and Kopeinig \(2008\)](#) for more extensive discussion.

are robust to this alternate methodology.

Table 7: Impact of demand and supply side of corruption on tax evasion and public procurement - ATT

	Matching Methods					Obs
	Nearest-neighbor	Three nearest neighbor	Radius	Local linear regression	Kernel	
Dependent variable:	Tax evasion					
Demand side of corruption	6.662*** (0.961)	6.820*** (0.833)	6.319*** (0.636)	7.394*** (0.762)	7.080*** (0.730)	16,214
Supply side of corruption	1.11 (1.01)	1.41 (0.840)	2.002*** (0.712)	1.164 (0.724)	1.77** (0.714)	16,455
Dependent variable:	Public contract procurement					
Demand side of corruption	2.493*** (0.226)	2.549*** (0.191)	2.842*** (0.154)	2.708*** (0.171)	2.735*** (0.167)	15, 113
Supply side of corruption	2.121*** (0.237)	2.073*** (0.199)	2.556*** (0.173)	2.297*** (0.176)	2.514*** (0.174)	15, 278

VI Conclusion

This paper distinguishes the demand and the supply sides of corruption and examines their relationship with tax evasion and the size of bribes paid to secure government contracts using a large sample of firms in 75 developing countries. We address endogeneity issues using various strategies and different robustness checks corroborate the main results of the paper. Our results indicate that the demand side of graft drives firms' tax evasion decisions in developing countries. Firms acquiescing to a bribe request by public officials are associated with increases in sales not reported for tax purposes of more than 16%. No evidence is found on an incentive for firms to initiate a bribe transaction in the context of tax evasion, which would likely signal to the authorities undeclared income. The findings suggest two mechanisms that can explain firms' tax evasion behavior. First, a culture of demanding bribes among public officials may reduce the risks faced by firms involved in tax evasion activities. Second, firms may internalize this culture of demanding a bribe in their tax evasion behavior, as the latter represents an additional cost for them. Such an outcome potentially generates a trap of underdevelopment wherein tax evasion and corruption are entangled due to weak governance and control within the tax administration authority. We also find that firms initiate acts of corruption in order to reduce the weight of government regulation and secure government contracts.

With regard to corruption in procurement contracts, we found evidence on the contrary that bribery is mainly a supply side phenomenon, initiated by firms in order to secure public contracts. The magnitude of the impact of the supply side of corruption on bribing to secure government contracts is at least three times higher compared to the demand side of corruption.

Our approach of characterizing the initiator of a corrupt contract allows refining various avenues of policy reforms and anti-corruption options for policymakers. With regard to tackling the demand side of tax evasion, reforms could focus on improving supervision and control of tax officials within the tax administration authority, limiting contact between entrepreneurs and tax officials, either through the rotation of tax officials to avoid repeated interactions, the four-eye principle (i.e., tax reports being checked by multiple individuals), or the implementation of an electronic tax system. Anti-corruption policies could also reward firms that report a corrupt tax official. Such policy should in the long-term reduce the number of corrupt tax officials and deter those who are pondering about the cost and benefits of asking for a bribe in exchange of a tax rebate. Clearly, such reporting should be confidential to avoid retaliation by other corrupt bureaucrats and such a policy assumes an independent anti-corruption agency of the highest integrity. As for public procurement, our findings suggest that a potential solution for governments seeking to break the vicious cycle of fraudulent transactions and corruption might be to implement a more transparent market-based allocation of government contracts, with

a focus on incentives and control of firms driving the supply side of graft for securing public contracts. Specific anti-corruption policies could, for instance, focus on rewarding public officials reporting a bribe offer and making liable the person or entity offering or promising a bribe.

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Appendix

Selection bias

Table .8: Comparison of firms reporting and not reporting bribe and tax evasion data

	Firms missing corruption data (1)	Firms missing tax evasion data (2)	Firms missing corruption and tax evasion data (3)	Firms missing bribing for government contract data (4)	Firms missing bribing for government and corruption data (5)
Panel A: Control variables					
Informal Competition	-0.00495 (0.0345)	-0.0507 (0.0432)	-0.00263 (0.0455)	-0.0189 (0.0437)	-0.0205 (0.0490)
Working capital financed by banks	0.500 (1.353)	1.256 (1.026)	4.153* (2.494)	3.272 (2.228)	3.634 (2.842)
Share of sales exported	-0.00951 (0.657)	-0.596 (0.616)	-0.880 (1.230)	0.205 (0.716)	-0.0882 (1.186)
Foreign share	0.312 (0.544)	-0.636 (0.563)	-0.118 (1.234)	0.519 (0.542)	0.551 (0.905)
Government share	-0.0335 (0.401)	0.132 (0.508)	-0.602 (0.871)	-0.630* (0.380)	-0.388 (0.613)
Sales	1485299 (1263798)	-355,232 (278,655)	130,614 (128,994)	-438,412 (302,245)	-91,831 (255,577)
Number of employees	5.404 (11.64)	-3.593 (9.005)	12.07 (22.11)	6.283 (8.333)	6.963 (16.52)
Use of e-mail or a website	-0.000289 (0.0131)	0.0115 (0.0118)	-0.0147 (0.0187)	-0.0150* (0.00823)	-0.0185 (0.0128)
Days spent in inspections	-0.135 (0.227)	-0.0992 (0.282)	0.429 (0.458)	0.293* (0.170)	0.179 (0.248)
Panel B: Additional key characteristics					
Capital stock	335,520 (211,481)	-52,653 (37,537)	25,089 (17,007)	10,444 (34,161)	86,260 (83,116)
Investment	2,783 (73,338)	-41,852 (109,977)	34,975 (162,242)	-102,488 (87,473)	-102,065 (102,375)
Profits	1.4E+06 (1.48E+06)	-153,923 (151,895)	-38,917 (44,699)	-59,313 (65,304)	-8,881 (10,425)

Notes. The dependent variable is in the left column. Coefficient estimates from the OLS regressions are in the second to sixth columns, where the dummy variable takes 1 for missing data on bribery and evasion activities and 0 otherwise. All regressions include country, sector, and year fixed effects. Robust standard errors clustered at the country level in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.