

Does Competition Kill Corruption?

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Does Competition Kill Corruption?

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Corrupt agents (officials or gangsters) exact money from firms. Corruption affects the number of firms in a free-entry equilibrium. The degree of deep competition in the economy increases with lower overhead costs relative to profits and with a tendency toward similar cost structures. Increases in competition may not lower corruption. The model explains why a rational corrupt agent may extinguish the source of his bribe income by causing a firm to exit. Assessing the welfare effect of corruption is complicated by the fact that exit caused by corruption does not necessarily reduce social welfare.

I. Introduction

An approach to corruption control based on economics suggests that increasing competition may be a way to reduce the returns from corrupt activities. The presumption is that no bribes can occur in markets in which perfect competition prevails, when there are no excess profits from which to pay the bribes. This argument is oversimple, as will be seen. Moreover, practical experience seems to show that countries that have increased levels of competition in the economy have sometimes experienced upsurges in corruption. The

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important point is that even when a policy on competition is a simple instrument for controlling corruption, economists still have not fully identified the conditions under which an increase in competition will effectively reduce corruption.¹

A fundamental reason why these issues are complex is that, depending on how it is defined, competition is not necessarily an exogenous parameter that one can vary in a model to see how corruption is affected. Corruption may itself affect the extent of competition. It is clearly wrong, for instance, to take the number of firms as an indicator of the level of competition in the market. The reason is that corruption affects the flow of returns from a particular investment and thus the number of firms in a free-entry equilibrium. This paper examines the theoretical relationship between competition and corruption and presents a model in which both the equilibrium number of firms and the level of graft are endogenously determined by other, deeper competition parameters. We call these parameters *deep competition* to distinguish their effects from measures of competition, such as the number of producers, that are defined from the equilibrium outcome and may themselves be affected by both institutionally created opportunities for corruption and deep competition.

Corruption always depends on power. This may be market power, for instance, when a purchasing agent for a monopoly overinvoices his transactions and the lack of yardstick comparison disguises his corruption. Or it may be discretionary power created by legislation. Thus a tax inspector might connive in the underreporting of the tax obligations of a farmer in exchange for a kickback, or a health inspector could agree to overlook the presence of cockroaches in a restaurant kitchen in return for a bribe. The health inspector's power comes from a law that gives him the power to close a cockroach-infested restaurant by order. Yet power does not have to spring from the law or the abuse of law. We can extend the use of the term corruption to cover simple protection rackets by gangsters, whose power is that of completely illegal violence.

The agent's power may or may not depend on a law. The gangster simply demands graft, contrary to the law. The victim fears to go to the law and pays up. The health inspector can shut a cockroach-infested kitchen. He uses this power not to ensure that kitchens are clean but to extract bribes, even from the owners of clean kitchens.

¹ The importance of further research on the relationship between competition and corruption has been stressed by Rose-Ackerman (1988). She argued that "the role of competitive pressures in preventing corruption may be an important aspect of a strategy to deter bribery of low-level officials, but requires a broad based exploration of the impact of both organizational and market structure on the incentives for corruption facing both bureaucrats and their clients" (p. 278).

One can imagine that the regulations are intricate, so that the health inspector can always find some legitimate reason to close a kitchen (at least this is what owners fear). Then it is tempting to say that regulations should be simple. As the example of taxation shows, however, simple regulations may suffer from drawbacks. It would be wrong to see corruption as always the consequence of excessive regulation or to imagine that complete laissez-faire will always be the answer. Good laws may nourish corruption. When one sits down in a restaurant, one may like to know that the kitchen is not crawling with cockroaches. Yet the law designed to give that guarantee may prove to be the vehicle for corruption. In the present paper we simply take the power enjoyed by the corrupt agent as given. If it is based on laws and regulations, we do not investigate how they came to be. There may be a rent-seeking motive, but we do not throw light on it. Similarly, if gangsters enjoy criminal power, we do not ask how and why.²

Corrupt payments may be made because the corrupt agent can reduce costs for the producer but demands payment in return, as happens with the tax inspector. We call this *cost-reducing corruption*. Alternatively, payments may be made because there is a surplus in the business, and it is better to allow the corrupt agent to take part of it than to lose everything, as happens with the protection racket. We call this *surplus-shifting corruption*, which is the main concern of this paper.

It is tempting to suppose that there will be no surpluses when there is perfect competition. This is true only if all firms have the same costs. If perfect competition is defined as all sellers being price takers, there is no implication that all firms have the same costs if we allow individual firm production functions not to exhibit constant returns to scale. If they did, the cheapest firm would take over the whole market. In any case, it could be a mistake to look for preexisting surpluses to model corruption in general equilibrium. Corrupt payments become built into the cost structure. In this case corruption does not need any preexisting rents or imperfect competition, since the prospective excess profits from which to pay bribes may be created by inducing exit. It is fatal to the understanding of the consequences of corruption to overlook this point.

The idea that corruption may generate surplus is illustrated with two examples. The first involves perfect competition. In a certain city, poor people sell boxes of matches on the street. This occupation

² Obviously huge areas of interest are set aside here. In particular, criminal corruption often involves bribing the police. Equally, corruption may not be reported for fear that the courts will be ineffective, perhaps because judges will be bribed.

has free entry and earns the sellers the reservation price for the lowest-skill labor. There is certainly no surplus. Then large, menacing men demand that match sellers hand over part of their takings for “protection.” As a result some sellers exit: the eventual equilibrium is one in which there are fewer match sellers. Each one earns more but pays the extra to the gangster. Corruption has generated its own surplus. To clarify the precise nature of that eventual equilibrium requires definite assumptions, as will be shown below.

In another example, one corrupt official can grant or withhold the license to operate a bar in a city. There are many identical bars and free entry, so there will be no surplus if the official is honest. The unique right to award licenses, however, has placed the official in the position of a monopolist. Let the official, having full information, calculate that monopoly profit from bars will be maximized at Π when N bars operate. Then he demands a payment of Π/N from any bar in return for the license to operate. This imposes the monopoly equilibrium, and the official takes Π . Corruption converts perfect competition to monopoly. The second example makes clear a point that is obscure in the case of the first. If corruption can generate a surplus where none previously existed, where does this tendency expend itself?

Our model is designed with the last question in mind. We are not modeling agency relationships. Instead we assume that officials have the power to exact a sum of money from existing firms and we focus on the process of bribe demands. No direct reduction of cost is offered in return for the bribe. It is a simple case of pay up or be closed down. We present a model in which corrupt officials are able to obtain permanent flows of graft (corrupt payments) from a group of producers (called *firms* without loss of generality) despite the fact that (1) the officials are many in number and do not coordinate their actions, (2) the officials are uncertain about the type of firm they face, and (3) the business has no barriers to entry.

The key to the argument, in summary, is that differences in the cost structure of firms create surpluses that an individual corrupt official can milk. This gives a motivation to all officials to demand bribes. This will drive the most inefficient firms out of business, enhancing the profitability of other firms, in turn making it possible for corrupt officials to demand larger bribes, and so on. This does not lead to the eventual extinction of all firms, because when the flow of payments from firms to officials reaches a high level, the officials are no longer willing to risk losing the source of their bribe income.³ We next introduce three ways to capture the degree of

³ Our basic result is analogous to work on business taxes and effluent charges for environmental harms (see Cropper and Oates 1992, p. 681).

deep competition: as a parameter that affects profits in any firm, as lower overhead costs relative to profits, and as less dispersed overhead costs. We then perform some comparative statics. In general, we cannot say that an increase in deep competition will lead to lower levels of corruption. Our results show that, even in a simple model, everything depends on the structure of the uncertainty about costs that faces the corrupt official.

Furthermore, if deep competition may increase corruption and corruption affects welfare by inducing exit, it is not clear what is the effect of deep competition on welfare. Romer (1994) has emphasized that one of the main contributions of research based on models of monopolistic competition (e.g., Dixit and Stiglitz 1977) is to model explicitly the limit to the set of goods available from the level of fixed costs in the economy. He suggests that corruption introduces large welfare costs by driving firms out of the market. But how could it be rational for a corrupt agent to induce exit of a firm under his control that constitutes his only source of bribe income? There is a similar puzzle in the behavior of trade unions since they sometimes push up wages to the extent of inducing exit of the firms that provide employment, hence extinguishing their source of income.⁴ Our model explains when that behavior may be rational and how increasing product market competition may limit the adverse effects on industrial variety of trade unions and corruption.

Modern research into the economics of graft began with Rose-Ackerman (1975), but despite the topic's practical importance, studies of corruption have remained rare in the profession. An early attempt to link corruption with competition appears in the book by Rose-Ackerman (1978, pp. 137–66). She analyzes a bureaucracy dispensing a scarce benefit and notes that the existence of a small number of honest officials induces honesty in all the bureaucracy by introducing the possibility that applicants reapply if they are asked for bribes. Shleifer and Vishny (1993) analyze a bureaucracy issuing complementary permits to perform some economic activity in exchange for bribes. They note that if the officials do not coordinate to extract bribes, they fail to internalize the effect of their demands for bribes on other officials' income.⁵ This is likely to be more damaging for growth than the existence of an organized and disciplined system of corruption. Ades and Di Tella (1994) empirically analyze

⁴ In the classic models of trade unions (e.g., Oswald 1985), firms react to higher wage demands by restricting employment. Higher expected wages compensate workers for the possibility of separation. In this setting, however, restricting employment does not imply a loss of product diversity.

⁵ It is formally close to the problem of the extraction of renewable resources by competing players in the classical fishing game. For an exposition, see Fudenberg and Tirole (1991).

the relationship between competition and corruption and find evidence that exogenous increases in product market competition reduce corruption in the bureaucracy. For a fascinating account of the workings of the Mafia and the business of private protection, the reader is referred to Gambetta (1993).

It is interesting to note the connection of our paper with the rent-seeking literature. Two extremes are usually emphasized in that literature, depending on the level at which rent seeking occurs. In the first extreme, a regulation that affects the level of competition in an industry is set up by a benevolent government, and a lower-rank bureaucrat abuses his powers to extract bribes. A typical example is an industry regulator who is in charge of enforcing the level of pollution allowed by the legal system and allows a different level in exchange for a bribe. In the second extreme, the bureaucrat directly affects the level of competition, for example, by introducing a tariff or by putting a limit to the entry of new firms, and charges a bribe to those directly benefiting from his action (the incumbent firms). In our model, the bureaucrat is of the first kind and does not affect the degree of competition in the industry directly. However, his actions affect the rate of return on capital investment and thus the long-run equilibrium number of firms. Thus he still affects the level of competition indirectly.⁶

In Section II we introduce the model and the equilibrium with corruption. Section III examines existence, Section IV presents our comparative static results, and Section V shows how much corruption takes in an important case. Section VI explores an example with perfect competition. Section VII analyzes some of the model's welfare implications. Section VIII presents conclusions.

II. The Model

Firms are all the same except for their overhead costs, expressed as a flow. There is a large number of potential firms. Their overhead costs are independently drawn from a cumulative distribution that measures the probability that a particular firm will have overhead costs no greater than C :

$$F(C). \quad (1)$$

Here $F(0) = 0$, $F(\infty) = 1$, and $F(\cdot)$ is an increasing function of C .

Our equilibrium will be one in which firms will operate if and only if their overhead costs (C values) are less than or equal to a critical

⁶ The classic papers in the rent-seeking literature are Tullock (1967), Krueger (1974), and Bhagwati (1982).

value C_0 . Then the proportion of firms operating—called the abundance of firms and denoted A —is given by

$$A = F(C_0). \quad (2)$$

Firms that operate all earn the same gross profit. The root property that the model requires is embodied in the following axiom.

AXIOM 1. The operating profit of any firm is a monotonically decreasing function of abundance.

Notice that the assumption is equally consistent with (1) the assumption that firms operate as price-taking perfect competitors, selling essentially the same output on a single market; (2) the assumption that firms compete as oligopolists, selling the same product; or (3) the assumption that firms compete as monopolistic competitors, selling differentiated products in a market in which consumers value variety.

In the first case, the effect of density is analogous to the influence of the number of similar farmers with upward-sloping supply curves supplying a market with an agricultural good that has a downward-sloping demand curve. More producers means more supply, a lower equilibrium price, and lower profit for each producer. In the second case, each firm has a more elastic demand curve and charges a lower price. In the third case, higher density shifts the producer-specific demand curve to the left, since alternative firms offer more closely competing services, and profit falls.

Below we treat cases 1 and 2 and leave aside case 3, which would involve a more complicated model of the Dixit and Stiglitz (1977) type.⁷ Each firm is in the territory of one corrupt agent, so Rose-Ackerman's case of overlapping jurisdictions discussed above is not being treated. We do not require each corrupt agent to control only one firm, although, for convenience, we do assume them to be expected profit maximizers. On the other hand, our corrupt agents will be small in the following sense. They recognize that demanding graft may cause exit, but they do not take into account in their calculations that the exit they cause will increase the profitability of remaining firms. This is in contrast to the simple example given above in which one official controls the licensing of all bars in a city. The optimal level of graft we gave for that case takes into account induced exit and implied profitability. As we shall show, describing equilibrium for uncoordinated demand for graft involves more difficult modeling.

⁷ The difference would arise because we assume that firms have different overhead costs, so that only at the margin would a firm earn zero net profit. Dixit and Stiglitz assume that all potential entrants have the same costs.

An important implication of the assumption that each firm is in the territory of one corrupt agent is that we do not treat the case in which one firm faces several demands for corrupt payments. That would happen, for example, if a fire regulation official and a hygiene official each independently demanded graft. When such multiple demands are not optimally coordinated, more exit is caused because there is an externality. Part of the cost of the risk that demanding more graft may cause exit falls on another party.

While the agent cannot observe C for his firm, he does know the operating profit all firms are making, denoted P . By axiom 1, P depends uniquely on abundance. However, in deciding how much graft to demand, the corrupt official does not need to use information about A . Given P and the distribution $F(\cdot)$, he can decide how much graft to demand. Note that we treat the relation between official and firm in a particularly simple way, although we believe that a simple case captures much that is important. The official demands a bribe: the firm either pays up or exits, and exit is irreversible.⁸

Obviously there is no room in a rational game for haggling over the level of the bribe. As any firm could claim not to be able to afford a bribe, such a claim could not play a role. One could, however, model a multistage game in which, for example, exit would not be irreversible but would attract a significant penalty. Then officials could strike lower-bribe bargains with firms that first exit, resulting in a separating equilibrium. While we do not doubt that the analysis of more complex models of this type could be interesting and provide insights, we stay with the irreversible exit assumption throughout this paper.

If the corrupt official is interested only in the expected value of his return,⁹ he will face the following program:

$$\max_G G \cdot F(P - G). \quad (3)$$

The maximand is the product of the amount of graft demanded G and the probability of obtaining that amount.

Figure 1 illustrates this maximization problem and selects a case in which there are multiple and separate maximizing values for G . In the figure the level of G is measured along the horizontal axis

⁸ Formally the problem is close to one in which the agent chooses a level of graft and faces a probability of punishment that increases smoothly with the amount of graft demanded. For a discussion of this case, see Rose-Ackerman (1978, p. 100).

⁹ This assumption carries the implication that a corrupt agent may control many firms, when maximizing total expected return implies maximizing expected return from each firm. But note again that the agent must not be so large that his effect on general profitability is taken into account.

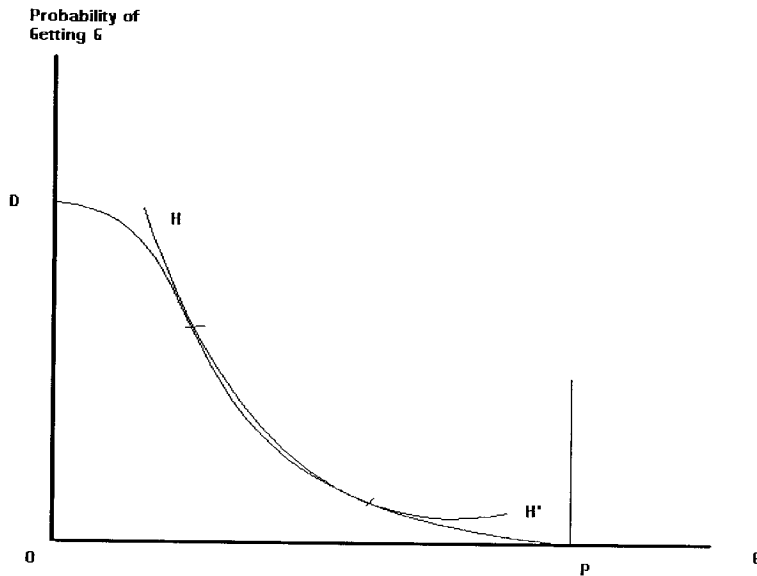


FIG. 1

starting at zero from the origin on the left. The distance OP is the level of profit for all firms. The heavy curve DP shows the probability of obtaining any particular level of G , that is, the probability that the firm can afford to pay it. The firm can afford to pay G if its costs C do not exceed $P - G$. The probability of that being so is shown by the height of the cumulative distribution of costs for any firm, drawn from the origin at P toward the left. The curve HH' is a rectangular hyperbola along which the product of G and the probability of obtaining G are constant. The constant is the highest level of that objective obtainable. For the case shown in the figure, two distinct and separate values of G both maximize the objective.

Multiple equilibria are a possibility because the cumulative distribution of C drawn in the figure is a nonconcave function. This, however, is a standard property of cumulative distribution functions, for example, in the case of the normal distribution. In all that follows we shall ignore the issue of multiplicity. When we do comparative statics, we shall look at the effect of a small change close to a local maximum and use the second-order conditions, which must be satisfied close to any regular maximum. For both the maxima shown in the figure, second-order conditions will be satisfied, despite the fact that for the higher value of G the curve DP is locally nonconcave.

The first-order condition for the maximization of (3) is

$$F(P - G) - G \cdot F_1(P - G) = 0, \tag{4}$$

where the subscript denotes differentiation. Rearranging (4) gives an equation that has a simple intuitive interpretation:

$$1 = G \cdot \frac{F_1(P - G)}{F(P - G)}. \quad (5)$$

The left-hand side denotes gain: a marginal increase—that is, a \$1.00 increase—in graft increases graft income by \$1.00 if the firm stays in business. The right-hand side represents the risk of losing all graft income G if graft demands induce exit, since G is multiplied by the probability that the firm is within \$1.00 of the maximum it could pay. For a regular local maximum, the second derivative of (4) with respect to G should be strictly negative. Denote that second derivative by S . Then

$$S = -2F_1(P - G) + G \cdot F_{11}(P - G) < 0. \quad (6)$$

THEOREM 1. When profitability is varied, the rate of change of graft with respect to profit is less than one.

Proof. To see the effect of profitability on graft, totally differentiate (4) to obtain

$$S \cdot \frac{dG}{dP} + F_1(P - G) - G \cdot F_{11}(P - G) = 0, \quad (7)$$

or

$$\frac{dG}{dP} = \frac{S + F_1(P - G)}{S} = 1 + \frac{F_1(P - G)}{S} < 1, \quad (8)$$

as required. Q.E.D.

REMARK 1.—Notice that it cannot be shown that dG/dP is positive.

Figure 2 illustrates this. Initially the level of profit is the distance OP . The cumulative distribution of costs is drawn from the origin at P toward the left, as in figure 1, as the curve DTP . This curve is tangent at T to a rectangular hyperbola with origin at O , HH' . When profit is larger, now the distance OP' , the curve DTP shifts horizontally to the right to become the broken curve $D'T'P'$, which is tangent to the rectangular hyperbola II' at T' . If G were to increase by the full extent of the rise in profit, T and T' would have to be at the same vertical height, because the distance between the two curves is equal to the increase in G along a horizontal. But that is impossible because rectangular hyperbolas with a common origin do not have constant slopes along a horizontal; they have common slopes along a ray through the origin, such as OT .

Nothing rules out T' being to the left of T .

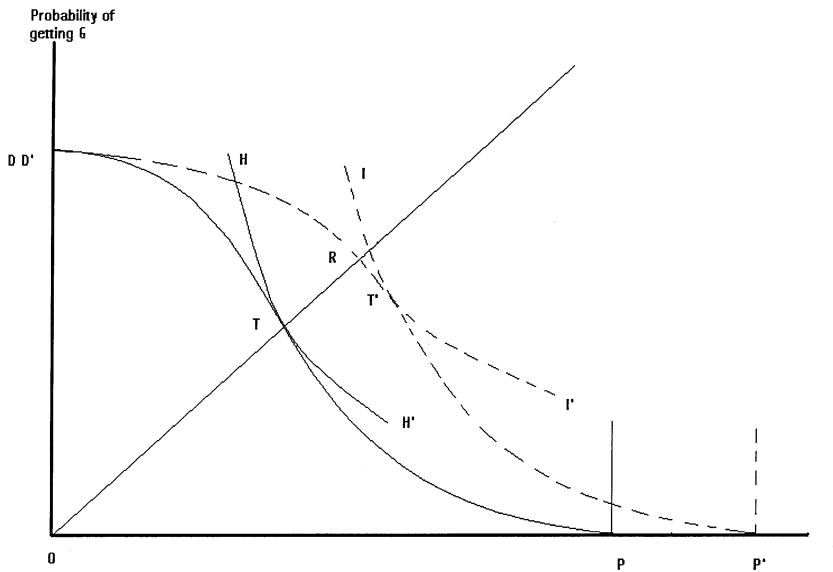


FIG. 2

III. Existence

In treating existence (and for the comparative statics exercises of the next section), we always assume the maximizing G to be a unique function of profit, as will be the case when the multiple equilibrium problem discussed above does not arise.

THEOREM 2. When G is a unique function of P , there exists a unique equilibrium density.

Proof. Assume a value for equilibrium density—think of it as a guess—and call it A_1 . Then profit will be $P(A_1)$ and graft will be $G[P(A_1)]$. A firm will stay in business if

$$C < P(A_1) - G[P(A_1)]. \tag{9}$$

Therefore, the density implied by the assumption of density A_1 is

$$A_2 = F\{P(A_1) - G[P(A_1)]\}. \tag{10}$$

Consider the relation between A_1 and A_2 implied by (10). Theorem 1 implies that $P - G$ increases with P . If A_1 is larger, profit will be smaller; therefore, profit minus graft will be smaller. Therefore, A_2 will be smaller. Figure 3 illustrates this. Equilibrium corresponds to the intersection between the downward-sloping line AA , which shows the function mapping A_1 into A_2 , and the 45-degree line. To determine the value of A_2 corresponding to $A_1 = 0$, care must be

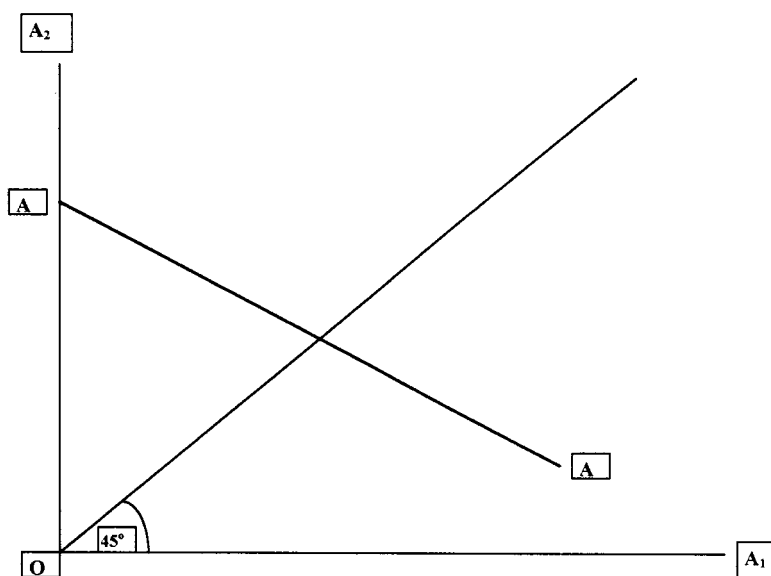


FIG. 3

taken. When no firm is operating, there is no profit level with which to test what proportion of firms could pass the entry test. We decide the height of the curve at $A_1 = 0$ by taking the limit of the height as $A_1 \rightarrow 0$ from above. When firms are extremely sparse, profit is very high and remains so even after graft. Therefore, it cannot be the case that graft is so high that very few firms choose to operate. There is no degenerate equilibrium at zero density. That is why figure 3 shows the curve that gives A_2 as a function of A_1 (drawn as a straight line for convenience) with a positive intercept at $A_1 = 0$. Then sloping downward, it cannot avoid intersecting the 45-degree line once. That intersection must occur for $A < 1$. Q.E.D.

IV. Comparative Statics

In this section we establish some comparative statics relating corruption and deep competition. As we discuss it, there are two aspects to deep competition. One aspect concerns how fiercely any number of firms already in the market compete with each other, that is, how far they force down prices and lower profits. The other aspect is the ease of entry into the market from outside. These two aspects are not always independent. For instance, other things being equal, high profitability for insiders attracts entry from outsiders. However,

there are other influences on ease of entry, and they will be varied here.

Specifically, we consider three cases. In the first case, a parameter (which we call α) affects the fierceness of competition once inside the market. Each firm is more of a threat to others in the market. This parameter might be transport costs. The lower transport costs, the closer the sales of different firms are to being perfect substitutes. The other two cases concern ease of entry. Our second case is based on the fact that it is easier for firms to enter a market if all producers have similar production functions. In our model this means that the overhead costs of all producers are close to each other, because differences in overhead costs are the only differences in production functions we allow. Our third case uses the fact that high overhead costs deter entry, regardless of whether they are similar for different producers. The reason is that high overhead costs prohibit entry on a small scale (see Tirole 1988, chap. 8).

We now give some empirical content to our three cases: (1) When shoppers can travel easily by automobile, competition between retail sellers located at different places is intensified. (2) Where entry is not prohibited by restrictive regulation, similarity of production functions makes markets highly contestable; for instance, airlines may compete strongly to provide traffic on a particular route when costs are similar for all carriers, as would be the case if aircraft could be leased and crews hired on short-term contracts. (3) It is difficult to enter the wide-body airframe construction sector because of the huge overhead costs involved: on this case, see Dertouzos et al. (1989, p. 11), who cite some numbers. We now give formal expression to the three cases.

Competition Case 1: Lower Profit for Given Abundance

Our competition parameter is α , where we have $\partial P(A, \alpha) / \partial \alpha < 0$. The equilibrium can be described by the following implicit system, which consists of equations (2) and (4) rewritten:

$$A - F[P(A, \alpha) - G] = 0 \quad (11)$$

and

$$F[P(A, \alpha) - G] - G \cdot F_1[P(A, \alpha) - G] = 0. \quad (12)$$

PROPOSITION 1. An increase in the competition parameter decreases the proportion of firms operating and has an ambiguous effect on corrupt payments per firm.

Proof. The system satisfies the condition required by the implicit function theorem: both implicit functions have continuous deriva-

tives and the endogenous variables Jacobian is nonzero when evaluated at the equilibrium. Use of the implicit function theorem leads to

$$\frac{dA}{d\alpha} = \frac{-F_1^2 \cdot \frac{\partial P(A, \alpha)}{\partial \alpha}}{S + \frac{\partial P(A, \alpha)}{\partial A} \cdot F_1^2}, \quad (13)$$

which is always negative since the denominator is negative. The effect of competition on graft is given by

$$\frac{dG}{d\alpha} = \frac{(F_1 + S) \cdot \frac{\partial P(A, \alpha)}{\partial \alpha}}{S + \frac{\partial P(A, \alpha)}{\partial A} \cdot F_1^2}, \quad (14)$$

which is negative only as long as $GF_{11} \notin [F_1, 2F_1]$. More precisely, we have $GF_{11} < 2F_1$ from the second-order condition for a maximum in the corrupt official's maximization problem, and $GF_{11} - F_1$ signs the expression. Q.E.D.

Remark 2.—In the limit as $GF_{11} \rightarrow [F_1, 2F_1]$, increases in competition always increase corruption.

When competition is stronger, the proportion of firms operating falls. This is not paradoxical since it follows directly from the free-entry condition. The ambiguous finding for the value of G , corruption per firm, can be understood as follows. Competition reduces the level of profits per firm available to pay overhead costs plus graft. But this does not imply that the amount of the smaller total going to graft might not increase. The increase in competition could take the marginal firm to a region in the cost support in which there is a low proportion of firms. Then it could become less probable that further graft demands will induce exit of the firm under the agent's control and extinguish the source of graft income for the agent. The first-order condition expressed as (5) shows that the equilibrium level of graft per firm, G , is the inverse of the probability density for a firm being marginal.

Competition Case 2: More Similar Costs (Compressing the Support)

In deriving the next result we make two assumptions: (1) The support of F is $[C_{\min} + \delta, C_{\max} - \delta]$, so that increases in δ shrink the support of the distribution. (2) The function F is uniform.

PROPOSITION 2. An increase in competition characterized by a compression in the support of overhead costs has uncertain effects on the proportion of firms operating and the level of graft per firm.

Proof. The system satisfies the condition required by the implicit function theorem: both implicit functions have continuous derivatives, and the endogenous variables Jacobian is nonzero when evaluated at the equilibrium. Use of the implicit function theorem leads to

$$\frac{dA}{d\delta} = \frac{C_{\max} + C_{\min} - 2P}{-2(C_{\max} - C_{\min} - 2\delta)^2 + \frac{\partial P(A, \alpha)}{\partial A} \cdot (C_{\max} - C_{\min} - 2\delta)}, \quad (15)$$

where the numerator has an uncertain sign and the denominator is negative, and

$$\frac{dG}{d\delta} = \frac{C_{\max} + C_{\min} + 4G - 2P - \frac{2G[\partial P(A, \alpha)/\partial A]}{C_{\max} - C_{\min} - 2\delta}}{-2(C_{\max} - C_{\min} - 2\delta) + \frac{\partial P(A, \alpha)}{\partial A}}, \quad (16)$$

where the numerator has an uncertain sign and the denominator is negative. Q.E.D.

To provide the intuition for this result, recall that the first-order condition for the corrupt official is the distribution minus the density times the level of graft. The effect of shrinking the support is to always increase the density (at the marginal firm) so that the official would always tend to reduce graft demands on this account. The effect of competition on the distribution is uncertain, however. It is driven by the sign of the expression $-C_{\max} - C_{\min} - 2G + 2P$. But this is exactly the expression that signs the distance to the median. If it is positive and the marginal firm has higher overhead than the median, then higher competition increases graft from the official's maximization. A third effect comes from the fact that if we are above the median, the free-entry condition implies that higher competition will induce entry (the proportion of firms that enter is equal to the distribution function, which has increased). But this reduces profits, which in turn reduces corruption.

*Competition Case 3: Higher Overhead Costs
(Shifting the Support)*

In deriving this result we make two assumptions: (1) The support of F is $[C_{\min} + \phi, C_{\max} + \phi]$ so that ϕ acts as a support shifter. (2) The function F is uniform.

This specification intends to capture the idea that uncompetitive industries may be characterized by a heavy structure of overhead costs. We use the uniform distribution to separate the effects of shape from other aspects of the distribution (note that under the uniform we always have $GF_{11} \notin [F_1, 2F_1]$).

PROPOSITION 3. A decrease in competition characterized by higher fixed costs always decreases graft per firm and the proportion of firms operating.

Proof. The system satisfies the condition required by the implicit function theorem: both implicit functions have continuous derivatives, and the endogenous variables Jacobian is nonzero when evaluated at the equilibrium. Use of the implicit function theorem leads to

$$\frac{dA}{d\phi} = \frac{1}{-2(C_{\max} - C_{\min}) + \frac{\partial P(A, \alpha)}{\partial A}}, \quad (17)$$

which is always negative as the denominator is negative, and

$$\frac{dG}{d\phi} = \frac{C_{\max} - C_{\min}}{-2(C_{\max} - C_{\min}) + \frac{\partial P(A, \alpha)}{\partial A}}, \quad (18)$$

which is always negative. Q.E.D.

V. How Much Does Corruption Take?

THEOREM 3. When the density function of $F(\cdot)$ is uniform, (a) a corrupt agent takes half of the maximum profit from each firm; and (b) with integration over all surviving firms, corrupt agents take three-quarters of the profits remaining after overhead costs have been paid.

Proof. Under a uniform distribution with support $[C_{\max}, C_{\min}]$, the first-order condition in (4) can be written as

$$\frac{P - G - C_{\min}}{C_{\max} - C_{\min}} - \frac{G}{C_{\max} - C_{\min}} = 0, \quad (19)$$

with the second-order condition readily checked:

$$G = \frac{P - C_{\min}}{2}. \quad (20)$$

To see part *b*, note that graft G is demanded of all firms that stay in business. The overhead costs of these firms increase linearly from

C_{\min} to P . Hence profits remaining with the firm after overhead costs have been paid decrease with overhead costs uniformly from $(P - C_{\min})/2$ to zero. Therefore, the average value for profits remaining with the firm after overhead costs have been paid is

$$\frac{P - C_{\min}}{4}. \quad (21)$$

Q.E.D.

VI. The Model with Perfect Competition

We show an example to emphasize our claim that the model developed in this paper can be applied to a market for a single good characterized by perfect competition in the sense that all producers are small price takers. We assume a distribution of farms, most of which earn net profits in equilibrium. Pure profits in equilibrium are consistent with standard general equilibrium theory if firms have strictly convex production sets. However, our model is inconsistent with the convexity assumption because we assume that each farm has to pay a fixed overhead cost to produce a positive output.

Assume that the price of farm output is determined by demand and supply equality as

$$A \cdot N^* \cdot \frac{dR(p)}{dp} = D(p), \quad (22)$$

where $R(p)$ is the revenue function of a single farm (common to all farms and not including overhead costs), N^* is the maximum number of farms that could operate, A is the proportion of farms producing, and $D(p)$ is the market demand curve. Notice that equilibrium will be defined for a given population of potential farms. If all operated, A would be one. Otherwise A will be less than one.

We assume that overhead costs are distributed uniformly as

$$F(C) = \frac{C}{C_{\max}} \quad (23)$$

and

$$F_1(C) = \frac{1}{C_{\max}}. \quad (24)$$

Where variable profit exceeds C_{\max} , corrupt agents will take all of the excess, since collecting it induces no risk of exit. However, the

certain gain of that surplus has an effect on the agent's decision. If more is demanded, everything may be lost.

Remark 3.—High profits relative to overhead costs make it less probable that graft will induce exit.

Assume that profit exceeds C_{\max} . Denote by g graft in excess of $R(p) - C_{\max}$. Then the corrupt official solves

$$\max_g [R(p) - C_{\max} + g] \cdot \frac{C_{\max} - g}{C_{\max}}, \quad (25)$$

which, after simplification, gives

$$g = C_{\max} - \frac{R(p)}{2}. \quad (26)$$

Consider a farmer with overhead costs $C \leq C_{\max}$. Then his total profit after graft will be

$$C_{\max} - g - C = \frac{R(p)}{2} - C \quad (27)$$

and

$$A = \min \left[\frac{R(p)}{2C_{\max}}, 1 \right]. \quad (28)$$

When $A = 1$, graft causes no exit.

VII. Welfare Effects of Corruption

Traditional economic analysis maintains that bribes constitute transfers between economic actors and have, therefore, only redistribution effects. Some authors, starting with Leff (1964), have argued that corruption may lead to improved economic outcomes, basically because bribes might serve as piece rates to motivate badly paid bureaucrats and because it may be a way to avoid cumbersome regulations. Others, starting with Myrdal (1968), argue that corruption distorts incentives and provides a prize to introducing further regulations, so that it is detrimental to growth and investment.¹⁰ Romer (1994) claims that this might grossly underestimate the costs of corruption by overlooking its effect on the number of products available. Acting as a tax on ex post profits, graft induces exit of

¹⁰ Mauro (1994) shows that the empirical evidence is consistent with Myrdal's hypothesis.

firms, causing the loss of consumer surplus associated with the consumption of each product lost on account of exit (what Romer calls a “Dupuit triangle”).

In our model, corruption does not affect or distort what firms do when they operate. Therefore, the welfare effects of corruption are solely those associated with the exit caused by demands for graft. Evidently in a different model—for example, when the corrupt agents can imperfectly observe variables including profit—what firms do may be distorted in a welfare-reducing manner.

In popular discussions of corruption, it is too often assumed that the problem of corruption is commensurate with its scale, whether measured per firm or as a grand total. While that may be true of moral damage, it is a poor measure of economic cost. We have seen that the danger that demanding more graft will cause exit is what deters the corrupt agent at the margin. For that reason graft that runs no risk of causing exit will always be demanded. However large it may be, it is a pure transfer and produces no effect on economic allocation.

We have taken that point further to note that safe intramarginal graft *discourages* graft at the margin and thus reduces the economic effect of graft, which is graft-induced exit. There is nothing paradoxical about this conclusion. It is not saying that any way of increasing profits in a sector increases welfare because it discourages graft; for whatever increases profit may itself be welfare reducing. Suppose, for instance, that a high minimum price is imposed on a sector. Firms will sell less at the higher price, and it is possible with free entry that there will be more firms and a higher profit per firm, with the marginal firm having higher overhead costs. Consumer welfare will fall. Now introduce corruption and suppose that the high profits produce the consequence that it causes little exit. That is not a benefit to welfare, particularly because exit would not raise the price that consumers pay.

A free-entry equilibrium in which firms have overhead costs does not possess the optimality property of a competitive equilibrium (see Tirole 1988, pp. 298–99). In our model, as we are ignoring the benefits of variety, ideally one firm would serve the market; overhead costs would be financed by lump-sum taxes; and price would be marginal cost. Without intervention, this is not what happens. Free entry determines the number of firms that operate, and we have to compute the welfare level for a representative consumer. It would be wrong to suppose that the smaller the number of firms operating the better, because that is closer to the optimal number. For in a second-best situation, the number of firms affects price as well as total overhead expenses.

The analysis most appropriate for the investigation of the effect on welfare of a variation in the number of firms in our model is provided by Mankiw and Whinston (1986). That model, like the present model, pertains to a homogeneous good, so the question of the optimal amount of variety does not arise.¹¹ Working with the same assumption as axiom 1 above, Mankiw and Whinston show that a free-entry equilibrium involves an excessive number of producers in the sense that a small restriction on entry will improve welfare, when pricing is freely determined in a wide class of oligopoly games.

In Mankiw and Whinston's model, all potential producers have the same overhead cost, whereas in our model that cost is variable. However, their result still applies, as is shown in the following sketch proof (for details, see Mankiw and Whinston [1986]).

THEOREM 4. In a free-entry model with a distribution of fixed costs, the number of firms is higher than optimal.

Proof. In the free-entry equilibrium the fixed cost of the marginal firm is C_0 . Mankiw and Whinston show that welfare would be higher for some reduction in the abundance of firms when all firms have the same fixed cost as the marginal firm. Then provided that fixed costs decrease continuously as the number of firms falls, welfare would again be higher for some (possibly smaller) reduction in the abundance of firms. Mankiw and Whinston's marginal condition (p. 51, eq. [3]) confirms this, since it depends only on the cost of the marginal firm, not on how costs change. Q.E.D.

Theorem 4 shows the welfare effect of corruption in a surprising light. It is tempting to assume that graft causes exit and that exit is welfare reducing. Then it would follow that if graft could be cut out directly, say by an anticorruption drive, this would be good for welfare even if consumers receive all the proceeds of graft. On account of the second-best nature of a free-entry equilibrium, it is not that simple. Conceivably graft could be beneficial if it moves abundance closer to the social optimum. Then graft would be doing accidentally what an ideal policy should do consciously. Of course graft may cause too much exit, which is a more probable outcome.

The argument becomes still more complicated where the attack on graft is indirect, and particularly when the method used is to increase competition to try to cut down graft. The effect of competition on graft can be ambiguous, and the consequences for welfare are uncertain.

¹¹ Free entry combined with variety is considered by Dixit and Stiglitz (1977). They show that the sign of the difference between the number of firms in a laissez-faire free-entry equilibrium and the number in a social optimum in which the planner controls entry prices is ambiguous.

For example, for competition case 1, we saw that an increase in the competition parameter α decreases the proportion of firms operating and has an ambiguous effect on corrupt payment per firm. That change upsets the relation between abundance and welfare. Higher α lowers working profit per firm, given abundance. Price is lower given abundance, which in itself is good for consumers. However, lower profit causes more exit, which could be bad for welfare.

For competition case 3 we argued that higher overhead costs represented by shifting the support correspond to less deep competition. Evidently such a change is directly welfare reducing regardless of its indirect effects on corruption and equilibrium abundance. We showed that a decrease in competition characterized by higher fixed costs always decreases graft per firm and the proportion of firms operating. This is likely to be welfare reducing, although it is conceivable that moving abundance down and closer to the social optimum would outweigh the other negative aspects of this change.

VIII. Conclusions and the Matchbox Sellers Again

This paper presents an analysis of the relationship between competition and corruption. The setting is one in which a group of corrupt officials have the power to exact a sum of money from firms under their control. We cannot use the number of firms as an exogenous indicator of the degree of competition since it is affected by the level of corruption in a free-entry equilibrium. Instead we introduce three ways to capture the degree of deep competition in the economy: as a variable that increases the extent to which firms compete fiercely, perhaps a reduction in transport costs; as a tendency toward more similar cost structures; and as a tendency toward lower overhead costs relative to profits. We performed some comparative statics. In general, we cannot say that increases in competition lead to lower levels of corruption. Our results show that, even in this simple model, everything depends on the structure of the uncertainty about costs that the corrupt official faces.

In the context of monopolistic competition, Romer (1994) claims that corruption introduces large welfare costs by driving firms out of the market. But how could it be rational for a corrupt official to extinguish the source of his bribe income by causing a firm under his control to exit the market? Our model explains why such behavior might be rational and how and when increasing product market competition may limit the adverse effects of corruption on the abundance of producers.

In the Introduction we introduced the example of poor people

selling boxes of matches on the street and discussed how corrupt seizure of their takings could drive some out while increasing the profitability of those remaining. While that case was useful for motivating the questions this paper addresses, it is worth remarking in closing that we have not exhibited an equilibrium for that example. When there is no differentiation between the costs of different producers, there is nothing to explain why some exit and others do not; hence there is no way for the corrupt agent to balance the costs and benefits entailed in asking for more. This is a degenerate instance of our model with a uniform distribution and the support compressed, as in competition case 2 above, but so far as to extinguish all differences between producers.

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