

## Is the Bureaucrat the Main Responsible for Corruption?

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**Abstract.** *The combination of a simple game-theoretic interaction between two firms bidding for a public project and the possibility of moral hazard on the part of the public official who is in charge of this project results in the proposition that there cannot be corruption unless the public official signals so. The result is lower quantity and quality of the goods and services offered through public projects.*

**Keywords:** public project, moral hazard, public official corruption.

**JEL Codes:** D73, H57, D82.

### 1. Introduction

As OECD (2007, 5) reports: “In OECD countries, public procurement accounts for 15% of GDP; in many non-OECD countries, that figure is even higher. But while public procurement can mean valuable business opportunities, it is also exposed to bribery. Such corruption undermines markets and welfare, and exerts a corrosive effect on society by eroding trust in leaders, institutions and business itself.” Or, in so far as public projects are concerned, “the American Society of Civil Engineers claim that corruption accounts for an estimated \$340,000,000,000 of worldwide construction costs each year” (Sohail and Cavill 2006, 4). This article is an exercise corroborating theoretically the empirical finding that white-collar corruption is a main source of corruption in public procurement (Gottschalk and Smith 2016), but put in the context of public project biddings. The discussion below is also related to the bank lending corruption in so far as small and medium enterprises (SMEs) are concerned, because SME banking makes it difficult for SMEs to borrow, encouraging thereby bribery to bank officers similar to bribery for public procurements (Martini 2013).

The next section puts forward a *problematique* of two firms competing for a public project (for a loan in the case of two SMEs) on whether each separately or jointly should engage in bribery to get the project. These are calculations of the firms before any interaction with the public project agency. Both firms conclude that they should not bribe anyone. So, for bribery to take place, it should be signaled by the relevant agency administrator. And, if this is the case, anything may be expected from him/her after a deal has been reached. This is an important conclusion because the relevant administrator may be just another white-collar official in case of delegated hierarchies or the minister him/herself in case of unified control. It is a conclusion attesting to the popular view that “the fish rots from the head” and explains why we chose here

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to focus specifically on public sector corruption instead of a more general presentation of the subject that would include bank corruption, too. Methodologically, only after firms have made the calculations discussed in the next section, a game with the public agency is prompted; a game like those mentioned the relevant literature, namely cheap talk, costly signal, and verifiable signal game models (Gailmard and Patty 2011).

It is not necessary, therefore, to go into the matter of the game-theoretic interaction. Instead, we take for granted from the literature the conclusions about this interaction with the presumption that a firm-administrator deal is reached with such a corrupt administrator that can show arbitrariness at will. Given this, the discussion expands in section 3 on the after-game implication of this behavior on the quantity and quality of the output of public projects. It is assumed that the competing firms wish to collaborate with the public sector with a product other than that of their main line of business in order to raise their overall profitability. It is contemplated that the firm earning a project will treat its collaboration with the public sector as a substitute for its market operation. Yet, the mistrust towards a public official who in the previous section was shown to be one capable of any arbitrariness, will make the firm undermine the quantity and quality of the public project it gained.<sup>1</sup>

## 2. Calculations of the competing firms before interaction with the bureaucrat

Let there be two firms which compete to undertake at  $t = 0$  a public project of fixed value  $V$  to finish at  $t = 1$ . The project is decided by the government and appoints a public official in charge of it. It would cost each firm  $C_i, i = 1, 2$  so that at  $t = 1$  profit will be  $\Pi_i = V - C_i$ . Nevertheless, each of them contemplates the possibility of bribing the official with the amount  $B_i$  in order to fix the terms of the competition so as to gain the project, and claim at  $t = 1$  that extra funds  $\hat{V}_i \geq (\hat{C}_i + B_i)/\delta$  are needed to complete it at  $t = 2$  with cost  $\hat{C}_i$ . The bribing firm would earn this way  $\bar{\Pi}_i = V - C_i - B_i + \delta(\hat{V}_i - \hat{C}_i)$ , which will be at least equal to  $\Pi_i$  because  $\bar{\Pi}_i \geq \Pi_i \Rightarrow \hat{V}_i \geq (\delta\hat{C}_i + B_i)/\delta$ , where  $\delta$  is a discount factor. Presumably, the government does not want to leave the project unfinished at  $t = 1$ , and  $\hat{C}_i$  includes any penalties for not having finished the project as scheduled.

The  $i$ th firm believes with probability  $c_i$  that  $C_j > C_i$  and with probability  $b_i$  that  $B_j > B_i$ , where  $j = 1, 2, j \neq i$ . So, if  $NB$  stands for the choice not to bribe, payoffs from  $B_i$  are  $c_i(1 - b_i)\bar{\Pi}_i$  or  $\bar{\Pi}_i$  when  $B_j$  or  $NB_j$  is chosen, respectively, while the payoff from  $NB_i$  is  $0$  or  $c_i\Pi_i$  if  $B_j$  or  $NB_j$  is selected, correspondingly. Bribery is clearly the best thing to do, since  $c_i(1 - b_i)\bar{\Pi}_i > 0$  and  $\bar{\Pi}_i > c_i\Pi_i$ . The term  $c_i$  in the payoffs under the option  $B$  indicates that both firms are aware of the dominance of this strategy and hence, that the project will be undertaken by the cheaper one as if there was no bribery. Therefore, their decision whether to bribe or not depends on whether they believe that the official in charge of the project will keep its promise, because if not, profit will be  $\bar{\Pi}_i = V - C_i - B_i < \Pi_i$ .

Let  $q$  be the probability that the official keeps its promise. There is no reason why should this probability differ between firms. Letting  $\bar{\bar{\Pi}}_i = qc_i(1 - b_i)\bar{\Pi}_i + (1 - q)c_i(1 - b_i)\bar{\Pi}_i$ , payoffs from  $B_i$  are  $\bar{\bar{\Pi}}_i$  or  $q\bar{\Pi}_i + (1 - q)\bar{\Pi}_i$  when  $B_j$  or  $NB_j$  is chosen, respectively, while the payoff from  $NB_i$  is  $0$  or  $c_i\Pi_i$  if  $B_j$  or  $NB_j$  is selected, correspondingly. Payoff  $\bar{\bar{\Pi}}_i > 0$  but  $q\bar{\Pi}_i + (1 - q)\bar{\Pi}_i \geq c_i\Pi_i$  iff:

$$q \geq \frac{c_i \pi_i - \tilde{\pi}_i}{\tilde{\pi}_i - \pi_i} = \frac{B_i - (1 - c_i)(V - C_i)}{\delta(\tilde{V}_i - \tilde{C}_i)} \quad (1)$$

Note that  $q \geq 0$  when  $B_i \geq (1 - c_i)(V - C_i)$ . So, what really (1) says is that the slightest trust to the official is the one that should make a firm which believes to be the high-cost one, bribe the official with more than what the firm would earn if it was granted the project without bribery. Inserting  $B_i = (V - C_i)$  in  $\tilde{\pi}_i$ , it becomes equal to  $\delta(\tilde{V}_i - \tilde{C}_i)$ , which this firm will ask from the official to be at least as large as  $\pi_i$  in exchange of this sizeable bribery. This is how a firm sees trust; it entails this behavior and expectations on its part. But, there is no ways a firm can make the official fulfill firm's expectations, there is a moral hazard problem, firms know it, and no one bribes anyone.

Could cooperation between the two firms to give the low-cost one,  $j$ th firm, some percentage  $\xi$  of  $(V - C_i)$  to the high-cost,  $i$ th firm in order to ignore the competition, and bribe with the remaining percentage the official to have the project extended for one period as above, would be to the mutual advantage of all parties involved? The percentage  $\xi$  should be that which will discourage the high-cost firm to enter the competition at  $t = 1$ ; that is,  $\xi(V - C_i) \geq \delta(\tilde{V}_i - \tilde{C}_i) \Rightarrow \xi \geq \delta(\tilde{V}_i - \tilde{C}_i)/(V - C_i)$ . But, for the official, the bribery with  $(1 - \xi)(V - C_i)$  is less than the bribery  $(V - C_i)$  by the high-cost firm, and even less than the bribery with  $(V - C_j)$  by the low-cost firm. The low-cost firm should show no confidence to the official. Therefore, nor cooperation between the firms can make corruption worthwhile. Corruption may be made possible only if the public official signals so. It is certainly the case of white-collar corruption either of penal character or as the outcome of institutional corruption (Thompson 2013) or of broader systemic corruption (Arellano-Gault 2016). Figure 1 illustrates the percent of firms experiencing at least one bribe payment request in selected countries of Eastern Europe and Central Asia.

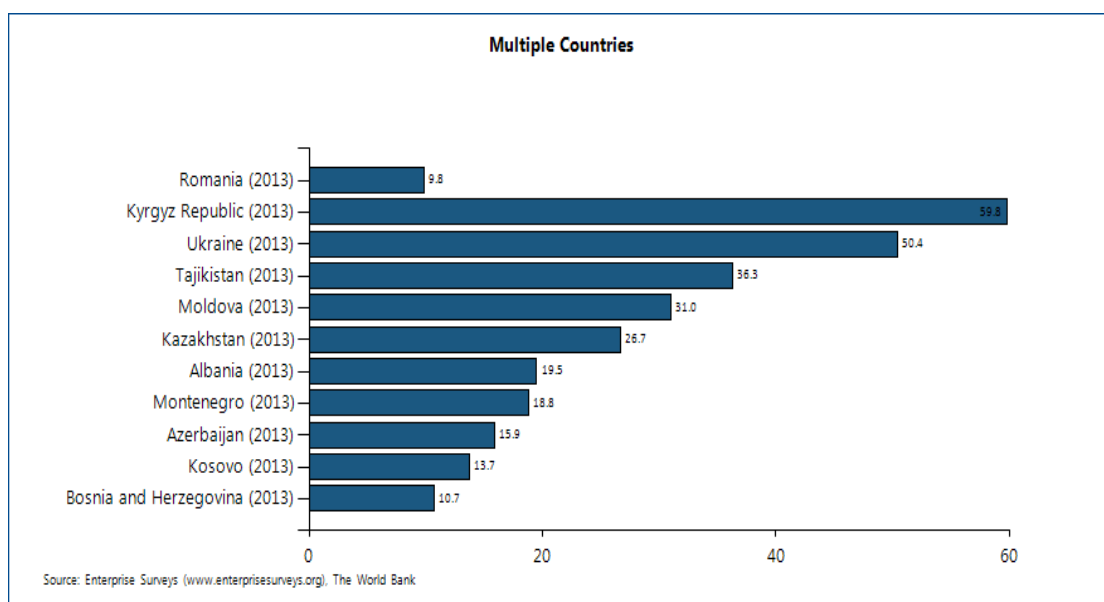


Fig. 1: Bribery Incidence: Percent of firms experiencing at least one bribe payment request;  
<http://www.enterprisesurveys.org/graphing-tool/multi-country-comparisons>

### 3. Bureaucrat corruption and quantity/quality of the public project

What does this mistrust to the public official implies for the business environment? Let the main line of production of the two firms be good  $Q_A$ , whose price is  $P_A$ . Let  $\Pi_{Ai}(Q_A) = Q_{Ai}P_A(Q_{Ai} + Q_{Aj}) - K(Q_{Ai})$  be the profit earned by the  $i$ th firm,  $i, j = 1, 2, i \neq j$ , from producing good  $Q_A$  under Cournot competition in the market of this good, where  $P_A(Q_{Ai} + Q_{Aj}) \equiv P_A(Q_A)$  is an inverse demand curve and  $K(Q_{Ai})$  is a firm-specific cost function. Each firm may choose to produce one additional good,  $Q_B$ , differing slightly from firm to firm and from  $Q_A$ . Firms cannot influence the price of the ‘‘Cournot’’ product and produce another good too, which can be used to bid public projects and whose price can manipulate in a monopolistically competitive environment, earning in the latter case,  $\Pi_{Bi} = Q_{Bi}P_{Bi}(Q_{Bi}) - K(Q_{Bi})$ . The way they do it, is so as the use of the additional good in connection with the public sector can substitute for or complement  $Q_A$  in order to compensate for profit variation during Cournot competition.

If  $s \in (0, 1)$  denotes the share of  $\Pi_{Ai}$  to total firm profit, and if the  $e > 0$  is the coefficient capturing substitutability or complementarity, the utility that each firm derives from its operation is:

$$U_i(\Pi_{Ai}, \Pi_{Bi}) = \frac{(\Pi_{Ai}^s \Pi_{Bi}^{1-s})^{1-e_i}}{1-e_i} \quad (2)$$

The sign of the derivative  $\partial^2 / \Pi_{Ai} \Pi_{Bi} = (1-e_i)s_i(1-s_i)U_i / \Pi_{Ai} \Pi_{Bi}$  depends on whether  $e_i > 1$ , indicating substitutability, or  $e_i < 1$ , reflecting complementarity. Actually  $e$  refers The curvature of the profit indifference curves in the  $\Pi_{Ai} - \Pi_{Bi}$  space ranges from near a straight line to near a right angle, with slope,

$$\frac{\partial \Pi_{Bi}}{\partial \Pi_{Ai}} = -\frac{s_i \Pi_{Bi}}{(1-s_i) \Pi_{Ai}} \quad (3)$$

In principle, a firm is expected to be maximizing its utility from its operation at the highest indifference curve given the price ratio  $P_{Bi}/P_A$ . Nevertheless, the indifference curves do not appear to be smooth as follows: Inserting in (3) the relationships,

$$\Pi_{Ai} = Q_{Ai}P_A - k_A Q_{Ai} \quad \text{and} \quad \Pi_{Bi} = Q_{Bi}P_{Bi} - \zeta_i Q_{Bi}$$

and solving for  $Q_{Ai}$ , yields,

$$Q_{Ai} = \frac{P_A s_i (P_{Bi} - \zeta_i)}{P_{Bi} (1-s_i) (P_A - k_A)} Q_{Bi} \quad (4)$$

Assuming for simplicity linear inverse demand relationship,  $P_A = f - h \sum_t Q_{At}$ , and  $P_{Bi} = \beta_i - \zeta_i Q_{Bi}$ , and constant marginal costs,  $k_{Ai} = k_A$ , and  $k_{Bi}$ , inserting these relationships in (3), results in the quadratic equation in  $Q_{Ai}$  (or in  $Q_{Bi}$ ),

$$Q_{Ai}^2 h(\beta_i - \zeta_i Q_{Bi})(1-s_i) - Q_{Ai} \{ (1-s_i) [(f - h Q_{Aj})(\beta_i - \zeta_i Q_{Bi}) - k_A] + h s_i [\beta_i - \zeta_i (1 + Q_{Bi})] \} + (f - h Q_{Aj}) s_i [\beta_i - \zeta_i (1 + Q_{Bi})] Q_{Bi} = 0$$

with two positive roots. The one with the negative sign of the square root of the discriminant cannot be rejected as being negative because its numerator will be positive if,

$$2(\beta_i - \zeta_i Q_{Bi})(1 - s_i)[(f - hQ_{Aj}) - k_A]hs_i[\beta_i - \zeta_i(1 + Q_{Bi})] > -2(\beta_i - \zeta_i Q_{Bi})(1 - s_i)h[\beta_i - \zeta_i(1 + Q_{Bi})][(f - hQ_{Aj})(2Q_{Bi} - 1) + k_A]$$

which is true. Therefore, for a given  $Q_{Bi}$ , there is one combination of the two goods in which the “Cournot” product is high, and a second one in which it is low.

The former combination is associated with complementarity and the latter one with substitutability. This is a conclusion that does not obtain formally but to which common sense leads within the present particular analytical framework. Common sense also suggests that earning a public project by one from the two firms, is lucrative and a good reason to be on the “passive” side in the market of  $Q_{Ai}$ , which is to what substitutability translates in practice. In technical jargon, the firm earning a public project becomes a quantity-Stackelberg follower. Yet, if the kind of public-official corruption mentioned earlier – one in which even arbitrariness on the part of the official may be anticipated – is present, it would be prudent on the part of the firm earning a public project to be on the safe side by trying to minimize its loss in case commitments are broken. The effect of such an attitude on the quantity and quality of  $Q_{Bi}$  supplied to the public sector will be adverse. If there are instances in which corruption is “sand” rather than “grease” in the wheels of growth, the one examined here belongs to the case of “sand” (Campos et al. 2010).

#### 4. Concluding remarks

For a firm to have earned a project after its pre-game calculations, it should have entered next into a game with the public administrator. In cheap talk games, the presence of private information allows the conclusion of a deal whose content depends mostly on the degree of preference convergence between the firm and the administrator. The firm could be sure about the viability of the deal only if preferences were fully endogenized, which can never be the case in the real world. In costly signaling and communication games, no contract will be an equilibrium one just because signaling for the bureaucrat is costless and private information about his/her type can remain secret. So, what a firm can conclude under any kind of game interaction with the administrator, is that s/he may exhibit arbitrariness at any stage of the project depending on the public official’s interests; much more so when it is interaction with a corrupt official. Hence, the firm would do well on its part if it did not commit fully to the project.

Indeed, as Tanzi and Davoodi (1997) emphasize, corruption in procurement hampers the productivity of public investment, lowers the quality of existing infrastructure, shrinks capital spending productivity and as a consequence hurts growth prospects. And, as Liu and Mikesell (2014, 346) note in connection with the US, “...at the expense of social sectors, corruption is likely to distort states’ public resource allocations in favor of higher-potential “bribe-generating” spending and items directly beneficial to public officials, such as capital, construction, highways, borrowing, and total salaries and wages.” The matter of the misallocation of resources is certainly much more important for the growth of developing countries where corruption is moreover extensive. Figure 2 depicts the percent of public transactions where a gift or informal payment was requested in selected countries from Eastern Europe and Central Asia.

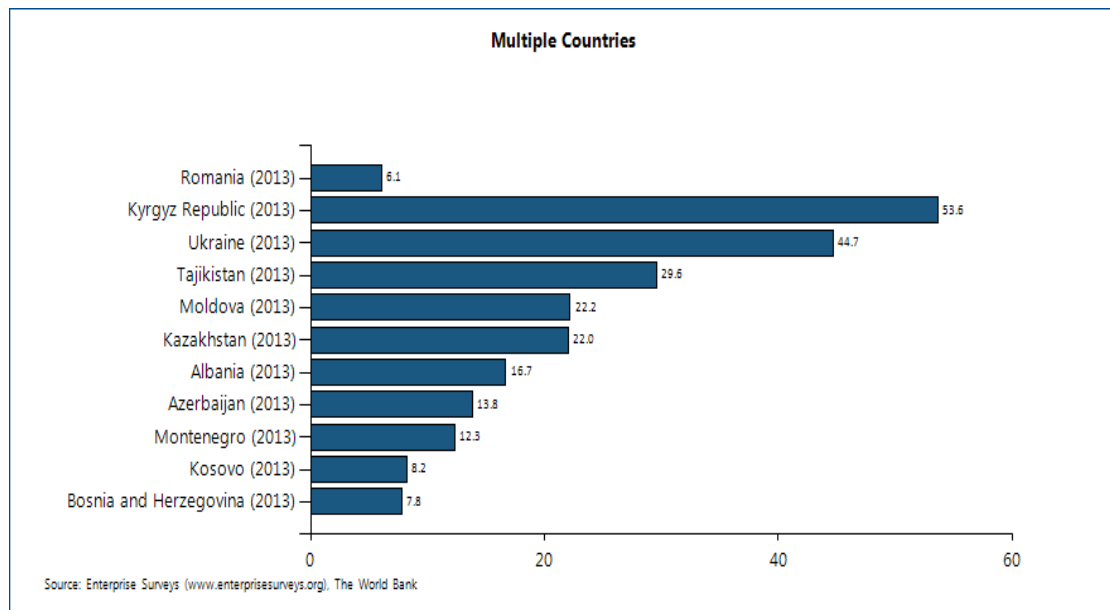


Fig. 2: Bribery Depth: Percent of public transactions where a gift or informal payment was requested;  
<http://www.enterprisesurveys.org/graphing-tool/multi-country-comparisons>

It would be proper to conclude with a discussion of the results in connection with the corruption in SME banking. SMEs may not be marketing more than one product. But, in view of corrupt bank officials, they have every reason to handle a loan once earned the same way a public project will be treated when the public official is corrupt: Partial repayment of the loan under irregular intervals, and use of the loan for purposes beyond those for which the loan was granted. There is clearly an issue of distorted financial and real resource allocation regardless the multiproduct character of an SME. This too, is as important socio-politically as bribing a minister to get a public project to the extent the abuse of SME lending is made directly or indirectly for the financing of political ambitions. For example, Khwaja and Mian (2005) report that in Pakistan, “political firms” borrowed 45 per cent more and had 50 per cent higher default rates than other bank borrowers. This also exemplifies why the white-collar corruption is in general more important for the developing economies.

## Notes

<sup>1</sup> Put the scenario explicitly, each firm independently puts down on a sheet of paper some calculations on whether it should bribe the bureaucrat or not. It realizes that it should not be prudent to do so. Then, it continues its calculations to see if it can enter into some mutually beneficial arrangement with the other firm. And, the best such arrangement cannot be other than have the low-cost firm compensate the high-cost one for withdrawing from competition, get the project the low-cost firm, and bribe the bureaucrat to make this move worthwhile. Only the low-cost firm could afford to do this, because of its low cost. Each firm independently contemplates this possibility too, realizes that such a scheme would not work out either, and none of them approaches the other firm to discuss it. So, each firm decides to bid for the project without bribery. A game next will be prompted only if the bureaucrat is corrupt; otherwise, no game is prompted. If it is, it will take place in line with some bureaucracy model and there is an extensive list of them in the literature. To elaborate upon one more such game lies beyond the scope of the paper. Instead, section 3 takes for granted that one of the two firms got somehow the project from a corrupt bureaucrat, and examines what

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this would imply for the market structure in which the two firms are operating, and for the quantity and quality of the project.

## 5. References

- [1] Arellano-Gault David, Understanding the Trap of Systemic Corruption, *Governance: An International Journal of Policy, Administration, and Institutions*, 2016, 29(4), 463-465.
- [2] Campos Nauro F., Ralitzia Dimova and Ahmad Saleh, Whither Corruption? A Quantitative Survey of the Literature on Corruption and Growth, 2010, IZA Discussion Paper 5334; <http://ftp.iza.org/dp5334.pdf>
- [3] Gailmard, Sean and John W. Patty, Formal Models of Bureaucracy, *Annual Review of Political Science*, 2011, 15, 353-377.
- [4] Gottschalk Peter and Christy Smith, Detection of White-collar Corruption in Public Procurement in Norway: The Role of Whistleblowers, *International Journal of Procurement Management*, 2016, 9(4), 427-443.
- [5] Khwaja, Asim Ijaz and Atif Mian, Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market, *Quarterly Journal of Economics*, 2005, 120 (4), 1371-1411.
- [6] Liu Cheol and John L. Mikesell, The Impact of Public Officials' Corruption on the Size and Allocation of U.S. State Spending, *Public Administration Review*, 2014, 74(3), 346-359.
- [7] Martini, Maira, *Reducing bureaucracy and corruption affecting small and medium enterprises*, U4 Anti-Corruption Resource Centre, CMI, Bergen, Norway, 2013, 8 pp; <file:///C:/Users/seven/Downloads/380.pdf>
- [8] OECD, *Bribery in Public Procurement: Methods, Actors and Counter-Measures*, 2007; <http://www.oecd.org/daf/anti-bribery/anti-briberyconvention/44956834.pdf>
- [9] Sohail M. and Sue Cavill, Corruption in Construction Projects, in: Serpell, A. (ed.), *Proceedings of the CIB W107 Construction in Developing Countries Symposium "Construction in Developing Economies: New Issues and Challenges"*, 2006, Santiago, Chile. Santiago: CIB; <https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/3966/1/CIB%20Conference%20Paper%20Corruption%20in%20construction%20projects.pdf>
- [10] Tanzi Vito and Hamid Davoodi, *Corruption, Public Investment, and Growth*, 1997, IMF Working Paper 97/139; <https://www.imf.org/external/pubs/ft/wp/wp97139.pdf>
- [11] Thompson Dennis F., *Two Concepts of Corruption*, 2013, Edmond J. Safra Working Papers 16; <file:///C:/Users/seven/Downloads/SSRN-id2304419.pdf>