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The Microeconomics of Corruption: The Classical Approach

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The Microeconomics of Corruption: The Classical Approach*

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1 Introduction

This chapter reviews the classical approach to the microeconomics of corruption. Based on the pioneer work of Gary Becker (1968) and George Stigler (1970) on the economics of crime, Becker and Stigler (1974), Rose-Ackerman (1974, 1978) and Banfield (1975), among others, applied standard economic tools to analyse corruption.

In particular, this chapter focuses on a principal-agent model of corruption. That is, it focuses on the relationship between the principal – the top level of government – and the agent – an official, who is susceptible to taking bribes from private firms interested in supplying the government with a particular good or service. This chapter provides a simplified version of Rose-Ackerman (1974, 1978) to explore the relationship between market structure, government preferences and the likelihood of corruption. As a corollary, it considers the extent to which corruption can be reduced by revising contracting procedures and reorganising market structures.

Although no formal training in economics is required for reading this chapter, the knowledge of economic principles such as demand, supply and market equilibrium is useful.¹ The only analytical tools used are simple algebra and diagrams. There are three types of agents in the stylised economy examined below, namely, a policy-maker, a lower level bureaucrat and firms. The policy-maker is an honest individual who establishes the government's preferences over goods and services that will be procured by the government. The lower level bureaucrat, who is responsible for the purchasing decisions, chooses his actions in order to maximise his expected gains from any dealings which may include bribes. However, the policy-maker monitors the purchasing decisions. The firms

*I thank Robert Albon and Steve Dowrick for many useful comments.

¹There are many outstanding economics principles textbooks that may be helpful to the reader such as Gans, King and Mankiw (1999) and Taylor (1998).

also choose their actions – for example, whether or not to offer a bribe to the official and if so the size of the bribe – to maximise their profits.

Throughout this chapter we consider the case where the goods the government wishes to buy may be potentially provided by many sellers.

2 Government with well-defined preferences

This section assumes that the government has well defined preferences. For example, the government will accept a less preferred alternative only if the price is lower. The likelihood of corruption will depend on how homogenous the goods are and on the existence of private markets where these goods are traded.

2.1 Homogenous goods

Suppose private markets exist and goods are homogeneous. Examples include office supplies, computers, furniture and cleaning services. These products and services are homogeneous in nature and are available in the market place. In this case corruption is unlikely to occur for at least two reasons. First, sellers have no incentive to bribe government officials to sell a good that otherwise would be sold in the market. Second, corruption can be easily detected as it will be apparent that the government paid more than the market price

Now suppose private markets do not exist but goods are still homogeneous. Examples include the construction of a children's playground or a bridge. These goods are homogenous in the sense that they will be built according to a given specification. As the bridge specification is unique, there is no pre-existing price known to all. Thus, the government cannot buy this good in the market place and, therefore, bribery may occur. Firms may try to bribe the government official so that he chooses to buy their goods or services. Nevertheless, bribery may be eliminated if the government uses a tender process in which sealed bids are submitted, the winner is the seller with the lowest bid and bids are made public after the winner is selected.²

2.2 Differentiated goods

Now suppose each seller provides a somewhat differentiated good. Examples include the provision of accounting or word-processing software, the design and

²One still has to determine the price to be paid by the government to the seller with the lowest bid. With a honest auctioneer (i.e., the individual who conducts the tender process) and when the sellers' costs are represented by independent and identically distributed random variables, the pricing rule chosen does not matter. For example, the government's expected price is the same whether it pays the lowest or the second-lowest bid. (Riley and Samuelson, 1981). In particular, the government's expected price is equal to the second-lowest seller's cost. However, if the auctioneer is corrupt then the particular mechanism does matter for the likelihood of bribery occurring (Jones and Menezes, 1995). Moreover, sellers may still collude amongst themselves and force a (honest) government official to pay more than the second-lowest cost (Mailath and Zemsky, 1991).

production of military aircraft or nuclear submarines. If these differentiated goods are available in the market place, as is the case of word-processing software, then corruption is unlikely to occur. The reason is that prices of each word processor are known to all economic agents and the government is able to rank the products in terms of their desirability. Therefore, the existence of bribery would be easily detected from observing whether more has been paid than the price of a preferred product.

Under these circumstances, corruption can only persist if there are special advantages in doing business with the government – such as reputation building or if the government is a large buyer. Again corruption of this type can be eliminated by using a sealed-bid tender process as described in the previous subsection.

On the other hand, if private markets do not exist, then corruption is likely to occur as shown below. For example, although there are general accounting software packages available in the market place, they may not be suitable for use by the government who requires instead the development of a customised package. In this case it is still reasonable to assume that the government has well-defined preferences over distinct features of the software. That is, it is prepared to pay more for more preferable options.³

The assumption is that an honest policy-maker establishes the government's preferences and reviews purchasing decisions, but a lower level bureaucrat makes the purchasing decisions. There are many potential sellers who offer a spectrum of price and quality packages. These goods or services are not available in the market place.

Given that firms have perfect knowledge of the government's preferences, all sellers' offers appear should equally desirable to the government. If one producer clearly dominated the others at the initial offering prices, then the other sellers could be expected to lower prices and raise quality to bring themselves into line with the dominant seller if this can be done without causing financial losses.

Once sellers have made their price-quality offerings equivalent to one another, the contracting official can satisfy the policy-maker by purchasing from any of the competitors because there are no private markets. Thus, firms may attempt to win the contract through bribery. The contracting official is assumed to organise the bribery market by truthfully informing each corrupt firm of the size of the bribe offers he has received.

Denote by b^i the size of the total bribe offered by seller i to the official and by $P^O(b^i) = \frac{b^i}{2}$ the expected penalty to the official. The expected penalty is simply the penalty if caught times the probability of being caught. One possible interpretation of the given expected penalty is that the entire bribe is confiscated if the official is caught and the probability of this event is equal to 50 per cent.

³This assumption may not be reasonable in the purchase of nuclear submarines or military aircraft where preferences over distinct features may be unclear or even not specified at the time of design. The next section examines the situation where the government *does not* have well-specified preferences.

Note that this expected penalty increases with the bribe.⁴

Thus, the expected gain to the official from engaging in corruption, denoted by π^O , is given by:

$$\pi^O(b^i) = b^i - P^O(b^i) = \frac{b^i}{2}$$

The official will accept a bribe if and only if the expected gain from doing so is greater than or equal to zero. Thus, the official will accept any nonnegative bribe.

Let p denote the price per unit offered in equilibrium, q the quantity demanded by the government, T^i i 's total cost of producing q units, and $P^S(b^i) = b^i$ the expected penalty to seller i . One possible interpretation of the given expected penalty is that the seller has to pay a fine equal to twice the value of the bribe if caught and the probability of this event is equal to 50 per cent. Note that this expected penalty also increases with the bribe.

Seller i 's expected profit, denoted by π^i , is given by the difference between total revenue from selling q units at price p and the total cost which includes both production costs and the cost of bribing the official (bribe plus expected penalty). That is,

$$\pi^i(b^i) = pq - T^i - b^i - P^S(b^i) = pq - T^i - 2b^i$$

Seller i is willing to offer a bribe rather than lose the contract as long as i 's expected profits from doing so are greater than or equal to zero:

$$pq - T^i - 2b^i \geq 0$$

That is,

$$b^i \leq \frac{pq - T^i}{2}$$

The maximum feasible bribe from seller i 's point of view is $\frac{pq - T^i}{2}$. Therefore, the firm with the lowest cost can offer the highest bribe and win the contract. But they will not usually have to offer as much as the maximum bribe – they can still win by offering a bribe just fractionally above the second firm's maximum. The actual size of the bribe is somewhere in between the maximum feasible bribe for the winner and the maximum feasible bribe for the firm with the second lowest cost. Let firm 1 have the lowest cost and firm 2 the second lowest cost. In the diagram below the actual size of the bribe is somewhere between $\frac{pq - T^1}{2}$ and $\frac{pq - T^2}{2}$ and it is determined by the relative bargaining

⁴One can argue that the likelihood of detecting bribery increases with the size of the bribe – larger bribes are easier to detect because the official may exhibit signs of wealth or larger banking transactions may attract the attention of the taxation office. In addition, many legal systems impose penalties (fines and jail terms) for corruption that increase with the size of bribes.

power of the official vis-a-vis that of firm 1. Any bribe less or equal to $\frac{pq - T^2}{2}$ cannot be an equilibrium because at this level firm 2 will also be willing to bribe the official in order to win the contract.

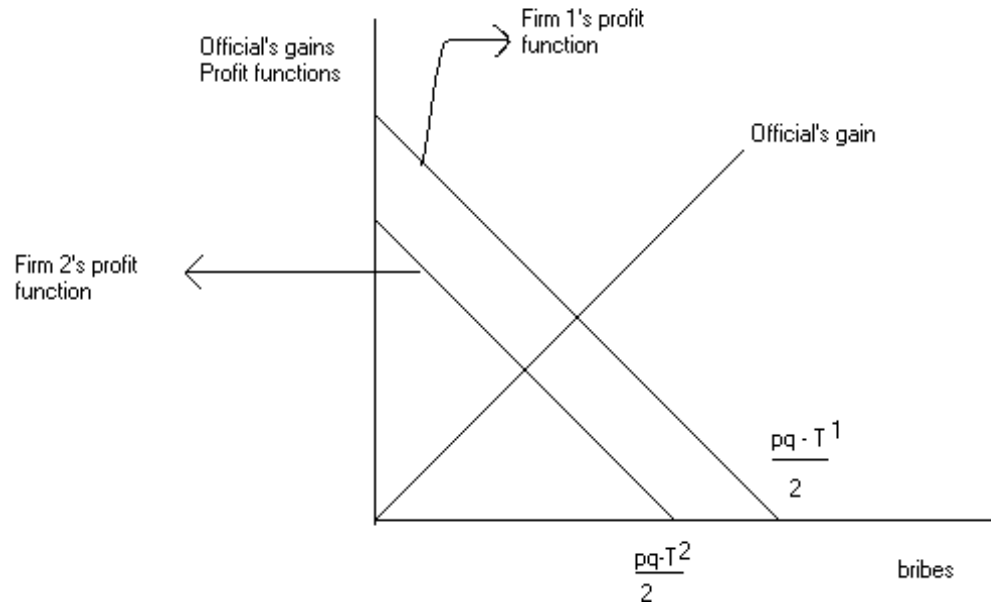


Figure 1: Corruption equilibrium with many sellers

For the bribery market to work as described above we need at least two firms willing to participate. That is, we need $pq - T^2 \geq 0$. Moreover, the resulting allocation is efficient as the contract is won by the firm with the lowest cost.

3 Bribery when Government's preferences are unclear

In this section we explore another reason for bribery to occur. Suppose now that the government is procuring a military training aircraft or the construction of a bridge. It is reasonable to assume that the government's preferences are not well defined. Suspension bridges may be esthetically nicer than the alternative but it is unclear how much more the government should pay for such a bridge. A military training aircraft that can fly very low may be preferred to one that cannot. Again it is not clear how much more the government should be prepared to pay for such a feature.

As in section 3, an honest policy-maker establishes the government's preferences, which are now not well specified, and reviews purchasing decisions. The purchasing decisions are made by a lower level bureaucrat who can engage in corrupt dealings with firms. This official is again assumed to organise the bribery market by informing each seller truthfully of the bribe offers received from other firms. As in the previous section, there are many potential sellers.

In this stylised model, the quality level of the good provided by seller i , denoted by α^i , is fixed but the price charged by seller i , denoted by p^i , can vary. The parameter α^i is assumed to be a number between 0 and 1, where $\alpha^i = 0$ implies that the good is of the worst possible quality and $\alpha^i = 1$ means that the good is of the best possible quality. This parameter can also be interpreted as some feature of the good being procured by the government – in the example of the bridge, α^i could represent the number of lanes or the life expectancy of the bridge provided by firm i .

The expected penalty to the seller is assumed to be

$$P^S(b^i) = p^i(b^i + \frac{p^i}{\alpha^i})$$

That is, an increase in the price charged by firm i or a decrease in the quality provided increases the expected penalty. This increase can occur either because both low quality and expensive goods are more likely to attract the attention of the policy-maker who reviews the purchasing decision or because penalties may be more severe in the case of either lower quality or high price. For example, an official who was proven to have received a bribe on the construction of a bridge that has collapsed because of low quality is more likely to receive a harsher penalty than an official who was caught but whose corrupt dealings did not include procuring a bridge of low quality.

Suppose firm i produces q units of a good of quality α^i , chooses to charge a price p^i and offers a bribe b^i . Then firm i 's expected profit is given by

$$\pi^i(p^i, b^i) = p^i q - T^i - b^i - p^i(b^i + \frac{p^i}{\alpha^i})$$

Firm i 's expected profit is equal to the revenue obtained from selling q units minus production costs and the costs of bribing the government official (bribe

plus expected penalty). For a given price p^i , firm i is willing to offer a bribe b^i as long as $\pi^i(p^i, b^i) \geq 0$. Let the function $(b_0^i, p_0^i)^S$ denote the price-bribe combination that yields zero profits for each firm where

$$b^i \leq \frac{p^i q - T^i - \frac{(p^i)^2}{\alpha^i}}{1 + p^i}$$

The shaded area in figure 2 illustrates all combinations of price p^i and bribe b^i that yield positive profits for firm i . Note that for prices below \bar{p}^i , an increase in the price has to be accompanied by an increase in the bribe in order to keep profits equal to zero. For prices above \bar{p}^i , an increase in prices has to be accompanied by a decrease in the bribe in order to keep profits equal to zero. The value of \bar{p}^i can be obtained by deriving the right hand side of the above expression with respect to \bar{p}^i and setting it equal to zero. This yields $\bar{p}^i = \sqrt{1 + (\alpha^i)^2} + \alpha^i T^i - 1$.

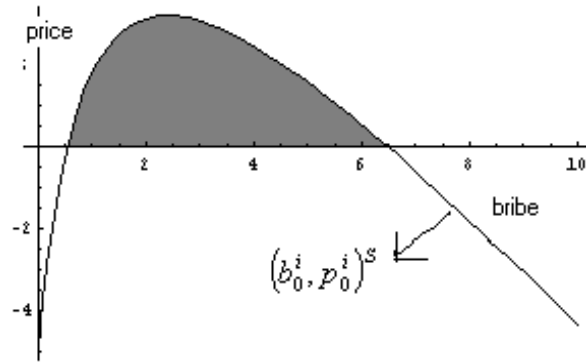


Figure 2: Firm i 's price-bribe combination for $T^i = 5, q = 10$ and $\alpha^i = 0.7$.

The official's expected penalty is also assumed to be an increasing function of the price charged by seller i and a decreasing function of the quality. The justification is the same as above. In particular, the expected penalty to the official is given by

$$P^o(b^i) = p^i \left(\frac{b^i + \frac{1}{\alpha^i}}{20} \right)$$

Given a price p^i charged by firm i , the official's expected gain from receiving a bribe b^i is equal to:

$$\pi^o(b^i, p^i) = b^i - \frac{p^i}{20} \left(b^i + \frac{1}{\alpha^i} \right)$$

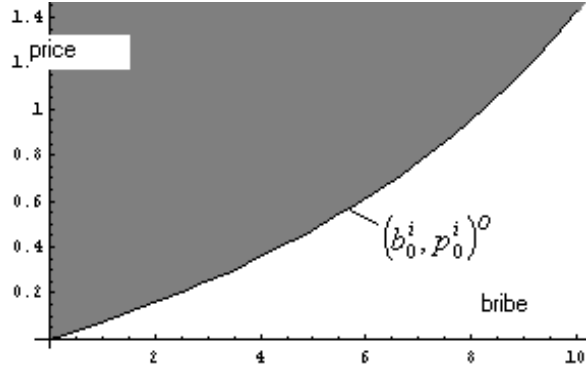


Figure 3: Official's price-bribe combination for $T^i = 5, q = 10$ and $\alpha^i = 0.7$.

For any price p^i , the official accepts a bribe b^i if $\pi^o(b^i, p^i) \geq 0$. Denote by $(b_0^i, p_0^i)^O$ the price-bribe combination that yields at least zero gain for the official where

$$b^i \geq \frac{p^i}{(20 - p^i) \alpha^i}$$

The shaded area in figure 3 indicates all combinations of price p^i and bribe b^i that yield positive profits for the official. Note that for any given p^i , one can find the value of b^i that makes the official indifferent between accepting or rejecting the bribe.

If expected penalties are sufficiently high, bribery is deterred – $(b_0^i, p_0^i)^O$ lies above $(b_0^i, p_0^i)^S$ so mutual gain is impossible. Otherwise, any bribe-price combination satisfying these two inequalities simultaneously is feasible in that both the firm and the official can gain from the transaction. In this case, the firm that wins the contract is the one for which the official's net gain (measured by the distance between the two curves) is the highest. The equilibrium price and bribe combinations are displayed in figure 4 for the case where firm i can offer the official the highest net gain and $T^i = 5, q = 10$ and $\alpha^i = 0.7$.

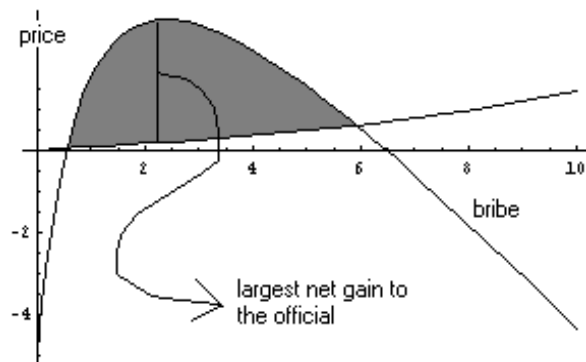


Figure 4: Equilibrium price-bribe combinations when firm i offers the highest net gain to the official and $T^i = 5, q = 10$ and $\alpha^i = 0.7$.

4 Policy Implications

There are several important implications from the above analysis. First, a firm is more likely to win the contract by bribing the official the more efficient it is, i.e. the lower its costs are. Second, firms can also reduce their and the official's expected penalties by offering goods of higher quality. Third, political influences can also play a role. For example, firms may lobby law makers to introduce less severe penalties and to reduce the likelihood of an audit. This could be accomplished by convincing law makers to reduce the appropriation to the government department that conducts the audits. Finally, perhaps the most important implication is that penalties may be ineffective to eliminate bribes unless they are sufficiently large.

The above models assume away several interesting possibilities. First, it was assumed that firms that lose a contract either do not learn of the bribe or fail to report the winning firm to law enforcement officials. However, if a losing contractor does credibly threaten to expose corrupt practices, it is in the winner's interest to propose a cartel in which contractors share in the bribes and the benefits. Whistle-blowing legislation is typically designed to create the right incentives for members of the cartel to report other members' illegal activities. A more complete model would address such possibilities.

The above models also assumed away informational issues. The official may not truthfully inform firms of the bribe offers he has received and may exaggerate their values. If firms think that this is possible, then they may not believe the official's claims. Similarly, a firm's cost may not be known to other firms and to the official resulting in strategic behaviour by all agents. These information asymmetries may cause moral hazard (hidden actions) and adverse selection (hidden information) problems – to use modern economists' parlance. One of the main contributions of economists over the last twenty years is precisely to try to understand how information issues can affect outcomes. In particular,

under information asymmetries, corruption may lead to inefficient outcomes – unlike in the analysis above where the winning firm exhibited the lowest cost. Thus, the analysis above may have underestimated the costs of corruption.⁵

The objective of this chapter was to introduce some of the insights from the classical microeconomic theory of corruption. The underlying message is that the rigorous analytical approach of economists may provide insights to understand the causes of corruption and to help the design of anti-corruption mechanisms. A simplified version of the work of Rose-Ackerman was provided to point out that the amount of corruption discovered is not a function only of the amount of resources devoted to surveillance and law enforcement — there are other economic factors at work. In particular, if the market structure changes from one of the forms more prone to corruption to another in which the incentives for bribery are smaller, pre-existing corrupt relationships are more likely to be uncovered. For example, if a good that was produced exclusively for the government is now sold in private markets, bribery will be easily detected. Similar discoveries may occur when policy-makers can specify their preferences more precisely. For example, by revealing the technical criteria used in the procurement of a certain good, it may become clear that officials paid more for a less preferred object.

This analysis also suggests the wisdom of considering more basic changes in the relationship between government and private sector. When there may be hidden corruption costs involved in buying goods specially for the use of the government, it may be better to purchase standard goods from the market place, despite possible quality loss. If this cannot be avoided, policies should be designed to reduce vagueness in purchasing instructions given to officials and to increase monitoring of purchasing decisions. It should be stressed that although such policies may help to reduce corruption, they may not be able to completely eliminate it unless penalties are very large.

5 Further Reading

The economics literature⁶ on corruption has grown substantially since the seminal work of Banfield, Rose-Ackerman, and Becker and Stigler. Instead of providing a complete list of recent contributions to the literature, I indicate below some representative papers from the different approaches taken by economists.

One issue that has attracted the attention of economists is the relationship between corruption and development. Mauro (1995) provide empirical evidence that corruption lowers investment and consequently lowers economic growth. His work is extended in Mauro (1998) to include cross-country evidence on the link between corruption and the composition of government expenditure.

⁵Shleifer and Vishny (1993) explicitly investigate the effects of corruption on resource allocation.

⁶The recent literature on corruption in the related fields of Sociology and Political Science is not listed here. See, for example, the citations in Alam (1989). There is also a large related literature on tax evasion that is not referenced below. See Chander and Wilde (1992) and the references therein.

Bardhan (1997) provides an excellent survey of the theoretical research on the link between corruption and development. Gray and Kaufmann (1998) and Robinson (1998) provide a more interdisciplinary and policy-oriented view on this link.

A second strand of papers explore the link between market structure and corruption – as in Rose-Ackerman (1974,1978). Examples of papers in this strand include Banerjee (1997), Bliss and Di Tella (1997) and Lui (1996). While Banerjee and Lui associates the existence of corruption to the existence of market distortions, Bliss and Di Tella point out that competition may not necessarily lower corruption in certain industries.

A third stream follows Becker and Stigler (1974) and, for a given market structure, investigates compensation schemes for the bureaucrat that may reduce or eliminate corruption. For example, Mookherjee and Png (1995) propose an optimal compensation policy for a corruptible inspector, charged with monitoring pollution from a factory. Chand and Moene (1997) examine the issue of controlling fiscal corruption by providing incentives to officials. They conclude that simply providing bonuses is not enough.

Finally, there is strand of the literature that examines corruption within an organisation. For example, Kofman and Lawarrée present a model of corruption in an organisation that suggests that external auditing can be better explained by its role in enhancing the independence of internal auditors. Mehmet (1998) examines the more specific problem of the existence of corruption in a public organisation. It is shown that there is a trade-off in the choice of the supervision procedure and penalties: the reduction of individual corruption results in higher risk of organised corruption.

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