Journal of Public Economics 4 (1975) 187–203. © North-Holland Publishing Company

THE ECONOMICS OF CORRUPTION

Susan ROSE-ACKERMAN*

Yale University, New Haven, Conn. 06520, U.S.A.

Received January 1973, revised version received July 1974

This paper considers the relationship between market structure and the incidence of corrupt dealings in the government contracting process. Three cases are analyzed. We first deal with a situation in which government preferences are well-defined and many firms compete for the contract; we then contrast this case with one in which government preferences are 'vague' and finally eliminate the competitive assumption to consider the case of bilateral monopoly. It is then possible to consider the extent to which various criminal sanctions will deter corruption and the degree to which criminal incentives can be reduced by revising contracting procedures and reorganizing market structures.

1. Introduction

Although corrupt behavior can arise in a number of different contexts, its essential aspect is an illegal or unauthorized transfer of money or an in-kind substitute. The person bribed must necessarily be acting as an agent for another individual or organization since the purpose of the bribe is to induce him to place his own interests ahead of the objectives of the organization for which he works.[1] In order to be eligible for a corrupt transaction, the 'bribee' must necessarily be in a position of power, created either by market imperfections or an institutional position which grants him discretionary authority. While this paper concentrates upon the classic relationship in which a private individual attempts to corrupt a government bureaucrat in order to obtain a government contract, the analysis may be generalized to include situations in which 'private, non-governmental' officials are the recipients of bribes and others in which one government bureaucrat bribes another.

The analysis proceeds in three stages. First, we assume the government contracting official can choose from among a large number of sellers each offering products that are either identical or differ in well specified ways from

*The author wishes to thank Robert Inman, Robert Pollak and the referees of this journal for helpful suggestions. Kent Bernard provided the requisite legal research.

[1]Accepting a payoff need not imply that the bribed individual behaves any differently than he would in the absence of corruption. For example, a particular producer might be chosen if no bribes are paid because he is the most efficient and also be selected under a corrupt regime because he is willing to pay the highest bribe.

each other. If the outputs differ, the government is assumed to have a well-defined preference function over the goods offered by different firms so that it will accept a less preferred alternative only if the price is lower. Second, we drop the assumption of a well-defined preference function. Third, the competitive assumption is dropped and the case of bilateral monopoly considered.

In each case, we specify the situations in which bribery is likely to occur and consider the ways in which incentives for corrupt behavior may be controlled. Unlike previous work in the economics of crime [Becker (1968), Stigler (1970)], we will consider the extent to which the organization of private markets and the structure of government programs themselves create incentives for criminal behavior. This broader focus will not only permit us to propose structural changes in the way government deals with suppliers, but allows a more sophisticated analysis of the impact of alternative criminal sanctions. For, as we shall show, an effective law must do more than impose heavy penalties upon the participants to the illicit bargain; so far as firms are concerned, even a heavy fine whose amount is a function of the bribe paid may fail to deter corrupt activity.

2. Many sellers and no vagueness

2.1. No product differentiation

When many sellers compete for a public contract, a bribe can affect two variables – the identity of the seller and the terms on which the sale is made. The impact of corruption on these variables, however, is limited by the care and precision with which the government has delineated its wishes. If the government knows exactly what product it wants and finds a large number of sellers willing to supply it, then corruption can be easily avoided. If a private market for the good exists, and there are no cost advantages in selling large quantities to a single purchaser like the government, the state will simply purchase the good at the private market price.[2] Any deviation can be easily detected, and under a regime of perfect competition sellers have no incentive to bribe the government simply to obtain the contract since they can sell all they wish privately. If no private market exists, bribes can be eliminated by using sealed bids to choose the contractor with the bids made public after the low bidder has been determined.[3]

[2]If selling in large lots to the government is cheaper than selling the product privately, bribery might still occur as sellers compete for the limited but more profitable government business. This case is basically similar to the one involving product differentiation discussed in detail in section 2.2.

[3]Such a procedure, although it eliminates bribery, does leave the way open for collusion if the number of suppliers is relatively small. Since sellers have no private market to fall back on if they lose the government contract, since price is the only means of choosing between products, and since each contract may represent a large share of the firm's business, sellers will have a high incentive to collude both to fix prices and divide the market.

2.2. Product differentiation

Suppose, now, that the government wishes to purchase a good in a market where there are many sellers but that each provides a somewhat different product. Once again if a private market exists, sellers will have no incentive to bribe unless there are cost advantages in government business. However, when the cost savings of government business are substantial or when the goods are never sold in private markets, corruption becomes a possibility.

To begin the analysis, it is necessary to specify the rules under which government contracting officials operate. Imagine, then, that a high-level policymaker defines the state's preference function over the available alternatives. Assume that the policymaker discharges this task perfectly, and specifies the relative prices that must prevail if the government is to be indifferent between the competing products. Having discharged this task, the job of negotiating a contract is delegated to a lower level bureaucrat whose purchasing decision will later be reviewed by the policymaker.

If firms have perfect knowledge of the state's preference function, one would expect suppliers to offer a spectrum of price and quality packages which all appear equally desirable to the government. If one producer clearly dominated the others at the initial offering prices, the other sellers could be expected to lower prices or raise quality to bring themselves into line with the dominant seller if this can be done without causing losses.

Once the sellers have made their price–quality offerings equivalent to one another, the contracting official can satisfy the policymaker by making a deal with any of the competitors. Thus, firms may attempt to win the contract through bribery. The contracting official, in turn, is assumed to organize the bribery market by truthfully informing each corrupt firm of the size of the bribe offers he has received.

Given this framework, it is possible to develop a model determining the conditions under which bribes will occur and the manner in which their level will be set.[4]

Let

G = gain to official in dollars,

π_i = profit of seller i in dollars;

and

$$G(X^i) = X^i - J(X^i) - R(X^i), \tag{1}$$

$$\pi_i(X^i) = P^i q - T^i - X^i - D^i(X^i) - N^i(X^i), \tag{2}$$

[4]This model draws upon Becker's (1968) analysis of crime in general. In the remainder of the paper we shall assume that there is no distinction between the seller's gains and losses and the gains and losses of the firm's representative in bargaining with the government. A fuller treatment would, however, include the agency relationship between the firm and its representatives and set out the penalties, moral costs, and rewards from bribery for managers, agents, and corporations. Clearly the firm is free to organize itself in ways that makes bribery more or less attractive to its agents.

where

X^i = size of total bribe paid by seller i,

P^i = price per unit of seller i's product,

q = quantity demanded by government (assumed given),

$J(X^i)$ = expected penalty to official, $J' \geqq 0$,

$R(X^i)$ = moral cost in dollar terms to official of accepting a bribe of X^i dollars, $R' \geqq 0$,

T^i = total cost of producing q units for seller i,

$D^i(X^i)$ = expected penalty to seller, $D' \geqq 0$,

$N^i(X^i)$ = moral cost in dollar terms to seller i of making a bribe of X^i dollars, $N' \geqq 0$.

The variable $J(X^i)$, representing the official's expected penalty, can be determined by multiplying the average penalty levied upon conviction by the joint probability of arrest and conviction.[5] An analogous procedure could be used to define the seller's expected penalty $D^i(X^i)$.

The set of bribes acceptable to the official includes all those such that $X \geqq J(X)+R(X)$. Four cases are considered here. (1) No bribes are acceptable. (2) All bribes are acceptable because, for example, $J'+R' < 1$ and $J(0)+R(0) = 0$. (3) All bribes *less* than some maximum will be acceptable but anything larger will fail because marginal moral costs and/or marginal expected penalties increase as X increases. (4) Bribes greater than or equal to some minimum bribe will be acceptable because, for example,

$$(J_{xx}+R_{xx}) \leqq 0, \quad \text{and} \quad J(0)+R(0) \geqq 0.$$

Consider, first, the more likely case (4), where any bribe greater than some $X_{\min}$ is acceptable. If several firms are willing to bribe and each firm's selling price, P^i, and product characteristics are fixed, each supplier has a feasible set of bribes that it will pay rather than lose the contract. This set includes all X^i such that:

$$X^i \leqq P^i q - T^i - D^i(X^i) - N^i(X^i). \tag{3}$$

Thus, in order for any bribe to be feasible, it is necessary for $P^i q - T^i > 0$. This means that, unless every firm in the market is corrupt, the potentially corrupt firm must be earning excess profits either because it is more efficient than the

[5]If penalties include jail terms, then both moral costs and penalties ought formally to be expressed as losses of utility not dollars. The formal condition permitting the use of dollars in our equations is a constant marginal utility of money for the individual involved so that the rate at which utility is translated into dollars is not affected by wealth. If officials and sellers are not risk neutral, the expected values could be translated into certainty equivalents.

marginal firm or because barriers to entry generate monopoly profits for all firms. For every seller i we can now find the maximum feasible bribe: X_0^i, where equality holds in (3). If $\max_i[X_0^i] = X_0^m \geqq X_{\min}$, then firm m will get the contract. Firm m may not, however, actually have to pay X_0^m. Instead, a bidding process can be expected to occur with the actual bribe paid falling between X_0^m and X_0^{m-1}.

If we assume that the expected penalty does not vary between firms, the successful firm will be the one with the largest gap between revenue and the sum of production and moral costs at X_0^i. Since production costs and moral costs are treated in a parallel fashion, the size of the maximum bribe a firm is willing to pay can fall either because production costs rise or a management reshuffle elevates more scrupulous executives.

Since cases (1) and (2) are trivial, consider, finally, the operation of the bribery 'market' when case (3) holds. The case might prevail, for instance, if larger bribes are easier to detect than smaller bribes or if the penalty levied upon conviction is an increasing function of X. The payoff, $\bar{X}$, that maximizes the official's gain, occurs where $1 = J_x + R_x$. If several suppliers are willing to offer bribes at least as great as $\bar{X}$, then corruption will not solve the official's decision-making problem. He still must determine which of the competing corrupt firms should receive the contract.

3. Many sellers and vagueness

3.1. The basic model

Since we have thus far assumed the existence of a well-defined government preference function, a contracting official induced by a bribe to accept a price–quality combination ranked lower than that offered by another seller is certain to be punished.[6] Since this is unrealistic, assume that preferences expressed in government regulations are not precisely defined so that if a firm increases its price or reduces its quality it merely increases the probability of punishment for both government official and private seller. While firms produce goods with varying quality levels, Y^i, our model does not permit them to change Y^i. This simplification does not limit the analysis substantially – allowing price to vary for a given quality is essentially identical to allowing quality to vary at a given price.[7] Thus,

[6]Of course, even with well defined preferences, an official might escape punishment if his superiors conclude that he is incompetent rather than corrupt and reprimand him or give him further training.

[7]Dealing with quality changes is more complicated than dealing with price changes because of the difficulty of specifying the units of measurement and the fact that the production function for quality, $T^i(Y^i)$, can vary between firms. Nevertheless, since the basic conclusions reached in this section would appear to carry over to the case where both P^i and Y^i are permitted to vary, this more complex case will not be treated separately.

$$J = J(P^i, Y^i, X^i), \quad J_p \geqq 0, \quad J_y \leqq 0, \quad J_x \geqq 0, \quad J(0, Y^i, X^i) = 0, \tag{4}$$

$$D^i = D^i(P^i, Y^i, X^i), \quad D_p \geqq 0, \quad D_y \leqq 0, \quad D_x \geqq 0, \quad D^i(0, Y^i, X^i) = 0. \tag{5}$$

It is now possible that firms will be willing to bribe even if they earn zero excess profits in the absence of bribery, because the higher prices they receive may overcome the additional moral and arrest costs.

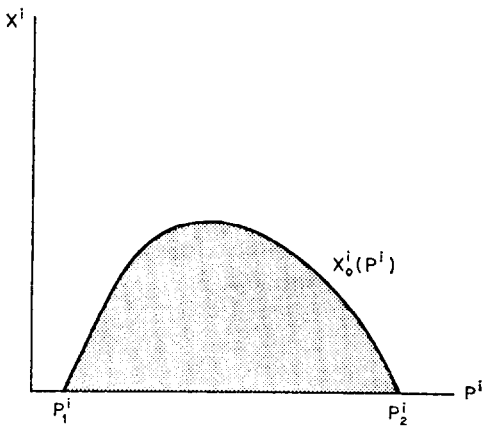

Fig. 1

Assuming that each firm i has a different fixed Y^i and that each can vary P^i, then for any firm i the feasible set of bribes includes those for which total 'profits' are greater than or equal to zero,

$$0 \leqq P^i q - T^i - X^i - D^i(P^i, Y^i, X^i) - N^i(X^i). \tag{6}$$

Letting the function $X_0^i(P^i)$ represent the price–bribe combinations that yield zero profits for each firm, the shaded area and the function $X_0^i(P^i)$ in fig. 1 represent one possible form for a firm's feasible set.

Under competitive assumptions where firms operate independently, we can determine which firm will make the winning bribe by a three stage analysis. First we must determine the form of the function $X_0^i(P^i)$ for each i. Second, we must specify the price–bribe combination for each firm that maximizes the official's net gain, $G^i_{\max}$, subject to the relationship between X^i and P^i when profits to the firm equal zero, where

$$G^i = X^i - J(P^i, Y^i, X^i) - R(X^i). \tag{7}$$

Third, the official must choose the firm where the gain is the greatest, G_{max}. If there is no time limit on reaching a final bargain, firm i does not need to know G^i_{max} in order to bribe the official. It can instead experiment with various price–bribe combinations provided it receives information on the preferred price–bribe–quality offers made by other firms. Eventually, this trial and error process can be expected to produce the gain maximizing offer. If, alternatively, firms are operating within a time constraint, their ignorance of the official's preferences could prevent the attainment of G_{max}.

We begin the analysis by specifying two plausible penalty functions for the firm and two for the official. We then demonstrate that, under these partial equilibrium assumptions, it is sometimes possible for a firm to be willing to tender an infinite bribe and for an official to prefer this outcome to all others. Having isolated the cases in which a finite bribe will be offered and accepted, we then consider the characteristics of firms that will make them likely to be the successful briber.

3.2. *Two penalty functions for the firm*

In this section we will consider firm behavior, if, on the one hand, the expected penalty is concave and increasing in P^i, i.e., $D_p \geqq 0$, $D_{pp} < 0$ (case 1) or, on the other hand, the firm's penalty is convex and increasing in P^i (case 2). Case 1 is consistent with a sanctioning strategy under which the penalty upon conviction is solely a function of the size of the bribe paid and the probability of conviction is a concave function of the firm's revenues. Alternatively, case 2 describes a situation in which the penalty imposed is an increasing, convex function of the revenues earned by the firm, and the probability of arrest and conviction is independent of the firm's revenue either directly or through the penalty levied upon conviction. We shall show that when the penalty depends on the size of the bribe (case 1), it may be wholly ineffective in reducing or preventing bribery even when the probability of arrest is close to one. On the other hand, if the firm's penalty upon conviction depends upon the revenue it earns (case 2), a determinate finite solution always exists which may, of course, occur at $X^i = 0$.

(a) *Case 1.* To assess the impact of our first penalty function, it is necessary to specify the way in which the firm's maximum bribe changes as P^i changes. Assuming that moral costs are constant at $\bar{N}$, and differentiating X^i_0 with respect to P^i, omitting the superscript i and the subscript 0, we obtain

$$\frac{\mathrm{d}X}{\mathrm{d}P} = \frac{q - D_p}{1 + D_x}. \tag{8}$$

Eq. (8) reaches an extremum at $q = D_p$. The second derivative of (8) is

$$\frac{\mathrm{d}^2 X}{\mathrm{d}P^2} = \frac{-D_{pp}(1+D_x)-(q-D_p)D_{xp}}{(1+D_x)^2}. \tag{9}$$

Since $q = D_p$ at the extremum, $\mathrm{d}^2X/\mathrm{d}P^2 > 0$ if $D_{pp} < 0$.

Thus, in case 1, the maximum feasible bribe as a function of P reaches a minimum when $q = D_p$ and rises thereafter. Beyond the minimum $\mathrm{d}X/\mathrm{d}P > 0$, and, in addition, $\mathrm{d}^2X/\mathrm{d}P^2 \gtreqless 0$ as $-D_{pp}(1+D_x) \lesseqgtr (q-D_p)D_{xp}$. Since we would expect D_{xp} to be positive, both sides of the inequality are positive, and $\mathrm{d}^2X/\mathrm{d}P^2$ can be $\gtreqless 0$. It is therefore possible that the maximum X acceptable to the firm might go to infinity as P goes to infinity if $\mathrm{d}^2X/\mathrm{d}P^2$ is positive for all P greater than some $\bar{P}$. If the official will also accept infinite bribes, there will be no finite solution to the problem of finding the X^i that maximizes G^i. From a general equilibrium perspective, of course, such an 'infinite solution' cannot exist since society's resources are finite. Instead we should understand this case simply as one in which the legal sanctions themselves do not determine the solution.

(b) *Case 2.* When the firm's marginal expected penalty rises as P^i (or revenue) rises, $D_{pp} > 0$, then the function X_0^i reaches a finite maximum. Assuming that $D(X^i, P^i) = 0$ when $P^i = 0$ and that X_0^i is positive for some P^* and negative for some $P^{**} > P^*$, then the maximum bribe at $q = D_p$ is positive and the function $X_0^i(P^i)$ is a single-peaked function like the one illustrated in fig. 1.

3.3. *Two penalty functions for the official and the equilibrium bribe*

In framing penalty functions for the official we shall attempt to isolate those situations under which infinite bribes will be acceptable and compare them with others in which the official's gain is maximized for a finite bribe. The important cases are, first, those where the marginal penalty with respect to X is less than one ($J_x < 1$) even for very high prices (case A) and second, those where $J_x \geqq 1$ for all P greater then some $\hat{P}$ (case B). In both cases we assume $J = 0$ for $P = 0$, $J_p \geqq 0$, and $J_{pp} \leqq 0$. Case A can occur when legal penalties for convicted officials are independent of the size of the bribe paid while the probability of arrest depends only upon the price at which the contract is negotiated. Case B is consistent with a legal regime that levies penalties upon conviction that are at least equal to the bribes received. Since it seems most realistic, we assume in both cases that the penalty upon conviction is independent of P which implies that $J_p \to 0$ as $P \to \infty$ and the probability of conviction approaches one.

Assuming constant moral costs, $\bar{R}$, and differentiating (7) with respect to P, we obtain

$$\frac{\mathrm{d}G}{\mathrm{d}P} = \frac{\mathrm{d}X}{\mathrm{d}P}(1-J_x)-J_p. \tag{10}$$

When case 2 holds, X_0^i reaches a finite maximum for firm i, and G must also be maximized for some finite P and X since the firm will never wish to offer infinite bribes in return for infinite prices. The form of J_x is irrelevant. (See fig. 2.) However, when case 1 holds, the form of J_x becomes crucial. If case A holds, the

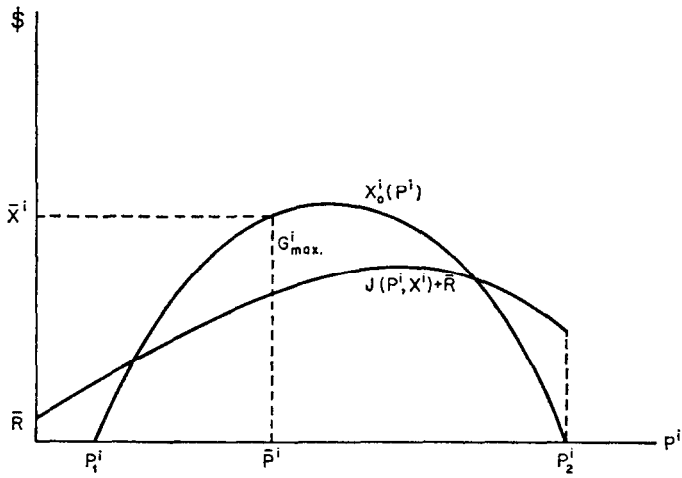

Fig. 2

gross marginal return from agreeing to a higher price dX/dP will be greater than the marginal cost of accepting the bribe $[J_x(dX/dP)+J_p]$ beyond some P, if $J_p \to 0$ as $P \to \infty$ (fig. 3a).[8] Hence infinite prices will be preferred by both firm and official, and if $d^2X/dP^2 > 0$, infinite bribes will be desired as well. When case B holds, as P increases, $dG/dP < 0$ beyond some P since $J_p \to 0$ and $J_x \geqq 1$ as $P \to \infty$. Neither infinite prices nor infinite bribes will ever be acceptable to the official whatever the sign of d^2X/dP^2 (fig. 3b).

In short, legal remedies may be wholly ineffective in combatting corruption. The conditions for an infinite solution, however, are asymmetrical in the sense that the penalty levied on a convicted firm must be independent of the firm's *revenues* (case 1) while the official's penalty must be independent of his *bribery receipts* (case A). If penalties on both firms and officials depend on the level either of firm revenues or of bribes, finite fines can prevent corruption. Even when legal sanctions are tied to the gains of firms and officials, however, stiff penalties may be ineffective in eliminating corruption if the probability of arrest and conviction depends negatively upon the severity of the punishment. Increases in legal penalties may lower the probability of arrest and conviction so much that

[8]Of course, if the penalty upon conviction should depend upon P so that J_P is greater than $(1-J_X)(dX/dP)$, G will reach a finite maximum in this case as well.

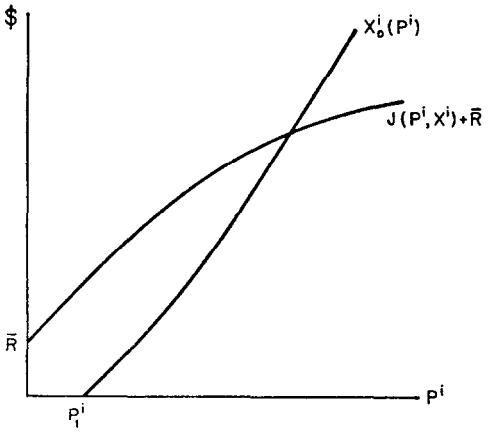

Fig. 3a

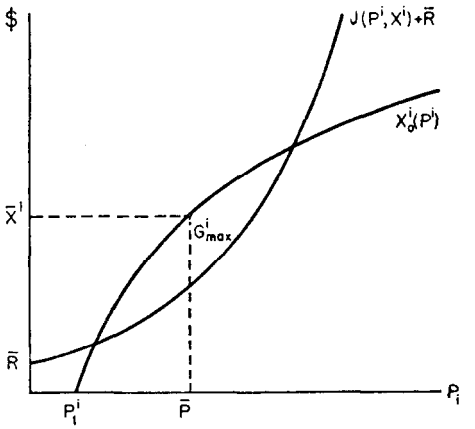

Fig. 3b

$J_x < 1$ for all X (case A) and $D_{pp} < 0$ for all P (case 1) even though the penalties actually levied upon conviction, $H(X)$ for officials and $K^i(P)$ for firms, have been chosen so $H_x \geqq 1$ and $K_{pp} < 0$.

3.3.1. Determining the identity of the successful corrupt firm

If expected penalties are not so high as to completely deter bribery, the firm that wins the contract is the one for which G^i_{max} is the greatest. Given our analysis, conditions that favor success are high efficiency (low T^i), few moral scruples (low N^i) and political influence which makes heavy punishment less likely. Similarly, corrupt firms producing high quality products are more likely to obtain the contract. In terms of figs. 2 and 3, an increase in quality, everything

else held constant, will raise $X^i(P^i)$ through the fall in $D(P^i, X^i)$ and lower $J(P^i, X^i)$ through the fall in the probability of detection at every price. Furthermore, if bribes are not paid as kickbacks out of revenue, the financial capacity of firms will not only determine G^i_{max} when no finite solution would otherwise exist but can also constrain the results in the other cases as well. A firm that would be able to make the winning bribe in the absence of any financial constraints may, in fact, lose because of 'imperfections' in the capital market. Finally, the impact of punishment upon future business must be explicitly considered as an element of D^i. If the firm is solely engaged in selling goods or services to the government, a conviction may lead to blacklisting by government agencies. In contrast a firm with a mixed public and private business can turn its energies to the private sector. In a perfectly competitive private market, all products are homogeneous and sold at a constant price; hence the identity of the seller is irrelevant. If, however, products are sold by brand name or if private sales depend upon a reputation for honesty, a conviction could seriously hurt non-governmental business as well.

3.3.2. The need for empirical work

Having shown that a penalty strategy based upon cases 1 and A may be ineffective in reducing bribery compared with the other possibilities examined, we turn to consider briefly the extent to which federal law in the United States incorporates these penalty functions. So far as corrupt government officials are concerned, statutes permit, but do not require, the judge to impose a fine which is a function of the size of the bribe.[9] While policy B thus is possible under federal law, empirical research is required to determine the extent to which policy B is actually carried out in practice. So far as the corrupt firm is concerned, penalty policy seems less satisfactory. While the statutes permit the government to deprive the firm of any of the excess profits it earned from the corrupt transaction, this provision cannot by itself deter bribery since the corrupt firm can never do worse than break even.[10] In addition, however, the firm also

[9]United States Code, vol. 18, sec. 201, par. (e), 1962, provides that the penalty for 'corrupt giving' shall be a fine of 'not more than $20,000 or three times the monetary equivalent of the thing of value, whichever is greater, or imprisonment for not more than fifteen years, or both . . .' Furthermore, United States Code, vol. 18, sec. 3612, 1949, provides that if the bribe itself can be recovered, it shall be deposited in the registry of the court. Therefore, the briber could be penalized an amount equal to *four* times the bribe. The judge, however, is not required to tie the fine to the size of the bribe, and the second part of the penalty, the jail term, is not tied by statute to the size of the bribe. Furthermore, there is a second statute, United States Code, vol. 18, sec. 203, para. (b), 1962, that provides that a briber 'shall be fined not more than $10,000 or imprisoned for not more than two years or both . . .' This second statute contains no provision for tying the fine to the size of the bribe although it does not, of course, explicitly prevent it.

[10]United States Code, vol. 18, sec. 218, 1962. Of course, if jail terms are imposed or extra-legal costs are important, the deterrent effects would be greater.

is subject to a penalty which can be a function of the size of the bribe it pays.[11] Such a penalty strategy is equivalent to policy 1 considered previously, rather than policy 2, which is to be preferred. Once again, however, empirical research is needed to determine the kinds of penalties actually imposed in practice.

3.3.3. The stability of a competitive bribery market

The preceding analysis assumed a stable bribery market in which firms that lose a contract either do not learn of the bribe or fail to report the winning firm to law enforcement officials. While an honest firm obviously has an incentive both to search out and report corrupt transactions, the problem is more complex for a firm that offers a bribe that is refused. Despite the loss of an individual contract, it may be profitable to refrain from discovering and reporting the corrupt transaction, if the firm hopes to win future contracts by means of bribery. The incentive to remain silent is increased, moreover, by the fact that the criminal law imposes sanctions upon those who attempt to bribe officials, regardless of their success.

If, however, 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. Taken to its extreme, the competitive case analyzed in this section could thus be reduced to the bilateral monopoly problem to which we now turn.

4. Bilateral monopoly

When only a single buyer and seller bargain without recourse to bribery, the range of indeterminancy in the price and quantity sold depends upon the ground rules under which the contract is negotiated. Under certain conditions the quantity sold will not be in doubt but only the division of the surplus, i.e., the price per unit. In particular, agreement on quantity can be expected when the participants see both price and quantity as negotiable.[12] In this context, the price per unit can vary between the minimum price the seller can receive and still cover costs and the maximum the government will pay rather than do without the good entirely. The efficacy of bribery depends upon the relative bargaining strength of the participants in the absence of payoffs. If the seller believes that he can appropriate most of the surplus 'fairly' he is unlikely to engage in corruption. To analyze this point rigorously, however, it is necessary to develop a workable definition of bargaining strength for use in a formal model.

[11]The penalties cited in footnote 9 for the giver of a bribe under sec. 201 and sec. 203 also apply to the receiver of a bribe as well.

[12]See Machlup and Taber (1960), Henderson (1940), and Fellner (1947). The alternative case in which buyer and seller both believe that only price is under their control is discussed by Mansfield (1970, pp. 270–272).

Cross (1969) provides a paradigm of the bargaining process which will serve as our point of departure. Cross's most important contribution is his explicit consideration of the passage of time in measuring 'bargaining strength'.[13] Suppose that the total surplus to be divided is M dollars and that the initial demands of the two participants are Z_1 and Z_2 dollars respectively.[14] If $Z_1+Z_2 > M$ then one or both of the participants must modify his demands to achieve an allocation of M between them. Since each participant is free to choose any level of initial demand, the problem each faces is to set Z_i so as to maximize the present value of the return he actually receives. Letting player 1 represent the entrepreneur, we shall examine his behavior under normal profit maximizing assumptions. Assume that a delay of one period in reaching agreement costs the firm C_1 dollars and, of course, delays the receipt of any gains by one period. On the other hand, player 1 will benefit from a delay because he expects that if he waits an additional period, player 2, the government official, will reduce his demands by r_2. The concession rate, r_2, is thus a measure of the government contracting official's bargaining strength: the lower is r_2, the stronger is the official's position. Given the official's initial demand Z_2, the time required until a demand of Z_1 can be satisfied is $w = (Z_1+Z_2-M)/r_2$. Assuming continuous discounting at rate a, the total present value of player 1's insistence on Z_1 is

$$U_1^* = Z_1 e^{-aw} - \int_0^w C_1 e^{-at} dt. \tag{11}$$

Eq. (11) reaches a maximum with respect to Z_1, where

$$\left[Z_1 + \frac{C_1}{a}\right]\frac{a}{r_2} = 1 \qquad \left(\text{at this point } (U_1^*)'' = \frac{-a}{r_2} e^{-aw} < 0\right). \tag{12}$$

If the second player does not concede at the expected rate, then player 1 will modify his demands over time. In Cross's work, players react to changes in each other's rates of concession but do not try to influence these concession rates directly. The possibility of corrupting one's opponent is not discussed,[15] but Cross's model can be extended to include this case by assuming that corruption can be used to raise the official's concession rate, r_2.[16] The government official is assumed here to be a passive recipient of the bribe. His concession rate is affected by the size of the bribe offered, but he does not try either to hold out for a higher bribe than the seller offers, or to bribe the entrepreneur to raise his concession rate.

[13]The discussion that follows is based on Cross (1969, pp. 42–64).

[14]Cross's initial analysis is in terms of utility not dollars. See footnote 5 for a discussion of the assumptions behind the use of dollar values.

[15]Cross (1969, pp. 120–180) does discuss other bargaining strategies such as the use of force, threats, promises, dirty tricks and bluffs.

[16]One might also think of bribery as being used to lower the initial demand, Z_2, made by the government. Since the end result would be the same, i.e., a higher return, Z_1, and a shorter bargaining time, w, this case will not be analyzed separately.

Assuming that the total cost to player 1 (the entrepreneur) associated with making a bribe of X is $g(X)$, the present value of his total return is

$$V_1^*(X) = U_1^*(X) - g^*(X), \tag{13}$$

where the bribe is offered in the present but actually paid at the time of agreement so that $g^*(X) = g(X)e^{-aw}$. The firm is, of course, only interested in the net gain that bribery can bring over the maximum return when $X = 0$, or max $[U_1^*(0), V_1^*(\bar{X})]$, where $\bar{X}$ is the bribe that maximizes (13).

The optimal level of X to the firm can be found by first determining the optimal level of Z_1 given any particular bribe, second, choosing the bribe, $\bar{X}$, that maximizes gain, V_1^* and third, determining whether or not $V_1^*(\bar{X}) - U_1^*(0) > 0$. The first part of this decision problem is solved by maximizing V with respect to Z_1, given any fixed X, where

$$V^*(X) = [Z_1(X) - g(X)]e^{-aw(X)} + \frac{C_1}{a}\, e^{-aw(X)} - \frac{C_1}{a}. \tag{14}$$

The maximum occurs at

$$\frac{r_2(X)}{a} = Z_1(X) - g(X) + \frac{C_1}{a}. \tag{15}$$

Since (15) must hold for each X, the second part of the decision problem can be solved by substituting (15) into (14) and maximizing (14) with respect to X. This operation yields

$$g'(X) = w(X)r_2'(X), \tag{16}$$

which determines the gain maximizing bribe so long as the second derivative is negative.

Fig. 4 illustrates a possible situation where a bribe of $\bar{X}$ dollars satisfies (16). We have assumed that $g'(X)$ falls as X increases, approaching B as a limit where $B \geqq 1$. Assuming $g(X) = X + D(Z_1, X, Y) + N(X)$ (using the notat on of sections 2 and 3), such a shape is consistent with the assumption that $D_x + N_x > 0$ and $D_{xx} + N_{xx} < 0$. In fig. 4, $w(X)r_2'(X)$ is zero for $X \leqq F$ where F equals the fixed costs of bribery to the government official.[17] Beyond F, $r_2(X)$ is assumed to rise but at a steadily declining rate.[18] Since $w(X)$ also falls as the size of the

[17] In the notation of sections 2 and 3 either moral costs are constant, $\bar{R}$, or J is independent of P^i.

[18] The less knowledge the government has about the return that it can expect in the absence of corruption, the less likely is either compensation or arrest to be tied closely to the size of the government's return, $M - Z_1$, and hence the more likely is an official to lower r_2 rapidly as X increases.

bribe increases, the whole expression $w(X)\, r_2'(X)$ falls. Given these conditions, if $g'(F) < w(F)\, r_2'(F)$, (16) will hold for some positive $\bar{X}$.

Once $\bar{X}$ has been determined, the final task for the private contractor is to compare his returns at $\bar{X}$ with his returns at $X = 0$. While many of the factors that make bribery likely here are also those that determine the size of the successful bribe in the case of many sellers, one distinctive aspect of the problem must be considered separately. Since we have assumed that the total surplus to be divided is fixed at M, the level of return when $X = 0$ has an important relationship to the incremental benefit of bribery. If the contractor's bargaining costs and his rate of time preference are high relative to the corresponding variables for the government official, bribes will, ceteris paribus, yield higher incremental

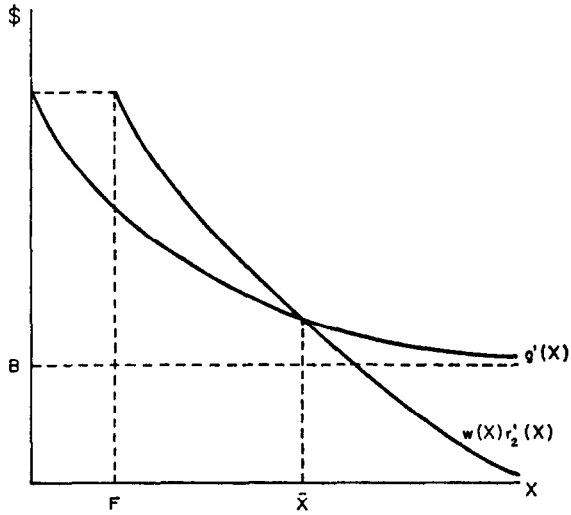

Fig. 4

gains than if C_1/C_2 and a_1/a_2 are low. In short, bribes are likely to be attractive to the firm when it finds waiting costly while the government contacting official does not, either because the project is not of urgent importance or because the government has some legal tool that, if used, can effectively hold down contract cost.[19]

[19]For example, when the government announces that a particular area will be subject to urban renewal at a specified future time, the honest government official will never buy sites offered for sale at a price higher than the discounted present value of the price expected to emerge from a condemnation proceeding. His r_2 is low while the landowner will have a high r_1 since the property has little use as an income earning investment. Thus there is a strong incentive for the landowner to pay a bribe to induce the government official to agree quickly to a price favorable to the owner. Incentives for corruption are increased by the difficulty with which third parties can assess the price a court would have awarded the landowner in a condemnation proceeding.

5. Policy implications

Our analysis serves to pinpoint the areas in which significant resources should be devoted to continuing surveillance and criminal prosecution. Moreover, it suggests that the amount of corruption discovered will not merely be a function of the amount of resources devoted to surveillance and law enforcement. More fundamental factors are at work: if the market structure changes from one of the forms we have shown to be especially conducive to dishonesty to another in which the incentives for bribery are more limited or non-existent, pre-existing corrupt relationships are likely to be uncovered.[20] Similar discoveries may occur when government policy-makers succeed in specifying their preferences more precisely and it is found that the price of the product falls substantially.

The analysis also suggests the wisdom of considering more basic changes in the relationship between government and the private sector. First, we have shown that when the government purchases a good also sold on the private market, the incentives for bribery are substantially less than those obtaining when government is the sole purchaser. Thus, when policy-makers recognize that there can be hidden corruption costs involved in ordering goods especially for state use, it may often appear that the purchase of standard items sold on private markets will be justified despite some quality loss. Since corruption costs can seldom be accurately assessed, however, the extent to which government purchasing policy should favor goods generally available in the private market must be left to 'good judgment' informed by the factors previously discussed. Second, when goods must be ordered especially for government use, policies should be designed to reduce vagueness in purchasing instructions given to officials, thereby reducing the costs of effective surveillance and increasing the probability of detection of serious peculation. Unfortunately, neither of these strategies will prove feasible in every case – the private demand for spaceships is currently non-existent and research contracts are necessarily vague as to outputs. This leads us to consider a third policy option: instead of purchasing the ill-defined good from private enterprise, direct government production may be considered.[21] Under this strategy, the state firm will enter the market only to purchase standardized inputs, thereby minimizing the incentives for private businessmen to pay bribes out of their excess profits. Of course, corruption is not limited to transactions involving private individuals. If the managers of state owned firms are compensated on the basis of the 'profitability' of their enterprise, the same incentives for bribery will exist as in private corporations. Even if the funds allocated to a publicly held firm cannot be translated into private profits unless officials are willing to

[20]For example, imagine a monopolist in an otherwise weak bargaining position who is selling to the government at a price greater than marginal cost as a result of the payment of a bribe. If a new entrant now offers to sell at a greatly reduced price, anti-corruption forces will be alerted and naturally inquire why this lower price had not been previously obtained.

[21]The argument for expanded government production of goods and services parallels the discussion of vertical integration in Williamson (1971).

embezzle as well as bribe, maintaining a high level of firm activity could well mean improved working conditions, increased power in shaping government policy, and promotions for the officials involved.[22] Just as bribes can be paid out of a private firm's excess profits, so may bribes be paid out of a public firm's budget allocation. Thus before public production can be justified on anti-corruption grounds, it must be demonstrated in each particular case that (a) employees of a state firm would be more honest than their private counterparts; or (b) the incentive structures adopted for the state firm lower the benefits to be gained from bribery; or (c) the detection of serious peculation in a state firm will be cheaper than the effort to detect bribes paid by private sellers to government contracting officials.

Finally, the analysis suggests that bribery could be quite prevalent in the private sector. In the United States, for example, it is not a federal crime for one entrepreneur to bribe an official of another non-governmental enterprise, although it is sometimes a misdemeanor under state law[23] and firms are, of course, free to fire corrupt officials and recover damages resulting from official breaches of trust. These sanctions may be sufficient to deter corruption in large portions of the private market either because many identical sellers are competing or because there are many buyers willing to purchase a standardized product. Nevertheless, there are many situations in which neither of these conditions obtain.

[22]Downs (1967, ch. II, VIII, IX).

[23]See, for example, Pennsylvania Code, vol. 18, sec. 4667, 1963. The statute provides for a fine of up to $500 or a jail term of up to one year or both.

References

Becker, G., 1968, Crime and punishment: An economic approach, Journal of Political Economy 76, 169–217.

Cross, J.G., 1969, The economics of bargaining (Basic Books, New York).

Downs, A., 1967, Inside bureaucracy (Little, Brown and Co., Boston).

Fellner, W., 1947, Prices and wages under bilateral monopoly, Quarterly Journal of Economics 41, 503–509.

Henderson, A., 1940, A further note on the problem of bilateral monopoly, Journal of Political Economy 48, 238–243.

Machlup, F. and M. Taber, 1960, Bilateral monopoly, successive monopoly, and vertical integration, Economica N.S. 27, 101–119.

Mansfield, E., 1970, Microeconomics (W.W. Norton, New York) 270–272.

Stigler, G., 1970, The optimum enforcement of laws, Journal of Political Economy 78, 526–536.

Williamson, O.W., 1971, The vertical integration of production: Market failure considerations, American Economic Review Papers and Proceedings 61, 112–123.