

Why Do Transparent Public Procurement and Corruption Go Hand in Hand?

Raffaella Coppier

Università di Macerata

- **Gustavo Piga***

Università di Roma "Tor Vergata"

In this paper we try to construct an hypothesis as to why, as data seem to show, countries that adopt more "transparent procurement", as calculated by the share of tender advertised publicly, are also the ones where corruption is considered more pervasive. We describe an economy where in equilibrium countries more prone to corruption find it optimal to increase transparency more to curb corruption itself. However, as transparency is costly to implement, this will not be enough to bring corruption levels to those of inherently less corrupt societies. We finally suggest alternative ways to reduce corruption in procurement. [JEL Classification: H57]

1. - Introduction

The greater part of modern States uses public procurement in order to obtain the goods and services that it deems are necessary to support its public policy actions. But this procurement is not immune to manipulations through collusion and corruption. As Rose-Ackerman (1999) said:

Corruption occurs at the interface of the public and private sectors. Whenever a public official has discretionary power over distribution to the private sector of a benefit or cost, incentives for bribery are created.(...) When the government is a buyer or a contractor, there are several reasons to pay off officials. First, a

<raffaellacoppier@unimc.it>; <gustavo.piga@uniroma2.it>.

firm may pay to be included in the list of qualified bidders. Second, it may pay to have officials structure bidding specifications so that the corrupt firm is the only qualified supplier. Third, once a firm has been selected, it may pay to get inflated prices or to skimp on quality.

Corruption means that the person who runs the auction, the auctioneer, twists the auction rules in favor of a bidder in exchange for a bribe. The World Bank estimated the volume of bribes exchanging hands for public sector procurement alone to roughly 200 billion dollars per year (see Kaufman, 2004). The problem, while more acute in developing countries, is by no means irrelevant for more economically advanced ones: Kaufman (2003) reports that “favouritism in procurement award” remains the number one problem for OECD firms once compared with other sources of bad public governance (illegal political financing, legal political financing influencing politics, firm’s capture of laws and regulations, ineffective Parliament). In general, corruption is a problem if the auctioneer is an agent of the seller, as is the case if the seller is a government.

There are different kinds of corruption in procurement. Lengwiler and Wolfstetter (2006) survey most of them, their implications for efficiency and redistribution and the possible solutions to avoid it.¹ They point out, among other things, the central feature that plays, for corrupted outcomes, the use of discretion in evaluating tenders based on the MEAT (most economically advantageous offer) criterion. Rankings by quality are now fully accepted in the new EU directive, to gain flexibility and accuracy in awards, at the obvious expense of some added concern in terms of corruption possibilities. Distortion of quality rankings indeed remains a serious possibility that takes advantage of the sometimes poor monitoring capacity of external agents when analyzing the features of contract performance, mostly because of asymmetric information.

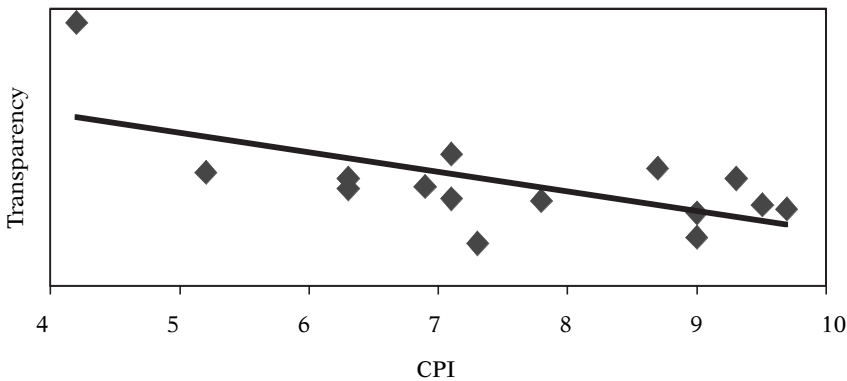
¹ Interestingly, they view the shift to e-procurement, with its added layers of security, as a strategic tool to reduce the effectiveness of some ways in which corrupt procurement has traditionally taken place.

Transparency is often suggested as a tool to reduce the potential for corruption. In the European Directive, transparency is considered, together with competition, as a “principle”. This creates in the mind of many economists a certain degree of confusion in that some kinds of transparency foster instead more collusion (e.g. in the case of reverse on-line auctions in a collusive environment, greater visibility of rivals’ offers increases the possibility of sanctioning any cartel defector) or are necessarily costly (for example the unit costs of an open procedure are larger the smaller the amount procured given the fixed nature of some of these, like publication costs and tender committee costs).

Nevertheless it is clear that publishing a tender improves the knowledge of the needs of the purchaser, fosters participation and raises accountability for the procurer, making corruption a more difficult and therefore less likely outcome.

GRAPH 1

CORRUPTION VERSUS TRANSPARENCY



Legend: CPI (Corruption Perception Index) is an index that defines corruption as the abuse of public office for private gain, and measures the degree to which corruption is perceived to exist among a country’s public officials and politicians. The scores range from ten (squeaky clean) to zero (highly corrupt). Transparency is measured by the share of total public procurement published in the Official Journal, source: EC, DG Market.

A look at the data seems however to say otherwise. If we rank countries by their inclination to corruption (Corruption Perception Index, CPI) as stated for example by Transparency International² we find that the least corrupt countries choose a less transparent way of handling their tenders (lower share of total public procurement published in the Official Journal, source: EC, DG Market) while countries reputed for their higher degree of corrupt behaviour appear more transparent in their procurement.

A more serious empirical analysis would be needed to study the statistical significance and the causality of this result. Here however we concentrate on understanding better the theoretical implications of such an outcome, verifying if it can be replicated in an environment with rational agents and what this tells us in terms of the importance of the role transparency plays in public procurement. The results are reassuring in that we find that the stylized fact mentioned above may have nothing to do with transparency playing a role in enhancing corruption opportunities. However, they also remind us that each country has its own culture and institutions and that transparency might not be enough to eradicate corruption at a cost which is compatible with society's agreement to eradicate it.

² The index defines corruption as the abuse of public office for private gain, and measures the degree to which corruption is perceived to exist among a country's public officials and politicians. It is a composite index, drawing on 16 surveys from 10 independent institutions, which gathered the opinions of businesspeople and country analysts. Only 159 of the world's countries are included in the survey, due to an absence of reliable data from the remaining countries. The scores range from ten (squeaky clean) to zero (highly corrupt). A score of 5.0 is the number Transparency International considers the borderline figure distinguishing countries that do and do not have a serious corruption problem. More than two-thirds of the 159 nations surveyed scored less than five out of a top score of 10 on the index, which reflects perceptions of business people, academics, and other political observers, both within and outside each country. More than half scored less than three, indicating the perception of a severe corruption problem. The index, first launched in 1995, draws on 16 surveys from 10 independent institutions, including The Economist Intelligence Unit, World Markets Research Centre, and Freedom House. As survey of surveys this index has the advantage that if the errors in the measurements are independent and are identically distributed, then the average used they give TI can reduce the error.

2. - The Model

Consider an economy composed of three types of players: a principal (the State), a population of agents (bureaucrats), and a population of identical firms. Economic agents are risk neutral. The State delegates the good's "y" purchase to a bureaucrat. There is a continuum of bureaucrats and firms, and their number is normalized to 1 for both categories. Bureaucrats earn a fixed salary "w", while firms sell to the State the good "y". We assume that the good's price is given, and let firms compete in quality: the higher the quality offered, the lower the profit for firms and the higher the welfare for the community. The bureaucrats organize an auction for the procurement of a certain good. It is further assumed that an information asymmetry exists, in that the State is unaware of the good's quality. In fact, the quality of the good is observable only after controls by an independent monitor. The State, in order to weed out or reduce corruption 1) *ex-ante* fixes the level of Transparency, "T", of the tender and 2) *ex-post* monitors firms' and bureaucrats' behavior uncorruptable third parties. It is common knowledge that the bureaucrat is corruptible, in the sense that he pursues his own interest, and not necessarily that of the State; in particular, the bureaucrat is open to bribery. In fact only the bureaucrat observes firms' bids' which are submitted in closed envelopes. As a general rule, the firm that offers the highest quality wins the auction. The bureaucrat can, when proclaiming the winner, lie on the bids's true quality in exchange for a bribe "b". Let b^d be the bribe demanded by the bureaucrat. Then, the firm has two options: 1) refuse payment of the bribe, or 2) accept to pay and start negotiating the bribe with the bureaucrat. For simplicity, we assume that the level of quality can take only two values: a high quality level, the highest level of quality — that correspond to the lowest profit level π_l — and a low quality level, the lowest level of quality — that correspond to the highest profit level π_h .

The State fixes the level of transparency "T". We assume that a higher transparency reduces the ability of the bureaucrat to be able to lie on the quality of the offered good. This implies that,

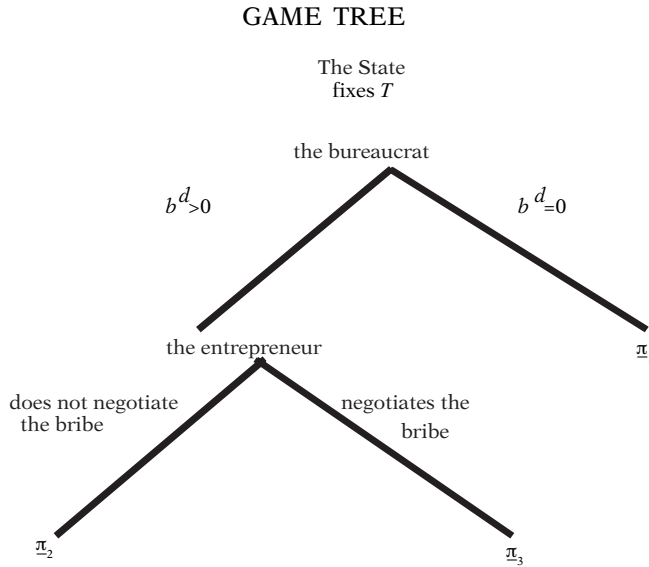
there is an inverted relationship between the possibility for the bureaucrat to make a bid of low quality a winning bid and the level of transparency “ T ”. In fact we assume that the bureaucrat supports a cost proportional to the transparency level “ T ”, in order to lie about the quality of good. In our model a higher transparency level will imply the reduction of the surplus that the bureaucrat and the firm can themselves share. The surplus reduction is such that beyond a certain threshold it eliminates the economic convenience of corruption. Furthermore, the State checks on the behavior of firms and bureaucrats. There is an exogenous probability “ q ” of being detected, given that corruption has taken place. $q \in [0, 1]$ can therefore be thought of as the *ex-post* monitoring level implemented by the State. The bureaucrat in country “ i ” caught in a corrupt transaction, incurs a cost — for the social stigma associated with being found guilty — equal to “ c_i ” where $c_i \in [0, 1]$. In our model every country is characterized by its own different “inner honesty”, whether due to historical developments, political regime, economic cycle or else. Each country therefore has a different level of costs it associates with finding corrupted actions. In the first part, for simplicity, we assume that bureaucrats all have the same moral cost. In the second part we let bureaucrats differ in this respect, by assuming that bureaucrats of a single country have different moral costs. The firm, if detected, must supply the high quality product — with π_i profit — but is refunded the cost of the bribe, paid to the bureaucrat.³

2.1 *The Game: Description and Solution*

Given the model just described, the economic problem can be formalized by the following three-period dynamic game with perfect and complete information (see Graph 2).

³ This assumption can be more easily understood when, rather than corruption, there is extortion by the bureaucrat, even though, in many countries, the relevant provisions or laws, stipulate that the bribe shall in any case, be returned to the entrepreneur, and that combined minor punishment, (penal and/or pecuniary), be inflicted on him/her.

GRAPH 2



(1) In the first stage of the game, the State fixes the level of transparency “ T ”, by minimizing its own loss-function.

(2) In stage two, the bureaucrat, facing a series of entrepreneurs that want to sell the product “ y ” to the Public Administration, may: *a*) decide not to ask for a bribe ($b^d = 0$) in which case all entrepreneurs will offer the high quality product and one entrepreneur selected by random draw will win the auction — with a π_l profit assumed > 0 — or, *b*) he may negotiate the payment of a bribe ($b^d > 0$) with one entrepreneur.

(2.1) If $b^d = 0$ no bribe is asked for, and the payoff vector for the entrepreneurs and bureaucrats is:

$$(1) \quad \underline{\pi}_1 = (\pi_l, w)$$

The game ends in the equilibrium NC (No Corruption).

(2.2) Otherwise, let $b^d = 0$ be the positive bribe asked for by the bureaucrat. In this case the game continues to stage three.

(3) At stage three the firm decides whether to negotiate the bribe or turn it down.

(3.1) If the firm refuses the bribe, then the entrepreneur must supply the high quality product and the payoff vector is given by:

$$(2) \quad \underline{\pi}_2 = (\pi_l, w)$$

Then, in this case the game ends. There is no penalty for the bureaucrat.

(3.2) Otherwise negotiation occur, and the two parties will find the bribe corresponding to the Nash solution to a bargaining game (b^{NB}) and the game ends. The bureaucrat supports a cost " T ", proportional to the level of transparency of the tender, in order to lie about the quality of good. This bribe is the outcome of a negotiation between the bureaucrat and the firm, who will be assumed to share in a given surplus. The payoffs will depend on whether the bureaucrat and the firm are detected, (with probability " q ") or not detected, (with probability $(1-q)$). There is a moral cost (c_i) for the detected bureaucrat. The firm, if detected, must sell a high quality product, but is refunded the cost of the bribe, paid to the bureaucrat. If the firm decides to pay the bribe, the expected payoff vector is given by:

$$(3) \quad \underline{\pi}_3 = ((1-q)\pi_h + q\pi_l - (1-q)b, w + (1-q)b - qc_i - T)$$

The game ends in the equilibrium C (Corruption).

In what follows, we refer to the firm payoff by a superscript (1), to the bureaucrat payoff by a superscript (2): they represent respectively the first and the second element of the payoff vector $\underline{\pi}_i$, $i = 1, 2, 3$.

We first determine the equilibrium bribe (b^{NB}) (see *Appendix A* for the proof).

Proposition 2.1. Let $q \neq 1$ ⁴. Then there exists a unique non negative bribe (b^{NB}), as the Nash solution to a bargaining game, given by:

$$(4) \quad b^{NB} = \mu \left[\Delta\pi + \frac{T}{(1-q)} + \frac{qc_i}{(1-q)} \right]$$

⁴ If $q = 1$ this stage of the game is never reached.

where:

$$\mu \equiv \frac{\lambda}{\lambda + \eta}$$

is the share of the surplus that goes to the bureaucrat and η and λ are the parameters that can be interpreted as the bargaining strength measures of the firm and the bureaucrat respectively and where $\Delta\pi = \pi_h - \pi_l$.

As a consequence of the model, let us assume that the bureaucrat and the firm share the surplus on an equal basis. This is the standard Nash case, when $\eta = \lambda = 1$ and the bureaucrat and the firm get equal shares. In this case the bribe is:

$$(5) \quad b^{NB} = \left[\frac{\Delta\pi}{2} + \frac{T}{2(1-q)} + \frac{qc_i}{2(1-q)} \right]$$

In other words, the bribe represents 50 percent of surplus. The payoff vector is given by:

$$(6) \quad \underline{\pi}_3 = \left(\frac{(\pi_h + \pi_l)(1-q)}{2} + q\pi_l - \frac{T}{2} - \frac{qc_i}{2}, w + \frac{\Delta\pi(1-q)}{2} + \frac{T}{2} - \frac{qc_i}{2} \right)$$

Comparative Statics

(1) By analyzing this derivative we observe that:

$$(7) \quad \frac{\partial b^{NB}}{\partial T} = \frac{1}{2(1-q)} > 0$$

Therefore, increasing the transparency's level increases the bribe's level;

(2) And by analyzing:

$$(8) \quad \frac{\partial b^{NB}}{\partial q} = \frac{T + c_i}{2(1-q)^2} > 0$$

Therefore increasing monitoring increases the equilibrium bribe, because the greater bribe serves to compensate the greater risk of being discovered.

By solving the static game, we can prove the following proposition:⁵

Proposition 2.2. Let

$$0 \leq \left(\frac{\Delta\pi(1-q)}{q} - \frac{T}{q} \right) = c_i^* \leq 1. \text{ Then,}$$

(a) if $c_i \in [0, c_i^*]$ the payoff vector is

$$(9) \quad \underline{\pi}_3 = \left(\frac{(\pi_h + \pi_l)(1-q)}{2} + q\pi_l - \frac{T}{2} - \frac{qc_i}{2}, w + \frac{\Delta\pi(1-q)}{2} + \frac{T}{2} - \frac{qc_i}{2} \right)$$

(b) if $c_i \in [c_i^*, 1]$ the payoff vector is

$$(10) \quad \underline{\pi}_1 = (\pi_b, w)$$

Then, once a transparency level equal to T is set:

(a) if $c_i \in [0, c_i^*]$, all the bureaucrats will be corrupt at that level of transparency T . If this condition (equilibrium C) applies, the firm finds it convenient to pay a bribe. The surplus is such as to make up for the expected cost of corruption. Thus the surplus to be shared between the firm and the bureaucrat will keep a negotiation going, whose outcome is the bribe corresponding to the Nash solution to a bargaining game. In this equilibrium all bureaucrats will be corrupt at that level of chosen transparency.

(b) if $c_i \in [c_i^*, 1]$, all the bureaucrats will be honest at that level of transparency T . If this condition (equilibrium NC) applies the difference in profits is not enough to make up for the expected cost of corruption. With this in mind, the bureaucrat will not ask the entrepreneur for a bribe and then all the bureaucrats will be honest and quality will be of a high level.

⁵ See *Appendix B* for the proof.

It follows that, once a transparency level equal to “ T ” is set, if the moral cost of the i -th country c_i is lower than

$$c_i^* = \left(\frac{\Delta\pi(1-q)}{q} - \frac{T}{q} \right)$$

then all the bureaucrats will be corrupt at that level of chosen transparency.

If the moral cost c_i is greater or equal than c_i^* then all the bureaucrats will be honest. Therefore, because all bureaucrats incur the same moral costs, this leads to a corner-solution: either all bureaucrats will be corrupt or they will be honest, depending on the moral cost of a specific country.

One implication of this very simple model is that, for a given level of predisposition to corruption in country i , if the State wants to eradicate corruption it will have to fix a level of transparency so that: $c_i = c_i^*$. Then,

$$(11) \quad T_i^* = (1-q)\Delta\pi - qc_i$$

is the minimum transparency level that country “ i ” – given its predisposition to corruption c_i – will have to put in place to eliminate corruption in procurement. Notice that with great moral costs (a country “innerly honest”) the needed level of transparency in procurement is low and viceversa.

2.2 Transparency with Heterogeneous Moral Costs

In the previous section we have shown that if all bureaucrats incur the same moral costs, this leads to a corner-solution: in fact, once a transparency level equal to T is set, if the moral cost is lower than c_i^* , then all the bureaucrats will be corrupt at that level of transparency; if moral cost c_i is greater or equal than c_i^* then all the bureaucrats will be honest. The corruption level depends on the hypothesis made on the distribution of costs.

That moral costs are equal across bureaucrats is a convenient assumption, but not necessarily a realistic one. For this reason we

introduce the hypothesis that these costs may vary across the various bureaucrats ($c_{i,j}$ the i -th country j -th bureaucrat), reflecting different ethical, moral and religious individual values or denoting a greater or lesser sense of their own impunity.

The cumulative density of probability, defines the distribution of individual costs for the i -th country $F(c_{i,j})$, where " i " is the country and " j " the specific bureaucrat of country " i ". This function represents the proportion of bureaucrats who agree to be corrupted when the transparency level is " T ". If, as we will assume, the distribution of bureaucrats' costs is uniform in the interval $[c_{i,\min}, c_{i,\max}]$, (in a different interval for each country), then the cumulative density function will be:

$$(12) \quad F(c_{i,j}) = \int_{c_{i,\min}}^{c_j} \frac{1}{c_{i,\max} - c_{i,\min}} dc_j = \frac{c_j - c_{i,\min}}{c_{i,\max} - c_{i,\min}}$$

We now solve the model by identifying the optimal level of transparency for country " i ". We then focus on a heuristic cross-country analysis. $F(c_{i,j})$ represents the number of bureaucrats in country " i " that will be corrupt, given a certain level of transparency " T ". Since

$$c_i^* = \left(\frac{\Delta\pi(1-q)}{q} - \frac{T}{q} \right)$$

substituting in (12) we obtain:

$$(13) \quad F(c_{i,j}) = \frac{\frac{\Delta\pi(1-q)}{q} - \frac{T}{q} - c_{i,\min}}{c_{i,\max} - c_{i,\min}}$$

Comparative Statics

(1) By analyzing this derivative we observe that:

$$(14) \quad \frac{\partial F(c_{i,j})}{\partial q} = - \frac{\Delta\pi - T}{(c_{i,\max} - c_{i,\min})q^2} < 0$$

Therefore increasing monitoring reduces the equilibrium level of corruption, because this reduces the potential surplus that the bureaucrat and firm can share, and thus reduce the corruption level. In particular we can demonstrate that the monitoring level that eliminates corruption is:

$$(15) \quad F(c_{i,j}) = 0 \Rightarrow q = \frac{\Delta\pi - T}{\Delta\pi + c_{i,\min}} < 1$$

Then to eradicate corruption a level of monitoring lower than 1 is necessary;

(2) And by analyzing:

$$(16) \quad \frac{\partial F(c_{i,j})}{\partial T} = -\frac{1}{(c_{i,\max} - c_{i,\min})q} < 0$$

Therefore, increasing the transparency' level also reduces the corruption level. If State "i" wanted to eradicate corruption it should fix a level of transparency T_i such that:

$$(17) \quad F(c_{i,j}) = 0 \Rightarrow -\frac{\frac{\Delta\pi(1-q)}{q} - \frac{T}{q} - c_{i,\min}}{c_{i,\max} - c_{i,\min}} = 0$$

i.e. when:

$$(18) \quad T_i^* = \Delta\pi(1 - q) - qc_{i, \min}$$

This level of transparency is necessary to eliminate corruption in country "i". However the State, in fixing transparency "T", beside its benefits must also take into account of the costs deriving from reaching a certain degree of transparency. Let us assume for simplicity that each State will have similar marginal benefit and marginal cost functions from increasing transparency. The marginal benefit is due to the advantage of obtaining a high quality product instead of a low quality product.

Let us assume the marginal benefit $BMA(T)$ to be constant as the value of procurement increases and equal across countries: $BMA = a$. Instead we assume that the marginal cost of transparency increases with transparency. With this assumption we want to capture the standard and partly exogenous structure of public procurement, characterized by some tenders with large values making up large shares of total procurement and a large amount of small tenders with small values: as the value of transparent procurement rises by one unit of value we reach smaller and smaller tenders and as the cost of tenders has a fixed component (e.g. tender committees and publication costs) the marginal cost per unit of value of procurement progressively increases. The loss function of the State in the first stage of the game will be given by:

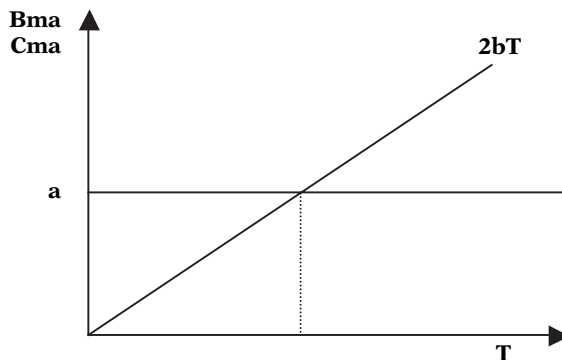
$$(19) \quad L = -aT + bT^2$$

Minimizing with respect to "T" we obtain:

$$(20) \quad \frac{\partial L}{\partial T} = 0 \Rightarrow T^{\circ} = \frac{a}{2b}$$

GRAPH 3

OPTIMAL TRANSPARENCY LEVEL



This figure shows the optimal transparency level. The horizontal line is the marginal cost $BMA=a$, while the positively sloped line is the marginal cost equal to $2bT$.

So each country “i” there will be two relevant values of transparency:

- $T_i^* = (1 - q)\Delta\pi - qc_{i,\min}$

is the specific level of minimum transparency needed to eliminate corruption due to the distribution of bureaucrats’ costs uniform in the interval;

- $T^\circ = \frac{a}{2b}T$

is the optimal level of transparency, assumed equal across countries.

3. - Analysis Cross-Country

In a heuristic fashion, let us consider the implications of this set-up for two countries: country “i”, with a low “inner honesty”, i.e. with, a distribution of bureaucrats’ costs uniform in the interval $[c_{i,\min}, c_{i,\max}]$ and country “k” with higher “inner honesty”, i.e. a distribution of bureaucrats’ costs uniform in the interval $[c_{k,\min}, c_{k,\max}]$ such that $c_{i,\min} < c_{k,\min}$ and $c_{i,\max} < c_{k,\max}$. Assume also that the distributions of moral costs are such that:

- $T_i^* = (1 - q)\Delta\pi - qc_{i,\min} > T^\circ = \frac{a}{2b}$

- $T_k^* = (1 - q)\Delta\pi - qc_{k,\min} < T^\circ = \frac{a}{2b}$

What will emerge is that country “k” with high “inner honesty” will choose a level of transparency of total procurement T_k^* , that will allow the eradication of corruption in procurement. Country “i” will instead not find it convenient to eradicate all corruption

— since $T_i^* > T^\circ$ — and fixing the share of transparent public procurement at $T = T^\circ$ would imply not maximizing total welfare given the costs of transparency. This implies that for country “i” the optimal level of transparency will be T° , even if such a level will not eradicate corruption. A share of bureaucrats, those with a level of moral costs lower than,

$$c^\circ = \left(\frac{\Delta\pi(1-q)}{q} - \frac{T^\circ}{q} \right) = \left(\frac{\Delta\pi(1-q)}{q} - \frac{a}{2bq} \right)$$

will continue to be corrupt.

This simple example shows that in equilibrium what emerges is that a country with greater honesty will fix a level of transparency in its procurement lower than a country that will appear more corrupt, confirming the only apparent paradox shown by the data that less corrupt countries choose to make transparent a lower share of their total procurement through open procedures.

4. - Conclusions

The European Union calls transparency a principle of procurement. It must be a principle to be pursued with pragmatism however, as the same EU Directives allow for different degrees of transparency depending on the size of the tender, recognizing implicitly that transparency has a cost for society. If transparency is costly, then we have shown that countries where corruption is more pervasive and less easy to eradicate will stop short of implementing the level of transparency in procurement that would dissolve corruption. It will however find it beneficial to implement larger transparency in procurement compared to countries with a better track-record for corruption intolerance. If we agree that corruption in procurement plays a large role in influencing total corruption in a country, this leaves one with a final question: how to eradicate corruption if transparency is costly? It is not an easy answer that we might want to leave open. We suggest however,

following the approach taken by other scholars, that other types of transparency might be imagined. Picci (2005) suggests using IT technologies to publish on user-friendly platforms the results of similar tenders across the country so as to allow public procurement stake-holders (including citizens) to monitor contract characteristics across administrations. This best-practice, benchmarking approach may create a strong constituency in the country, able to further raise the cost of corrupt behaviour and thereby reduce corruption. “Voice” and “Public Governance” will thus acquire new power thanks to the quality of specifically tailored e-based solutions.

A APPENDIX**The Nash Bargaining Bribe**

Let $\underline{\pi}_\Delta = \underline{\pi}_4 - \underline{\pi}_3 = \pi_\Delta^{(1)}, \pi_\Delta^{(2)}$ be the vector of the differences in the payoffs between the case of agreement and disagreement about the bribe, between bureaucrat and entrepreneur. In accordance with generalized Nash bargaining theory, the division between two agents will solve:

$$(21) \quad \max_{b \in \mathbb{R}^+} [\pi_\Delta^{(1)\eta}] [\pi_\Delta^{(2)\lambda}]$$

in formula

$$(22) \quad \max_{b \in \mathbb{R}^+} [\Delta\pi(1 - q) - (1 - q)b]^\eta [(1 - q)b - qc_i - T]^\lambda$$

that is the maximum of the product between the elements of $\underline{\pi}_\Delta$ and where $[0, w]$ is the point of disagreement, i.e. the payoffs that the entrepreneur and the bureaucrat respectively would obtain if they did not come to an agreement. The parameters η and λ can be interpreted as measures of bargaining strength. It is now easy to check that the bureaucrat gets a share

$$\mu \equiv \frac{\lambda}{\lambda + \eta}$$

of the surplus, i.e. the bribe is $b = \mu\tau$. More generally μ reflects the distribution of bargaining strength between two agents. Then the bribe b^{NB} is an asymmetric (or generalized) Nash bargaining solution and is given by:

$$(23) \quad b^{NB} = \mu \left[\Delta\pi + \frac{T}{(1 - q)} - \frac{qc_i}{(1 - q)} \right]$$

that is the unique equilibrium bribe in the last subgame $\forall q \neq 1$.

B APPENDIX**Solution to the Static Game**

Backward induction method. The static game is solved with the backward induction method, which allows identification at the equilibria. Starting from stage 3, the entrepreneur needs to decide whether to negotiate with the bureaucrat. Both payoffs are then compared, because the bureaucrat asked for a bribe.

(3) At stage three the entrepreneur negotiates the bribe if, and only if

$$\begin{aligned} \pi_3^{(1)} \geq \pi_2^{(1)} &\Rightarrow \\ \left(q\pi_l + \frac{\pi_l(1-q)}{2} + \frac{\pi_h(1-q)}{2} - \frac{qc}{2} - \frac{T}{2} \right) &\geq \pi_l \Rightarrow \\ (24) \quad c &< \left(\frac{(1-q)\Delta\pi}{q} - \frac{T}{q} \right) = c^* \end{aligned}$$

(2) Going up the decision-making tree, at stage two the bureaucrat decides whether to ask for a positive bribe.

$$\text{Let} \quad c < \left(\frac{(1-q)\Delta\pi}{q} - \frac{T}{q} \right) = c^*$$

then the bureaucrat knows that if he asks for a positive bribe, the entrepreneur will accept the negotiation, and the final bribe will be b^{NB} . Then at stage two, the bureaucrat asks for a bribe if, and only if

$$(25) \quad \pi_3^{(2)} \geq \pi_1^{(2)} \Rightarrow w + \frac{\Delta\pi(1-q)}{2} - \frac{T}{2} - \frac{qc}{2} > w$$

that is the bureaucrat's payoff. If

$$c < \left(\frac{(1-q)\Delta\pi}{q} - \frac{T}{q} \right) = c^*$$

holds, then (18) is always verified. Then, in this case if $c \leq c^*$, then bureaucrat ask for the bribe b^{NB} , that the entrepreneur will accept. The expected payoff vector is given by:

$$(26) \quad \underline{\pi}_3 = \left(\frac{(\pi_h + \pi_l)(1-q)}{2} + q\pi_l - \frac{T}{2} - \frac{qc_i}{2}, w + \frac{\Delta\pi(1-q)}{2} + \frac{T}{2} - \frac{qc_i}{2} \right)$$

The game ends in the equilibrium C (Corruption).

Let

$$c < \left(\frac{(1-q)\Delta\pi}{q} - \frac{T}{q} \right) = c^*$$

then the bureaucrat knows that the entrepreneurs will not accept any possible bribe, so he will be honest and the firm must sell the product at high level quality. The payoff vector for the entrepreneurs and bureaucrats is:

$$(27) \quad \underline{\pi}_1 = (\pi_l, w)$$

The game ends in the equilibrium NC (No Corruption).

(1) At stage one the State fixes the transparency' level T, by minimizing own loss-function.

BIBLIOGRAPHY

- BECKER S.G., «Crime and Punishment: An Economic Approach», *Journal of Political Economy*, no. 76, pages 169-217, 1968.
- KAUFMANN D., *Rethinking Governance. Empirical Lessons Challenge Orthodoxy*, World Bank Institute, paper prepared for the workshop on Corruption: its Consequences and Cures, Stanford University, January 31st-February 1st, 2003.
- —, «Six Questions on the Cost of Corruption with World Bank Institute Global Governance Director Daniel Kaufmann», in *News-The World Bank*, Washington, D.C. 2005.
- LENGWILER Y. - WOLFSTETTER E., «Corruption in Procurement Auction», in DIMITRI N. - PIGA G. - SPAGNOLO G. (eds.), *Handbook of Procurement*, by Cambridge University Press, forthcoming 2006.
- ROSE-ACKERMAN S., «The Economics of Corruption», *Journal of Public Economics*, pages 187-203, 1975.
- —, *Corruption, A Study in Political Economy*, Academic Press, 1978
- —, *Corruption and Government*, Cambridge University Press, 1999.
- SHLEIFER, A. - VISHNY R., «Corruption», *The Quarterly Journal of Economics*, pages 599-617, 1993.

