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Intermediation in corruption markets

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Abstract

Consider a government benefit that is earmarked for a group of people 'deserving' the benefit. Corruption happens when undeserving candidates obtain the benefit with the help of corrupt officials. Often, such corrupt activities are mediated by professional touts who act as intermediaries between the undeserving candidates and the corrupt officials. This paper analyses the equilibrium in such an intermediated market.

Intermediaries have no function in an economy where all government officials are corrupt. When there are some corrupt officials, intermediaries invest in identifying these officials, and charge a fee to direct candidates to officials of their choice. In a market with a single intermediary we show that, under fairly general conditions, (i) the intermediary is active, (ii) both deserving and undeserving candidates use the service of the intermediary, (iii) welfare in an economy with an intermediary is lower than that in an economy without intermediaries, and (iv) under some conditions, an optimal response to corruption is to reduce the number of officials dispensing the benefit.

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1. Introduction

Corruption is a ubiquitous activity in most underdeveloped countries. While corruption may be practised unilaterally (e.g. embezzlement), a wide variety of corrupt practices involve more than one agent (e.g. bribery). In the typical instance of corruption, a public official allows a private agent a privilege which that agent is legally not entitled to, in return for a payment in cash or kind. The privilege may be that of importing a dutiable good without paying the duty, or obtaining a driver's license when the applicant is not qualified. Such corruption requires cooperation between two parties—the official and the agent seeking the privilege—and must involve agreement on a price. Every such act thus presupposes a market transaction.

It is a special characteristic of this market, however, that buyers and sellers cannot publicly go about their search for trading partners. This distinguishes it from markets for everyday goods. Since information about potential partners is difficult to acquire, some individuals find it profitable to specialise in the acquisition and dissemination of such information. In economies where corruption is widespread, there is usually a well-developed network of such intermediaries; as a consequence it is easy to locate potential partners and negotiate prices, making corruption and rent-seeking an attractive and lower-cost alternative to legal activities. Agents therefore choose corrupt transactions over legal ones, in turn ensuring that the intermediaries stay in business. A further indication of "endemic" corruption is that even honest citizens with no intention or desire to bribe may habitually seek the service of an intermediary to ascertain where an honest transaction can be most conveniently conducted.

This paper presents a simple model of intermediation in corruption, where intermediaries capitalise on specialised knowledge about the identities of corrupt government officials. In our model intermediaries act as a conduit of information between government officials and members of the public in the disbursement of a public benefit. Many members of the public value the benefit, only some are entitled to it. Corruption then consists of an official conferring the benefit to a citizen who is not entitled to it. We show that the existence of intermediaries increases participation in corrupt acts, which is unsurprising, and that it encourages even honest agents to employ intermediaries, which is less so.

Much of the literature on corruption analyses the problem using the principal-agent model. Corruption is the outcome of a moral hazard problem which arises because of an information asymmetry between the government (principal) and the public servant (agent) (e.g. Bardhan 1997, page 1321).

The government cannot perfectly monitor the agent, so the latter has some discretion over his actions. He may use this discretion in a manner that promotes personal gain, e.g. by accepting a bribe to authorise an application that does not meet relevant guidelines.

A second approach to corruption analyses it as a rent-seeking problem (Krueger 1974, Shleifer and Vishny 1993). In its purest form, successful rent-seeking realises potential surplus by appropriately reallocating resources to high-surplus uses. Thus when many individuals are waiting in a queue, one of them who has a high opportunity cost for waiting may be willing to "buy" the place in front of the queue from another individual who has a lower cost of waiting. Thus this kind of corruption increases efficiency by suitably reallocating resources to their best uses. However, Shleifer and Vishny (1993) distinguish between corruption "without theft" and corruption "with theft", and show that the efficiency argument does not hold uniformly.

The literature, however, is largely silent on the subject of corruption intermediaries, though the most cursory casual empiricism indicates that these agents are thick on the ground in any underdeveloped economy. In an early paper, Basu (1986) analysed the power of the intermediary as arising from a coordination of expectations. Very recently, Bertrand et. al. (2007) have found substantial empirical evidence of both the existence and potency of intermediaries in the "market" for driving licenses in Delhi. They found that the services of an agent was more useful in obtaining a driving license than were superior driving skills.

Intermediaries have no function in an economy where all government officials are corrupt and willing to accept bribes indiscriminately from members of the public. They assume a meaningful role when only some officials are corrupt, or when such officials are wary of engaging in corrupt transactions with agents they do not know, perhaps for fear of being caught and punished. We do not address issues that arise from to the presence of vigilance against corruption. In such situations, corrupt officials may highly value the services of trusted intermediaries. In this paper we focus on the case where some officials are honest and others corrupt, and members of the public value information that identifies an official of one one type or the other.

The model presented here is a queuing model. Agents who want to obtain the benefit must incur some cost to do so; here the cost is modeled as the cost of waiting in line at a government counter staffed by an official. Clients access the intermediary to bridge gaps in two types of information. Those who are not entitled to the benefit but intend to obtain it by bribing an official access the intermediary to find out which officials can indeed be bribed, thus saving themselves the cost of waiting at an honest counter. when some agents do so allocation to counters is no longer random; there is systematic variation in the expected waiting costs at different counters. Therefore, even agents entitled to the benefit access the intermediary in order to ensure that they are directed to a counter where the wait is relatively shorter.

We assume that a fraction of officials are corrupt, and characterise equilibria in the case when there is no intermediary, and when there is a single monopolist intermediary. The most important findings are:

(a) In the economy with intermediaries, all types of agents use intermediation, including deserving candidates who do not pay bribes.
(b) If the benefit is very generous, then even deserving candidates pay a positive fee for intermediation.
(c) Welfare in an economy with an intermediary is lower than that in an economy without an intermediary.
(d) In the presence of corruption it is optimal for the government to reduce the number of officials dispensing the benefit as long as the benefit is sufficiently generous.

The next section sets out the model. It establishes the no-corruption benchmark and the equilibrium in the corruption market when there is no intermediation. Section 3 investigates equilibrium with a monopolist intermediary. The final section discusses directions for further investigation and concludes the paper.

2. The Model and preliminary results

The focus is on a service that is publicly provided to qualified citizens. There is a large population of citizens, out of which a randomly selected subset of $(M + N)$ citizens need the service in any given period. Of these, M are qualified to receive the service, and N are not. We will call the two types "deserving" (D) and "undeserving" (U) candidates, respectively. We think of this as a service that is required occasionally by individual citizens, such as a building permit or a driver's license. Thus undeserving individuals do not locate corrupt officials and strike up ongoing relationships with them.

The service is a transfer of amount B, received from the public exchequer. We assume that when the transfer is made to a deserving candidate, it increases social welfare by an amount αB ($\alpha > 0$), whereas when an undeserving candidate receives the transfer, social welfare is unaffected. Any private transfers between agents (e.g. bribes paid to clerks) also leave net social welfare unaffected.[1]

[1] Alternatively we could assume that a transfer to an undeserving candidate reduces

To receive this transfer, each candidate has to go to a counter staffed by an official, prove her credentials and pick up the money. There are K such counters and each candidate can go to any one of them. In the absence of additional information, any choice of counter by an individual is made at random. The documents a candidate has to bring have sufficient information to establish whether s/he deserves to get the transfer.

Suppose that all counters are staffed with honest officials. Then an undeserving candidate will immediately be identified as such and will be denied the transfer. Any deserving candidate will similarly be identified as such and obtain the transfer. There is a cost of queuing up at the windows, hence it does not pay any undeserving candidate to come to any window. Only deserving candidates will then stand in line and their benefit will be $B - \gamma(x)$, where x is the expected length of the line at any counter and $\gamma(.)$ is the cost of standing in queue. We assume:

A. 1: $\gamma(0) = 0, \quad \gamma'(.) > 0, \quad \gamma''(.) \geq 0.$

Therefore, when all officials are honest and the technology for identifying a deserving candidate is perfect (i.e., the identification is without any error), the utility of a deserving candidate is

$$V_D(M, 0; 1) = B - \gamma(\frac{M}{K}) \tag{1}$$

Where $V_j(x, y; \theta)$ is the utility of a type $j = D, U$, given that x deserving candidates and y undeserving ones apply for the transfer, and θ is the proportion of officials that are honest. $\frac{M}{K}$ is the expected length of the line at any counter assuming that candidates choose counters randomly. We will always assume that

A. 2: $B > \gamma(\frac{M}{K}).$

Now suppose that only k, $0 \leq k \leq K$ officials are honest, and define $\theta = \frac{k}{K}$. A dishonest official can make the transfer to an undeserving candidate but cannot deny the transfer to a deserving candidate. We assume:

Assumption 1. Counter officials are drawn at random from the population of all officials. The proportion θ of honest counter officials is constant independent of K and equal to the corresponding proportion in the population of all officials.

welfare (i.e., corruption is a public "bad"). This would not qualitatively alter our analytical conclusions.

Since the undeserving candidate is getting a transfer she is not entitled to, the dishonest official can charge an unofficial fee, or bribe, to affect this transfer. We assume that the bribe is determined by symmetric Nash bargaining, so that both the candidate and the official get $\frac{B}{2}$.[2]

A candidate has no way of knowing which counter has an honest official and which does not. We continue with our assumption that candidates are randomly allocated to the counters. Suppose that n of the N undeserving candidates apply. With probability θ the undeserving candidate will meet an honest official and with probability $(1-\theta)$ he will meet a dishonest official. His utility is then given by

$$V_U(M, n; \theta) = (1-\theta)(\frac{B}{2}) - \gamma(\frac{M+n}{K}) \tag{2}$$

The corresponding utility of a deserving candidate is:

$$V_D(M, n; \theta) = B - \gamma(\frac{M+n}{K}). \tag{3}$$

Proposition 1. *A deserving candidate will always apply.*

Proof. This follows directly from A.2 if no undeserving candidate is applying. An undeserving candidate will apply only if the utility in (3) is non-negative, which implies that V_D in (3) must be strictly positive. □

Proposition 2. *The number of undeserving candidates that apply decreases in θ and increases in K.*

Proof. As long as V_U in (2) is positive, undeserving candidates have an incentive to apply. Thus the equilibrium number of undeserving candidates that apply is the number that reduces V_U in (2) to zero. The proposition then follows directly from (2). □

Let $Z(K)$ be the cost of maintaining counters, including the salaries of officials and the infrastructure costs of setting up the counters. Suppose only deserving candidates apply for the transfer. Then the net social cost is $Z(K) + M\gamma(\frac{M}{K})$ (operating cost plus waiting cost), and the social benefit is αMB. An increase in the number of counters K increases the direct operating cost $Z(K)$, but reduces the average waiting cost $\gamma(\frac{M}{K})$. Let K_0 maximize social welfare when only deserving candidates apply;

$$K_0 = \arg\min_K \left[Z(K) + M\gamma(\frac{M}{K}) \right]. \tag{4}$$

[2]Using a different division rule does not make a qualitative difference. However, it would be more pleasing to have the division determined endogenously.

When $n > 0$ undeserving candidates also apply and obtain the benefit with positive probability. The social cost increases to $Z(K)+(M+n)\gamma(\frac{M+n}{K})$ while the social benefit remains unchanged at αMB. To deter undeserving candidates altogether, the waiting cost must be large enough to swamp the expected gain. Let K_1 be the largest number of counters for which this holds, i.e.,

$$K_1 \text{ satisfies } (1-\theta)(\frac{B}{2}) - \gamma(\frac{M}{K}) = 0. \tag{5}$$

Proposition 3. *Social welfare decreases in K for $K \geq K_1$.*

Proof. When $K \geq K_1$, the number of undeserving applicants, n, will increase until $V_U(M, n; \theta) = 0$ in equation 3. So in equilibrium, for any K, the total number of applicants must be such that the average waiting cost is $(1-\theta)(\frac{B}{2})$. Thus any increase in K is matched by a proportional increase in applicants. The net social cost from waiting increases proportionally, and the average waiting cost is not reduced. □

Observe that K_1 is independent of $Z(K)$ while K_0 is determined partly by it. This suggests that, when the cost of maintaining counters is sufficiently low, it will be optimal for the government to restrict the number of counters when some officials are dishonest, compared to what would be optimal in the absence of corruption. The following example demonstrates.

Let $Z(K) = zK$ and let $\gamma(\frac{M}{K}) = \frac{M}{K}$, i.e., both the cost of operating counters and the cost of waiting are linear. Then from conditions (4) and (5) we obtain $K_0 = \dfrac{M}{\sqrt{z}}$ and $K_1 = \dfrac{2M}{(1-\theta)B}$. Thus $K_0 > K_1$ if $B > \dfrac{2\sqrt{z}}{1-\theta}$. There fore, if B is sufficiently large, the socially optimal response to the existence of corruption is to reduce the number of counters, correspondingly reducing the net benefit received by each deserving candidate. Note also that if the number of counters is in fact set at K_1, there will be no actual instances of corruption, but the counters will be more crowded than in an economy without corruption. Indeed, overcrowding of government counters is a familiar phenomenon in underdeveloped economies.

Corollary 1. If the unit cost of maintaining counters is sufficiently low relative to the size of the benefit, then the socially optimal number of counters in the presence of corrupt officials is smaller than that when there are no corrupt officials.

3. A monopolist intermediary

Now suppose there is a single *intermediary* I, who has invested by finding out exactly which of the clerks are dishonest. A candidate who wants to be directed to a corrupt (or honest) clerk can approach the intermediary and acquire this information for a price. Below we present the intermediary's optimization problem, and establish the corresponding equilibrium.

Undeserving candidates have an obvious reason to seek the help of the intermediary; by going to a corrupt clerk they improve their probability of accessing the benefit from $(1-\theta)$ to unity, and avoid the cost of waiting in line at an honest counter. As some of them do so, however, the lengths of the lines at corrupt counters become longer than those at honest counters. Thus, some deserving candidates may also find it profitable to access the intermediary's services and be directed to the honest counters where the lines are now shorter.

Note that the intermediary can set different prices at which he sells information to the two types of candidates, without needing to verify their types (e.g. by evaluating their applications). A candidate asks the intermediary to direct him to a corrupt (respectively, honest) counter, and is pointed to an appropriate counter. If the number of counters is large, then this information is not especially useful to a candidate who in fact wishes to find an honest (respectively, corrupt) counter. Thus it does not pay the candidates to misrepresent their types to the intermediary.

Let m' and n' be the numbers of deserving and undeserving candidates, respectively, that go to the intermediary. Then $m = M - m'$ deserving candidates approach a counter without any information. Similarly, let n be the number of undeserving candidates that approach a counter without acquiring information from the intermediary. Any of the numbers m, m', n, n' may be zero. Note that we may have $n + n' < N$, since some undeserving candidates who could benefit from the service may not enter the market. Indeed we implicitly assume that N is sufficiently large to never become a binding constraint.

3.1. The intermediary's problem

The candidates that do not access the intermediary pick a counter randomly. Those who do are allocated in a straightforward way, as described below.

Lemma 1. *The intermediary directs all deserving clients to honest counters, and all undeserving clients to corrupt counters.*

Proof. For the first part, note first that if no D-candidates access I, then the expected wait at the corrupt counter must be at least as long as that at the honest counter. This is because the D (and any unmediated U) are distributed randomly, while mediated U, if any, are directed to the corrupt counters. Thus if any D-candidates approach I, it is to be directed to the shorter queue which is at the honest counter. The wait at the honest counter can be longer only if I directs sufficient numbers of deserving candidates to those queues. But then I is performing a disservice, and hence D-candidates will not approach him. The second part is self-evident. □

The length of the line at an honest counter is then:

$$l_h = \frac{M - m' + n}{K} + \frac{m'}{\theta K} \tag{6}$$

and that at a corrupt counter is:

$$l_c = \frac{M - m' + n}{K} + \frac{n'}{(1-\theta)K} \tag{7}$$

An unmediated candidate's expected waiting cost is $\theta\gamma(l_h) + (1-\theta)\gamma(l_c)$. If a candidate accesses I, his waiting cost changes by the difference between this value and the cost of waiting in the appropriate line. For a D-candidate this is the sole gain, and is given by

$$W_{m'} = [\theta\gamma(l_h) + (1-\theta)\gamma(l_c)] - \gamma(l_h) = (1-\theta)(\gamma(l_c) - \gamma(l_h)) \tag{8}$$

An unmediated U-candidate, if he enters the market, stands in a randomly chosen line, and obtains the benefit with a probability $(1-\theta)$. Thus his expected gain is:

$$V_n = (1-\theta)\frac{B}{2} - [\theta\gamma(l_h) + (1-\theta)\gamma(l_c)] \tag{9}$$

Uninformed U-candidates will enter the market as long as this gain is positive, thus in equilibrium this gain will be driven to zero or less. Of course if $V_n < 0$, then no uniformed U-candidate enters the market. Thus the condition that determines the number of *unmediated* U-candidates in the market, given arbitrary m, m', n' is:

$$V_n \leq 0, \qquad n \geq 0, \qquad nV_n = 0. \tag{10}$$

The expected gain of a U-candidate who accesses I is:

$$W_{n'} = [B/2] - \gamma(l_c). \tag{11}$$

Note that equations (8) and (11) show gross benefits before payments to the intermediary. All of the amount $W_{n'}$ is attributable to information from I, since in absence of this information the undeserving candidate would either not enter the market and hence get zero, or would compete with other unmediated U-candidates (if any), in which case his payoff would also be driven down to zero (by condition 10 above). The gain of the deserving candidate, $W_{m'}$, is similarly attributable to information transmitted by the intermediary.

We assume that the intermediary prices his services (to each type of candidate, respectively) to extract the entire surplus that is attributable to information.[3] For any given configuration of m', n', the profit-maximizing intermediary will charge D-candidates a fee of $W_{m'}$ and U-candidates a fee of $W_{n'}$. Thus his total revenue is:

$$R(m', n') = m'W_{m'} + n'W_{n'}. \tag{12}$$

His objective is to maximize $R(m', n')$ with respect to the two arguments. The number of unmediated U-candidates is simultaneously determined according to the condition (10). An *equilibrium* for this market is a triple (m', n', n) such that $R(m', n')$ is maximized and condition 10 is satisfied.

Using (8) and (11) we can rewrite the intermediary's revenue as:

$$R(m', n') = m'[(1 - \theta)(\gamma(l_c) - \gamma(l_h)] + n'[(B/2) - \gamma(l_c)]. \tag{13}$$

His maximization problem is

$$\max_{m',n'} R(m', n') \quad \text{s.t.} \quad 0 \leq m' \leq M; \quad n' \geq 0, \quad \text{and (10) is satisfied.}$$

3.2. Equilibrium with an active intermediary

An undeserving candidate, even when fully informed, can obtain at most $\frac{1}{2}B$ in benefit—the other half is captured by the corresponding dishonest official. Thus dishonest candidates enter the market only when $\frac{1}{2}B$ exceeds the waiting cost. We show below that this is indeed the threshold beyond which undeserving candidates enter. For relatively small values of B beyond this threshold, all of them use the intermediary's services. Further, as soon as there are some undeserving candidates in the market, some deserving candidates also use the intermediary's services. When the number of undeserving

[3]Thus we are ascribing the entire bargaining power to the intermediary. An alternative is to assume that the intermediary and the candidate splits these gains according to a symmetric Nash bargaining outcome. It will be easily seen from what follows that this does not qualitatively alter the results.

candidates equals that of the deserving, *all* candidates go through the intermediary. Only when the benefit is vary large do some undeserving candidates enter and try their luck without obtaining information from the intermediary. The last proposition completely characterises the equilibrium in the special case where waiting costs are linear—this simplification allowing us to derive closed-form solutions.

Proposition 4. *In equilibrium, if any undeserving candidates enter the market at all, then some of them use the intermediary's services.*

(a) If $B > 2\gamma(\frac{M}{K})$, then $n' > 0$, i.e., some undeserving candidates use the intermediary's services.

(b) If $n' > 0$ then $m' > 0$, i.e. some deserving candidates also use the intermediary's services.

[Proof in Appendix.]

Lemma 2. *In equilibrium, if the intermediary is active, then he serves deserving and undeserving candidates such that either*

(a) m' is interior and the lines at the corrupt and honest counters are of equal length, or

(b) $m' = M$ and lines at the corrupt counters are longer than those at honest counters.

[Proof in Appendix.]

Corollary 2. If $m' < M$, then the intermediary provides his services free to the deserving candidates.

This follows directly from equation (8) and the fact that the lines are equal.

In the remainder of the paper we assume that the waiting costs are linear. This contributes to simplicity and sharper results. In all cases, our results continue to hold (with minor quantitative adjustments) if we restore a strictly convex waiting cost. We normalise the constants such that

A. 3: $\gamma(x) = x$

Using **A. 3**, (6) and (7), equation (9) reduces to

$$V_n = (1-\theta)\frac{B}{2} - \frac{1}{K}[M + n' + n] \tag{14}$$

This will be useful in some of the arguments that follow.

In the following proposition, we completely characterise the equilibrium in the market with a monopolist intermediary and linear waiting costs. Define:

$$
\begin{aligned}
B_1 &= 2\frac{(2-\theta)}{\theta}\frac{M}{K} \\
B_2 &= \frac{4}{(1-\theta)\theta}\frac{M}{K}
\end{aligned}
$$

Note that $2\dfrac{M}{K} < B_1 < B_2$ for $\theta \in (0,1)$.

Proposition 5. *In equilibrium:*

(a) If $B \leq 2\frac{M}{K}$ then only deserving candidates apply, and the intermediary has no clients.

(b) If $B \in (2\frac{M}{K}, B_1)$, then all deserving candidates and some undeserving candidates apply. Some of the deserving candidates and all of the undeserving candidates use the intermediary's services.

(c) If $B \in [B_1, B_2]$ then all deserving candidates and some undeserving candidates apply, and all candidates use the intermediary's services.

(d) If $B > B_2$ then all deserving candidates apply and use the intermediary's services, some undeserving candidates apply and use the intermediary's services, and some undeserving candidates apply without intermediation.

[Proof in Appendix.]

3.3. Welfare

Intuition suggests that the equilibrium number of undeserving candidates that attempt to obtain the benefit is larger when the intermediary is active than when she is not, as we show below. As a consequence, social welfare is lower when the intermediary is active.

We continue with the assumption **A.3** of a linear waiting cost. Recall that the number of unmediated candidates in the market is n when there is no intermediary, and $n + n'$ when the intermediary is present.

Proposition 6. *In equilibrium,*

(a) When $B \leq 2\frac{M}{K}$, no undeserving candidates enter the market whether there is an intermediary or not.

(b) When $B \in (2\frac{M}{K}, B_2)$, the number of undeserving candidates entering the market with an intermediary is strictly larger than the number entering the unintermediated market.

(c) *When $B > B_2$, an equal number of undeserving candidates enter the market whether an intermediary is present or not.*

(d) *In both case (b) and (c) above, a greater number of undeserving candidates succeed in* obtaining *the benefit if the intermediary is present than if she is not.*

[Proof in Appendix.]

Corollary 3. Welfare in the economy with an intermediary is always weakly lower than in the economy without an intermediary. It is strictly lower when the size of the benefit is in the intermediate range $B \in (2\frac{M}{K}, B_2)$.

This follows since whenever the intermediary has any clients (i.e., $B > 2\frac{M}{K}$), *all* deserving candidates obtain the service, so the positive component of the welfare impact of the program is constant at αBM. However, the number of undeserving candidates is larger, and hence waiting costs are greater, until B rises above B_2.

Indeed, the welfare conclusion is weaker since we do not assign a negative weight to the disbursement of benefits to undeserving candidates. However, we know that the number of undeserving candidates that succeed in actually obtaining the benefit is strictly larger in the presence of the intermediary. As discussed in the introduction, the transfer to an undeserving candidate could very reasonably be considered a public evil, in which case our welfare conclusion would be further strengthened.

Next, observe that Proposition 2 holds in the intermediated market.

Corollary 4. In the market with an intermediary, the number of undeserving candidates that enter decreases in θ and increases in K.

We omit the proof, which follows from part of the proof of Proposition 5. As in Proposition 3, this implies that social welfare is (strictly) maximised at the value of K beyond which undeserving candidates enter the market, i.e., welfare decreases as K rises beyond K_2 given by:

$$K_2 \quad \text{satisfies} \quad \frac{B}{2} = \frac{M}{K} \tag{15}$$

Proposition 7. *In the economy with an intermediary, social welfare decreases with K for $K \geq K_2$.*

The proof exactly parallels that of Proposition 3, and is omitted. Note that $K_2 < K_1$, as can be deduced directly from using (15) in the example following Proposition 3. Thus, other things equal, the optimal number of counters in the economy with the intermediary is smaller than that in the economy without an intermediary. Note that once again if the optimal number of counters is operated, then no undeserving candidates actually enter the market, but each counter is more crowded than it would be in an optimally appointed economy with no corruption.

4. Conclusion

This paper makes an initial attempt at studying corruption markets with intermediation. We set ourselves the very limited task of analysing a market with a single intermediary, who only performs the service of directing members of the public to "appropriate" government officials, and in this uses the specialised knowledge of who is corrupt and who is not.

There is a large list of interesting phenomena that we have not attempted to analyse. We have not investigated potential collusion between officials and intermediaries. The intermediary and the corrupt officials share an interest in reducing the number of clients that come to the market unmediated. They reduce the profit of the intermediary because they contribute to longer lines, and corrupt officials lose potential profit because some unmediated candidates end up at honest counters. Thus there is scope for an alliance between corrupt officials and the intermediary, where the officials refuse to serve candidates that come unintermediated. Indeed, it is a common phenomenon that an undeserving agent will engage an intermediary to conduct the corrupt transaction on his behalf. An analysis of this phenomenon will require a study of the incentive and compliance mechanism that is incorporated in the contract between the intermediary and the official.

The question of collusion becomes more interesting once we acknowledge the presence of government vigilance against corruption. When officials are wary of engaging in corrupt transactions with agents they do not know—perhaps for fear of being caught and punished—intermediaries assume a special role. The citizen employs an intermediary to obtain the service for him (it is perfectly legal to hire an agent to stand in line with an application) and the official can safely accept the bribe from the trusted intermediary. Indeed, there is often a suspicion that respectable "professionals" are not above acting in such a role.

Finally, a major limitation of the present paper is the assumption of a monopolist. In most economies riddled with corruption, intermediaries are thick on the ground, each with access to his special coterie of corrupt officials. This raises interesting questions of competition and market structure.

The present paper proposes a framework for analysing a limited set of questions. Our hope is that this framework will prove to be sufficiently adaptable to incorporate related investigations of greater complexity and interest. In the meantime, we have established some results which we expect will be robust to such extensions: that intermediaries encourage greater participation in corrupt activities, raise costs for honest citizens, and generally reduce welfare.

Appendix: Proofs

Proof of Proposition 4.

Proof. For any (m', n', n), the expected payoff of an unmediated U-candidate $V_n = (1-\theta)W_{n'} - \theta\gamma(l_h)$ is weakly dominated by $W_{n'}$, the gross payoff of a mediated U-candidate. Thus if $n' = 0$, then $n = 0$ and there are no U-candidates in the market.
(a) But if $\frac{B}{2} > \gamma(\frac{M}{K})$ and there are no U-candidates, then the gross payoff of the marginal U-candidate who goes to the intermediary is positive, thus $n' > 0$.
(b) If $n' > 0$ and $m' = 0$ then $l_c > l_h$ by (6) and (7), so a D-candidate will be willing to pay a positive amount for I's services. Further, if I directs some deserving candidates to honest lines this reduces the length of the corrupt lines, so the intermediary can charge a higher price from undeserving clients. Thus the intermediary will provide services to a positive number of deserving clients. □

Proof of Lemma 2.

Proof. One of the first-order conditions for equilibrium with $m' > 0$ is

$$\frac{\partial R(m', n')}{\partial m'} \geq 0, \qquad m' \leq M, \qquad (M - m')\frac{\partial R(m', n')}{\partial m'} = 0.$$

Using (6), (7) in (13) and differentiating, we get

$$\frac{\partial R(m', n')}{\partial m'} \tag{16}$$

$$= (1-\theta)[\gamma(l_c) - \gamma(l_h)] \ + m'(1-\theta)\left[\gamma'(l_c)(-\frac{1}{K}) - \gamma'(l_h)(\frac{(1-\theta)}{\theta}.\frac{1}{K})\right] \ + n'\gamma'(l_c).\frac{1}{K}$$

$$= (1-\theta)\frac{1}{K}\left[(\gamma(l_c) - \gamma(l_h)) \ - \ m'\left[\gamma'(l_c) + \frac{(1-\theta)}{\theta}\gamma'(l_h)\right] \ + \ \frac{1}{(1-\theta)}n'\gamma'(l_c)\right]$$

$$= (1-\theta)\frac{1}{K}\left[(\gamma(l_c) - \gamma(l_h)) \ - \ \frac{m'}{\theta}\left[\theta\gamma'(l_c) + (1-\theta)\gamma'(l_h)\right] \ + \ \frac{n'}{(1-\theta)}\gamma'(l_c)\right]$$

Now note that $\frac{n'}{(1-\theta)} > \frac{m'}{\theta}$ implies that $l_c > l_h$, hence $\gamma(l_c) > \gamma(l_h)$. Then by convexity of γ, $\gamma'(l_c) \geq \gamma'(l_h)$, so in particular $\gamma'(l_c) \geq [\theta\gamma'(l_c) + (1-\theta)\gamma'(l_h)]$. Hence we must have

$$\frac{n'}{(1-\theta)}\gamma'(l_c) > \frac{m'}{\theta}[\theta\gamma'(l_c) + (1-\theta)\gamma'(l_h)].$$

So the last line of (16) must be positive, hence $m' = M$. Conversely, by an argument similar to the one above, the RHS of (16) vanishes if and only if $\frac{n'}{(1-\theta)} = \frac{m'}{\theta}$. Thus if m' is interior, the lines at the honest and dishonest counters must be equal. □

Proof of Proposition 5.

Proof. for parts (a) and (b) Suppose $m' < M$. Then from lemma 2 part (a) the lines are equal, so and we must have $\frac{n'}{(1-\theta)} = \frac{m'}{\theta}$. Let the intermediary vary m' optimally as n' varies, then it must be true that

$$\begin{aligned} l_h = l_c =& \frac{1}{K}[M + n' + n] \qquad\qquad \text{and} \\ \frac{\partial m'}{\partial n'} =& \frac{\theta}{(1-\theta)} \end{aligned}$$

Using (12), the intermediary's first-order condition for the choice of n' is

$$0 = \frac{\partial R(m', n')}{\partial n'} = W_{m'} + m'\frac{\partial W_{m'}}{\partial n'} + W_{n'} + n'\frac{\partial W_{n'}}{\partial n'}. \tag{17}$$

since line lengths are equal, deserving candidates pay a zero price (i.e., $W_{m'} = 0$), thus the first two terms vanish by choice of m'. Noting that $W_{n'} = \frac{B}{2} - \frac{1}{K}[M + n' + n]$, we have

$$\begin{aligned} \frac{\partial R(m', n')}{\partial n'} &= W_{n'} + n'\frac{\partial W_{n'}}{\partial n'} \\ &= \frac{B}{2} - \frac{1}{K}[M + n' + n] + \frac{n'}{K}[-(1 + \frac{\partial n}{\partial n'})] = 0 \end{aligned} \tag{18}$$

Now suppose $n > 0$, then we must have $V_n = 0$, i.e. $\frac{1}{2}(1-\theta)B = \frac{1}{K}[M+n'+n]$. This must continue to be true as n' varies, which implies $\frac{\partial n}{\partial n'} = -1$. Then (18) reduces to $\frac{B}{2} - \frac{1}{K}[M + n' + n] = 0$. But then $V_n < 0$ by (14), so n cannot be positive.

Thus if $m' < M$ then n cannot be positive. Hence $\frac{\partial n}{\partial n'} = 0$, and we must have

$$\begin{aligned} \frac{\partial R(m', n')}{\partial n'} =& \frac{B}{2} - \frac{1}{K}[M + n'] + \frac{n'}{K}[-(1 + \frac{\partial n}{\partial n'})] \\ =& \frac{B}{2} - \frac{1}{K}[M + 2n'] = 0 \quad \text{which implies} \\ n' =& \frac{1}{4}BK - \frac{1}{2}M \end{aligned}$$

Note that n' cannot be positive if $\frac{B}{2} < \frac{M}{K}$, which is claim (a).

Recall that the above arguments hold as long as $m' < M$. We know

$$m' = \frac{\theta}{1-\theta}n' = \frac{\theta}{4(1-\theta)}BK - \frac{\theta}{2(1-\theta)}M$$

which remains less than M if

$$B < 2\frac{(2-\theta)}{\theta}\frac{M}{K} \equiv B_1.$$

which proves claim (b). When $B = B_1$, we must have $m' = M$ and $n' = \frac{1-\theta}{\theta}M$ and line lengths are equal.

For parts (c) and (d), let $B > B_1$, then we know that $m' = M$. Thus

$$\begin{aligned} l_c =& \frac{n'}{(1-\theta)K} + \frac{n}{K} \\ l_h =& \frac{M}{\theta K} + \frac{n}{K} \end{aligned}$$

which implies

$$W'_m = (1-\theta)(l_c - l_h) = (1-\theta)\big[\frac{n'}{(1-\theta)K} - \frac{M}{\theta K}\big]$$

So (17) for the choice of optimum n' reduces to

$$\begin{aligned} R(n', m') &= \big[\frac{B}{2} - (\frac{n'}{(1-\theta)K} + \frac{n}{K})\big] - n'\big[\frac{1}{(1-\theta)K} + \frac{1}{K}\frac{\partial n}{\partial n'}\big] + \frac{M}{K} \\ &= \frac{B}{2} - \frac{2}{(1-\theta)K}n' - \frac{n}{K} - \frac{1}{K}n'\frac{\partial n}{\partial n'} + \frac{M}{K} = 0 \end{aligned} \tag{19}$$

Now let $n > 0$, then $\frac{\partial n}{\partial n'} = -1$ as before, and (19) reduces to

$$\begin{aligned} 0 &= \frac{B}{2} - \frac{2}{(1-\theta)K}n' + \frac{1}{K}n' - \frac{n}{K} + \frac{M}{K} \\ &= \frac{B}{2} - \frac{2\theta}{(1-\theta)K}n' - \frac{1}{K}n' - \frac{n}{K} + \frac{M}{K} \\ &= \big[(1-\theta)\frac{B}{2} - \frac{1}{K}(M + n' + n)\big] + \big[\theta\frac{B}{2} - \frac{2\theta}{(1-\theta)K}n' + 2\frac{M}{K}\big] \end{aligned}$$

But the first term in square brackets in the last line above is precisely V_n, which must vanish if $n > 0$, thus optimality of n' requires

$$\begin{aligned} 0 =& \big[\theta\frac{B}{2} - \frac{2\theta}{(1-\theta)K}n' + 2\frac{M}{K}\big] \\ \implies \quad n' =& \frac{1}{4}(1-\theta)Bk \;+\; \frac{1-\theta}{\theta}M \end{aligned}$$

This substituted in (14) yields

$$V_n \;=\; \frac{1}{4}(1-\theta)B \;-\frac{1}{K}[\frac{M}{\theta}-n]$$

Thus $V_n = 0$ is consistent with $n \geq 0$ only if

$$\begin{aligned} \frac{1}{4}(1-\theta)Bk \;&\geq\; \frac{M}{\theta} \\ \Longrightarrow B \;&\geq\; \frac{4}{\theta(1-\theta)}\frac{M}{K} \;\equiv B_2 \end{aligned}$$

which is part (d).

Finally note that if $B < B_2$ then we must have $V_n < 0$ hence $n = 0$ and $\frac{\partial n}{\partial n'} = 0$, so the optimisation condition (19) reduces to

$$\begin{aligned} \frac{B}{2} - \frac{2}{(1-\theta)K}n' + \frac{M}{K} &= 0 \\ \Rightarrow n' \;&=\; \frac{1}{4}(1-\theta)BK + \frac{1}{2}(1-\theta)M \end{aligned}$$

which substituted in (14) and rearranged does confirm that $V_n < 0$ for $B < B_2$, which establishes part (c).

□

Proof of Proposition 6.

Proof. In equilibrium, whether with or without the intermediary, the expected payoff of an unmediated undeserving candidate must be non-positive. From equation 2, using **A.3** this gives us:

$$n = \max\{\frac{1}{2}(1-\theta)BK \;-\; M,\; 0\} \tag{20}$$

when there is no intermediary.

In the market with an intermediary, we use equation (14) and condition (10) to get

$$n + n' \geq \frac{1}{2}(1-\theta)BK - M$$

From the proof of Proposition 5 we know that condition (10) holds with strict inequality for $B < B_2$, which implies that

$$n = 0 \quad \text{and} \quad n' > \frac{1}{2}(1-\theta)BK - M \quad \text{if} \quad B < B_2 \tag{21}$$

Note that, from equation (20), n is positive when B is larger than $2\frac{M}{(1-\theta)K}$, and thereafter increases in B for given K in the unintermediated market. when the intermediary is present, we know that the number of undeserving candidates in the market becomes positive for $B > 2\frac{M}{K}$ (see Proposition 5), which is a smaller value of B than is required in the non-intermediated market. Further, from equation (21), we know that for $B < B_2$, n' in the intermediated market is greater than n in the unintermediated market. These together establish parts (a) and (b).

when $B \geq B_2$, condition (10) holds with equality (see proof of Proposition 5), thus $n + n' = \frac{1}{2}(1-\theta)BK - M$. Comparing with equation (20) gives part (c).

finally, note that in all the cases, a positive number of undeserving candidates access the intermediary when she is present. These candidates obtain the benefit with certainty, whereas when there is no intermediary, undeserving candidates only obtain the benefit with probability $(1-\theta)$. This establishes part (d).

□

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