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Staff rotation, connection building and intermediaries in corrupt transactions[1]

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Abstract

Corruption has been a major problem in many societies throughout history. There is an extensive literature about the ways to discourage corruption, with staff rotation being one of the suggestions given. This article primarily focuses on the effect of staff rotation on corrupt transactions, although it also considers other factors, like connection building and use of intermediaries, which facilitate corrupt transactions. The roles of staff rotation, connection building and intermediaries are examined in three different settings: a stage game without intermediaries, an infinitely repeated game without intermediaries, and a game with intermediaries. Results suggest that staff rotation, increased penalties and a clean image of public office can be effective anti-corruption policy tools. Existence of intermediaries or a long term interaction between officers and the clients can solve time inconsistencies, thus, some corrupt transactions, which are not implementable otherwise, become feasible.

JEL Classification: K42, C72, D73.
Key Words: Corruption, Staff Rotation, Intermediaries, Connections, Bribe.

1. Introduction

Corruption has been a significant problem in many countries throughout history, with nearly universal agreement on its harmful effects. Corruption distorts income distribution, discourages investments, damages democracy and weakens ethical values.

Comprehensive surveys of corruption have been written by Rose-Ackerman (1999), Andvig (1991), Bardhan (1997) and Lambsdorff (2001), and the literature is rich with studies about corruption's harmful effects, for example Mauro (1995), Gould and Amaro Reyes (1983), United Nations (1989), Klitgaard (1991) and Mauro (1998).

There is also a comprehensive literature on determining the causes of and ways to prevent corruption. One of the most frequently suggested ways

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to prevent corruption is staff rotation (for example, Bardhan 1997), and some countries already use staff rotation effectively as an anti-corruption policy[2].

Rotation of public employees makes their establishing relations with clients more difficult and is expected to decrease corrupt dealings. Clients frequently try to establish connections with key officials in charge of giving certain public benefits to gain advantages that they are not legally entitled to. If staff rotation is frequent, the expected privileges from establishing connections with such public officers may no longer worth the increased costs.

Abbink (2004) conducted a laboratory experiment where new pairs of potential bribers and public officials were formed in every round. He then compared this to the base case where interacting pairs remain fixed. The results showed that rotation of the interacting pairs significantly reduced the level of bribes and the frequency of inefficient decisions due to bribery.

Mogiliansky et al. (2007) examined petty corruption cases in a setting where entrepreneurs were applying for approval of their projects to a track of two or more bureaucrats in a prescribed order and commented on the effect of rotation of the bureacrats on social welfare. Choi and Thum (2003) examined the effects of job rotation on corruption where officials take bribes to issue entrance licenses for the entrepreneurs. In both papers, the welfare effect of the job rotation was ambiguous, depending on various parameters in the models.

In this article, I focus on the effect of intermediaries on the frequency of corrupt transactions in a setting where the government uses staff rotation as an anti-corruption strategy, and where the nature and the risks of the corrupt service requires connection building investment.

When staff rotation exists, it may no longer be worthwhile for an individual client to incur the costs of establishing connections with every new public officer in order to get corrupt benefits. However, this may not lead to a decrease in the level of corruption. Instead, intermediary agents may begin to be used in corrupt transactions. An intermediary, having established a connection, can offer this to many clients in return for some commission. This would reduce the cost per corrupt transaction, so the process would be profitable, even with frequent job rotation. Thus, under some conditions, if a public office increases job rotation to prevent corruption, it may not decrease corruption but instead may simply increase the frequency of corruption through intermediaries.

Designing the system such that staff rotation is so frequent that even intermediaries are discouraged is also possible. However, in this case, this sacrifices the benefits to the organization from an employee's remaining in a

2 Transperancy International (undated) in its anti-corruption handbook discusses the importance of job rotation while giving examples of best practises, such as the example of Germany.

job for long enough to learn the job and gain experience and proficiency. Thus, an organization has to evaluate carefully the pros and cons of using staff rotation as an anti-corruption policy.

There is a rich literature on the role of intermediaries in various types of markets with asymmetric information. Intermediaries' roles in decreasing frictions, reducing inefficiencies, increasing the chance of coincidence of the desires of sellers and buyers, and preventing bargaining breakdowns have all been examined. Shevchenko (2004), Biglaiser (1993), Gehrig (1993) and Lizzeri (1999) are among these studies. On the other hand, Masters (2008) showed that, under some conditions, intermediaries may occur in a market endogenously, serving no useful purpose and having a welfare-reducing effect for the society. Similarly, Cosimano (1996) showed that, although intermediaries may serve the market by increasing the probabilities of successful trade, if they have high costs of intermediation, the net welfare effect of their existence for the society may be negative. In Rubinstein and Wolinsky (1987), the welfare effects of the existence of middlemen are ambiguous: whether intermediary is welfare improving or not depends on the nature of the matching probabilities.

Intermediaries usually occur as a sector around bureaucracies. Formally, they serve the clients by helping to collect necessary documents, fill in forms, etc., thereby allowing clients to save time. However, in many cases, these agents become a "safer way" to engage in corrupt transactions with bureaucrats. Intermediaries decrease the risks involved in corrupt transactions by establishing long-run, trust-based relationships with corrupt officials, and allow a number of clients to benefit from this in return for some commission.

There are a small number of studies explicitly modeling the role of intermediaries in corrupt transactions. Bayar (2005) examined how intermediaries make corrupt transactions easier and more profitable for the parties to the transaction. The study modelled the role of intermediaries in a briber-initiated corrupt transaction. It showed how intermediaries decrease the risk to a client who wants to offer a bribe to the public officer but fears being denounced to law enforcement agencies if the officer turns out to be honest. Bayar (2009) examined the other side of the relationship and modelled the role of intermediaries in a bribee-initiated corrupt transaction. Intermediaries in that case serve to decrease the risks faced by an officer who wants to demand a bribe from the client but hesitates due to the risk that the client may be an honest "whistleblower" type, and so denounce the officer to law enforcement agencies.

Hasker and Ökten (2008) also modelled the role of intermediaries in corrupt transactions. They did not explicitly take into consideration who initiates the corrupt transaction, thus ruling out the risks originating from the unknown dis/honesty of client or officer in a corrupt transaction. The study focused on the role of middlemen in decreasing the enforcement costs of corrupt transactions, mainly the probability that the public officer may renege. They also discussed staff rotation as a factor increasing the renege incentives of the public officer.

Lambert-Mogiliansky et al. (2009) examined the petty corruption of a track of bureaucracts who have the authority to approve business projects in a hiereachy and who demand a bribe as a condition of approval. Entrepreneurs who demand the approval may use intermediaries. In the stage game without intermediaries, expected costs exceed expected benefits for the entrepreneurs; thus they do not apply for the approval to the bureaucrat. In the dynamic game with the existence of intermediaries, under some conditions, bribing the bureaucrats and getting the approval using intermediaries is profitable for all parties.

Baç (2001) examined the connection building efforts of clients when the service demanded is an illegal one. Connection building decreases the risks and enforcement costs involved in a corrupt transaction by establishing mutual trust between the agents.

A common feature of all studies on corruption and intermediaries seems to be that the existence of middlemen can make some corrupt transactions that would otherwise be too costly to implement viable, thus increasing corruption.

In this article I model how staff rotation, connection building and image of public sector affect corrupt transactions, and what role middlemen may play to facilitate corrupt transactions in this setting.

The paper is organized as follows: section 2 establishes the model, and section 3 presents the results of the model and gives some policy suggestions that follow from them.

2. The model

This study models a corrupt transaction where there is a public office and a client who demands a service from this office, to which she is not legally entitled to. For example, this might involve a person who does not have the necessary qualifications getting a job in the public office, or getting a licence for an activity without having met the necessary requirements, or it might involve getting construction permits in a forbidden zone, etc.

These types of corruption are riskier than corrupt transactions where the service given to the client is a legal one and the bribe is given just to get the service faster or with less bureaucracy. When an illegal service is given to the client, it is both easier to be detected by law enforcement agencies (in contrast to bribes involved in legal services, given that the illegal service provided constitutes evidence), and the punishments are heavier. The crime is double: both an illegal service is given and a bribe is taken. Thus, usually, the parties to a corrupt transaction where the service in question is an illegal one perceive more risks and may try to decrease these risks by establishing trust-based connections with the public officers involved. This kind of a transaction is within the scope of the concept of "corruption with theft" (for a detailed analysis of corruption with theft and without theft, see Shleifer and Vishny (1993)).

I assume that the public officer has a monopoly power over the service in question, which is a realistic assumption. Large projects, which are more likely to be the subject of the types of corruption just described, are usually approved in one center in the bureaucracy.

In the model, I assume that a client, before demanding the illegal service from the officer, first makes an investment, E, to establish a friendly relationship with the officer. This investment may be in the form of making visits, doing some small, informal, non-monetary favors, etc. Establishing connections is not illegal, neither verifiable nor punishable. I assume that the level of E is fixed: it is a minimum necessary level of investment to build trust between the client and the officer. I define E as a welfare loss, an investment that costs the client but does not give a decent benefit to the officer.

The officer may be an honest officer who never takes a bribe, or a corrupt one who takes a bribe whenever it is profitable for him. The process of establishing connections is subtle: the client does not make her real intention clear until the friendship is really established, so the client may unwittingly establish a relationship with an honest officer. If the client connects with the officer which turns out to be honest, the client's efforts to establish connections, E, are wasted. In this study, I assume that when a client makes the investment E and becomes friends with the officer, she realizes whether the officer is corrupt or honest, and if the officer turns out to be honest, she does not offer a bribe. We assume single strategy choice for the honest officer, always declines bribe offers and places a complaint in law enforcement agencies. Thus, in this study, the initial investment of the client also removes the risk of offering a bribe to an honest officer[3]. The client, before making the investment, has an initial belief, with q probability, that the officer may be corrupt, and with (1-q) probability that the officer may be honest. This perceived probability is closely related to the general image of the public sector in the eyes of the citizens. In fact, clients form a "rational expectation" using information at hand: previous corruption experiences of themselves and their friends, media coverage of some corruption cases etc. In countries where corruption is widespread, q is perceived to be larger.

I assume there is staff rotation in the public office, with the officer in charge of the service being changed with an unkown periodicity. The probability that the officer in charge of the service will remain in office next term is represented by p. The probability that next term another official will

[3] Bayar (2005) examined the effect of perceived risks in corrupt transactions due to the unfamiliarity of the parties to each other; the client, while offering a bribe to the officer, is afraid of offering a bribe to an honest bureacrat who can denounce him to the law enforcement agencies, thereby incurring a penalty on the briber. Here, the initial investment E, removes this risk.

be in charge, so that E, the investment the client (or the intermediary) made to the previous officer, will be wasted is represented by (1-p).

We examine the game in three different cases: a stage game without the existence of intermediaries, a repeated game without intermediaries, and a stage game with intermediaries.

2.1. The case without intermediaries

In the case without intermediaries, the staging of the game is as follows: first, the client decides whether to establish a connection with the officer in charge of the service that the client is not entitled to. The illegal service gives the client Z amout of utility. If she decides to establish the connection, she incurrs the cost E and establishes a connection. After incurring the cost E, she learns whether the officer is honest or corrupt. If she learns that the officer is honest, she does not offer a bribe, so she suffers the loss of E (otherwise, if offers a bribe, the honest officer will surely decline and report to the law enforcement agencies, which will cause the client a loss of –E-F; where F is the amount of penalty). The game ends. When the honest officer is rotated, a completely new and independent game begins with the same logic. If she learns that the officer is corrupt, she decides whether to offer a bribe to the officer, and then the officer decides to either accept or reject; if the officer accepts, she states the amount of bribe s/he will demand in return for giving the service. During the connection building process, we assume that the officer and the client get to know each other and the officer learns about what valuation the client places on the illegal service, Z**.** After the amount of bribe has been decided on, in the implementation phase, the officer may be changed with probability (1-p), in which case the client again loses the initial connection building investment E (we assume that the bribe is paid after the client gets the service). With probability p, the officer remains in his job in the implementation period, provides the illegal service and, having done so, receives the bribe. The game tree of the game is given at the appendix.

In corrupt transactions, there is also a probability of reneging by both parties. If the penalty system in the country is such that only the client is punished in a corrupt transaction, the probability of the officer's renege increases and the client who faces the renege of the officer cannot complain to the law enforcement agencies[4]. On the other hand, if the system is such that only the officer gets the penalty, we can expect the probability of reneging by the officer falls near to zero. In this model, for simplicity, I rule out the renege probability by making the assumption that if any corrupt dealing is recognized by the law enforcement authorities, both parties of the

[4] Different legal systems in different countries apply penalties to corruption differently. Some countries like Taiwan penalize only bribe takers, while some other countries, such as Chile, penalize only bribe payers; others, like the USA, treat both parties symmetrically (Rose-Ackerman, 1999, pp.53-55).

corrupt transaction receive a penalty. I further assume that there is an independent probability of detection, ξ, by the law enforcement authorities. If any corrupt dealing is detected, I assume that both parties get a fixed penalty, F. However, the model's results could easily be generalized to the case where the penalties are different for the officer and client, or to the case where the penalty is a function of the amount of bribe taken.

Thus, on the path strategy space of a client is $S_C \in$ {(E,Offer,Pay), (E,Offer,Don't Pay), (E,Don't Offer), (Not)}; she either invests in the connection by incurring a cost, later decides whether to offer a bribe; if offers a bribe and if the officer accepts the offer by demaning a bribe of β, client then decides whether to pay or not what officer wants as bribe; or the client does not invest in the connection from the very beginning of the game, in which case the game does not start. The corresponding strategy space of the corrupt officer can be defined as S_O =[f: (E, Offer)→{Rj, Demand β}]. The strategy of the officer is a function from the bribe offering decision of the client to the two possible responses of the officer to that offer. Rj stands for rejecting the bribe offer of the client and β represents the amount of bribe he demands if the client offers a bribe and he accepts to give the illegal service in return for some bribe. I assume the behavior of honest officers as given: they never accept a bribe, and if they are offered a bribe, they refuse it and report the client to the law enforcement agencies (S_H =[f: (E, Offer)→{Reject-Report}]). These nodes are off the equilibrium path.[5] If faced with an honest officer, client prefers not to offer a bribe. If the honest officer is rotated, an independent new game begins and client can decide whether to make connection building investment with the new officer so on so forth.

If the officer that the client has invested in is rotated, the client gets –E. If the officer turns out to be honest, the client gets –E if does not offer a bribe and gets –E-F if offers a bribe. Otherwise, the utility function of the client, for each on the path strategy of her, can be defined as follows:

$$U_C(E,\beta,S_O)=\begin{bmatrix} -E & \text{if} \quad s_C=\{(E,Offer,Pay),(E,Offer,D-Pay)\} & \text{and} \quad s_O=Rj \\ Z-\beta-E-\xi F & \text{if} \quad s_C=(E,Offer,Pay) & \text{and} \quad s_O=demand\beta \\ -E & \text{if} \quad s_C=(E,Offer,D-Pay) & \text{and} \quad s_O=demand\beta \\ -E & \text{if} \quad s_C=(E,Don'tOffer) & \text{and} \quad s_O=demand\beta \\ 0 & \text{if} \quad s_C=(Not) & \end{bmatrix} \tag{1}$$

The utility function of the corrupt officer is defined as below. Honest officers' behavior is taken as given; they never accept a bribe; thus always get zero utility.

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[5] If we include also off the path equilibrium strategies, strategy space of the client would be as such : $S_C \in$ {(E,Offer,Pay, Offer), (E,Offer,Pay, Don't), (E,Offer,Don't Pay, Offer), (E,Offer,Don't Pay, Don't) (E,Don't Offer, Offer), (E,Don't Offer, Don't), (Not)}, where the fourth entry in each strategy representing the decision of the client after he faces with an honest officer.

$$U_O(E,\beta,S_O)=\begin{bmatrix} 0 & \text{if} & s_C=\{(E,Offer,Pay),(E,Offer,D-Pay)\} & \text{and} & s_O=Rj \\ \beta-\xi F & \text{if} & s_C=(E,Offer,Pay) & \text{and} & s_O=demand\beta \\ 0 & \text{if} & s_C=(E,Offer,D-Pay) & \text{and} & s_O=demand\beta \\ 0 & \text{if} & s_C=(E,Don'tOffer) & \text{and} & s_O=demand\beta \\ 0 & \text{if} & s_C=(Not) & & \end{bmatrix} \quad (2)$$

It is apparent that the officer gains more utility from receiving a bribe rather than rejecting the client's bribe offer, as long as β-$\xi F \geq 0$, that is, $\beta \geq \xi F$. Thus, ξF is the reservation utility of the officer. However, the fact that the officer has monopoly power gives him total bargaining power in his dealing with the client, so he extracts all the surplus from the client. This is an ultimatum game. Large parts of the literature on corruption, assume that there is some bargaining between the corrupt officer and bribe payer. However, since in this model the service in question is an illegal one, and the corrupt officer is the monopoly provider of it, it is realistic to assume that the bureaucrat has the whole bargaining power.

The officer uses his monopoly power to capture all the rents, rejecting all bribe offers except the one making the client just indifferent between paying the bribe and not paying (I assume for simplicity that the client pays the bribe when she is indifferent between paying and not paying). To solve for Subgame Perfect Equilibrium, we can analyse the game beginning from the last subgame. In the last subgame, the client prefers paying the bribe as long as $Z-\beta-\xi F\geq 0$ (since E is already a sunk cost for the client by the time the last stage has been reached). The amount of bribe that the officer demands thus equates to $\beta = Z-\xi F$. In this case, the expected utility of the client equals –E, if she makes the connection building investment[6].

Anticipating all these, the client calculates her expected utilities from making the connection building investment, or not making it, at the beginning of the game. If she makes a connection building investment, and if the officer turns out to be corrupt, and if he remains in office, she will get the service. However, since the bribe she will pay is high, she will end up with the utility U_C=-E. If the officer turns out to be honest, or turns out to be corrupt but doesn't remain in office, the client will not be able to offer a bribe and demand the illegal service. Thus, her initial connection building investment will be wasted and she will again end up with the utility U_C=-E. On the other hand, if she does not make the initial connection building investment, she will get zero utility. It is therefore optimal for the client not to make the connection building investment at the beginning, so the game ends before it has even started.

There is thus a time inconsistency problem here. The corrupt officer cannot credibly commit not to exploit the client, and not to take the whole surplus of the client plus E. If he could credibly commit not to exploit the

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[6] Rubinstein and Wolinsky (1987) shows a nice example of how existence/non-existence of sunk costs affects the bargaining power of the parties.

client, he would be able to obtain some positive amount of bribe (minus expected penalties). However, since he cannot credibly commit, he can gain nothing. We therefore reach the conclusion that unless the game is repeated, or there is some help from outside (like intermediaries), corrupt dealing is not likely to begin at all. I will now examine each possibility in turn.

2.2. Infinitely repeated game (without intermediaries)

If the service in question requires intermittent contact between the officer and the client, such as a yearly licence renewal, we can imagine the game as an infinitely repeated game. In this situation, the officer, while deciding, must take into consideration what will be the results of his actions on the future behavior of the client, assuming he remains in office.

In the infinitely repeated version of the game, we can check whether the officer, under some conditions, would commit himself not to exploit clients, thus making a corrupt equilibrium feasible.

The repated game is very similar to the one described in the previous section, with one difference. In the first stage, again, the client decides whether to make the connection building investment or not. Nature then decides whether the officer is honest or corrupt. If the officer turns out to be corrupt, in the third stage the client decides whether to offer a bribe to the officer and the officer then decides whether to accept it (and say the amount of bribe he wants to give the service) or not. Nature then decides whether the officer will remain in office or not. If the corrupt officer does not change, the client can continue to benefit from the public service given, as long as the bribed official remains in office. I assume that the illegal service yields profit, Z, to the client in each period. The service in question may be an annually renewed government contract, or a government job where the employment for the next term is reviewed each period, etc. The client pays a bribe (β) demanded by the officer each period and, as long as the officer remains in office, the connection continues, so the client can continue to get the benefit in return for a bribe.

Repeated game is the same with the one in the first part with the exception that, connection building investment is done just once at the first repetition and once the connection is established as such, client can benefit from it in other repetitions, as long as the corrupt officer remains in the office. Except the first repetition, connection building costs do not occur.

When the officer is replaced, unless the client first establishes a new connection with the newcomer, she cannot dare to demand the corrupt service due to the high risks involved. So the game ends. A completely new and independent infinitely repeated game begins with the new officer. The common discount factor is represented as δ.

We can again solve the problem for the interaction of the single client with a single public officer. The strategy space of a client in the first repetition is defined as before: $S_C \in$ {(E,Offer,Pay), (E,Offer,Don't Pay), (E,Don't), (Not)}. She either invests in the connection by incurring a cost before, later deciding whether to offer a bribe, or does not invest in the connection, in which case the game does not begin. Correspondingly, the strategy space of the corrupt officer is defined as S_O =[f: (E,Offer)→{Rj, demand β}]. If the officer changes then a completely new and independent repeated game begins with the new officer. If the officer is corrupt, and if he is not rotated, players can continue with the existing corrupt agreement at each repetition; there is no need to make a connection building investment each time interacting with the same officer; the bribe paid each period also serves to protect the connection. If the officer turns out to be honest, the client loses the connection-building investment, E, and cannot dare to offer a bribe. Instead, the game ends there; she waits for the officer to change, and then may begin a completely new and independent game by making a new connection-building investment. If the corrupt dealing is detected by law enforcement authorities, with probability ξ, again, the game ends, officer is taken from the office and a new game begins with a new officer. Thus, the situation is represented as an infinitely repeated game with random termination rules. Some situations may cause termination of the game which is otherwise infinitely repeated.

We can represent the expected utility function of the client as follows.

$$U_C(E,\beta,S_O)=\begin{bmatrix} -E & \text{if} \quad s_C=\{(E,Offer,Pay),(E,Offer,D-Pay)\} \quad \text{and} \quad s_O=Rj \\ (1-q)(-E)+q(1-p)(-E)+qp(Z-\beta-E-\xi F)+\delta qp(1-\xi)\left[p(Z-\beta-\xi F)+(1-p)0\right] & \\ +q\delta^2p^3(1-\xi)^2(Z-\beta-\xi F)+\ldots & \text{if} \quad s_C=(E,Offer,Pay) \quad \text{and} \quad s_O=demand\beta \\ -E & \text{if} \quad s_C=(E,Offer,D-Pay) \quad \text{and} \quad s_O=demand\beta \\ -E & \text{if} \quad s_C=(E,Don'tOffer) \\ 0 & \text{if} \quad s_C=(Not) \end{bmatrix} \tag{3}$$

The expected utility function of the corrupt officers is defined as below. Again, honest officers' actions are predetermined; they never take a bribe, when they are suggested bribe reject and reports to law enforcement agencies.

$$U_O(E,\beta,S_O)=\begin{bmatrix} 0 & \text{if} \quad s_C=\{(E,Offer,Pay),(E,Offer,D-Pay)\} \quad \text{and} \quad s_O=Rj \\ p(\beta-\xi F)+\delta p^2(1-\xi)(\beta-\xi F)+ & \\ \delta^2p^3(1-\xi)^2(\beta-\xi F)+\ldots & \text{if} \quad s_C=(E,Offer,Pay) \quad \text{and} \quad s_O=demand\beta \\ 0 & \text{if} \quad s_C=(E,Offer,D-Pay) \quad \text{and} \quad s_O=demand\beta \\ 0 & \text{if} \quad s_C=(E,Don'tOffer) \\ 0 & \text{if} \quad s_C=(Not) \end{bmatrix} \tag{4}$$

Proposition 1: For some parameter values, the infinitely repeated game has a cooperative subgame perfect Nash equilibrium, where there is no exploitation by the officer. There is a subgame perfect Nash equilibrium at β= $\beta^* = Z - \xi F - \frac{E(1-\delta p(1-\xi))}{qp}$, for patient enough players with high enough discounting (δ) levels, where the client remains indifferent between paying the bribe or not, covering the initial connection-building investment. That is, there is a SPNE in the grimm trigger strategy: each time the client applies to the officer, the officer demands the non-exploitive optimal bribe of β=β* and the client pays. If the officer demands an exploitative bribe of level β>β*, which leaves the client not covering the sunk cost, the client pays the bribe for that period, but for all subsequent periods trust has been broken, so the client never applies to the officer again if the officer stays in the office. If the officer is rotated, a completely new and independent game begins with the new officer. If the client learns that an officer is honest, she waits until rotation.

Proof : For the client not to have the incentive to deviate from the given cooperative strategy, the client's expected utility from making the connection-building investment must be positive under the cooperative strategy (since otherwise her best alternative which gives highest utility is doing nothing):

$U_c(E, \beta, S_O) \geq 0$

The bribe level which makes this inequality just hold can be calculated from (3) as:

$$(1-q)(-E)+q(1-p)(-E)+qp(Z-\beta-\xi F-E)+\delta qp(1-\xi)\left[p(Z-\beta-\xi F)+(1-p)0\right]+$$
$$\delta^2 qp^3(1-\xi)^2(Z-\beta-\xi F)+\ldots\geq 0 \qquad \beta^* \leq Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp} \tag{5}$$

We know that at this maximum bribe level, β*, the client has no incentive to deviate. We should now check whether, at this maximum bribe level, the corrupt officer has an incentive to deviate to the exploitation case (the case where β=Z-ξF). We know that, if the officer accepts offers of β* given in equation (5), he can capture the net surplus of the client (after the expected penalty and initial connection-building investment were compensated for). Otherwise, if the officer deviates to the exploitation case and begins to demand bribes more than β*, he may gain a higher profit in the first period. However, in all subsequent periods, the client will not apply to him because mutual trust will have been broken. Consequently, the officer will gain zero profit in later periods. Thus, as long as the expected utility of the officer is higher under β* than if he deviates, the officer will demand β*. When the officer deviates, he would obviously deviate to his best response bribe level, ignoring cooperation, so he would set β=Z-ξF. Which means:

$$p(\beta-\xi F)+\delta p^2(1-\xi)(\beta-\xi F)+\delta^2 p^3(1-\xi)^2(\beta-\xi F)+..\geq p(Z-\xi F-\xi F)+0+0+0....$$

$$\frac{\left(Z-\xi F-\dfrac{E(1-\delta p(1-\xi))}{qp}-\xi F\right)}{1-\delta p(1-\xi)}\geq Z-\xi F-\xi F+0 \qquad (6)$$

This inequality holds as long as

$$\frac{(Z-2\xi F)\delta p(1-\xi)}{1-\delta p(1-\xi)}-\frac{E}{qp}\geq 0 \qquad (7)$$

Thus, for some treshold values of the parameters, ξ, E, Z, p, δ and q (comparative statics will be given in the next section), the infinitely repeated game has a subgame perfect equilibrium where clients prefer to make a connection-building investment. If faced with a corrupt officer, they offer a bribe, the officer accepts, determines the amount of bribe as $\beta^*=Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}$ and the client pay, the officer gives the illegal service.

If equation (7) does not hold, the officer has an incentive to demand bribe at β=Z-ξF, thereby exploiting clients. However, clients are equally as able to solve the decision problem of the officer as he is, and so, predicting such opportunist behavior, they do not begin to make any initial connection-building investments. Thus, in the subgame perfect equilibrium, the corruption game does not begin. Q.E.D.

Comparative Statics of Proposition 1: We can reach some comparative static results from proposition 1 about how changes in the values of the parameters effect the Subgame Perfect Nash Equilibrium.

First, consider the optimum bribe level, $\beta^*=Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}$.

As the client's valuation of the corrupt service increases, and discounting of the future decreases, the value of the bribe, β, increases as expected. Decreasing the probability, q, of the client facing a corrupt officer has a decreasing effect on the level of the bribe. This is because the more the client perceives the public office to be clean, the less incentive she has to establish a connection with the public officers, who (the client believes) are more likely to turn out to be honest and thus unwilling to give the illegal service. To see the effect of a change in p on the size of the bribe, we can take the derivative of the right-hand side of the inequality with respect to p:

$$\frac{\partial\left(Z-\xi F-\dfrac{E(1-\delta p(1-\xi))}{qp}\right)}{\partial p}=\frac{E}{qp^2}\geq 0$$

As p increases, the likelihood that the officer who the client connected with will be in office next term increases. Consequently, expected future benefits increase for the client, so the amount of bribe also increases in proportion.

Obviously, as the required cost to establish a connection, E, increases, the bribe demanded by the officer decreases. We take the required investment level, E, as given in the model. If E were a decision variable for the officer, due to a trade off between the bribe and the investment, the officer would prefer less E and more bribe. However, taking E as a constant is more logical. For friendship and trust between people to occur, there needs to be some minimum level of effort, especially before people enter into risky dealings like corruption for an illegal service.

Now, consider the participation constraint of the officer, $\frac{(Z-2\xi F)\delta p(1-\xi)}{1-\delta p(1-\xi)}-\frac{E}{qp}\geq 0$. As long as Z is large, F and E are not very large, the officer has no incentive to deviate to exploitive behavior. To see the effect of p, we can take the derivative of this function :

$$\frac{\partial\left(\frac{(Z-2\xi F)\delta p(1-\xi)}{1-\delta p(1-\xi)}-\frac{E}{qp}\right)}{\partial p}=\frac{(Z-2\xi F)\delta(1-\xi)}{(1-\delta p(1-\xi))^2}+\frac{E}{qp^2}\geq 0$$

which is positive (as long as ξF is not prohibitively high). As p decreases, the officer's expectation about remaining in office in the next term decreases and thus the officer inclines more to opportunist behavior.

The effect of discount factor can be seen when we take the derivative:

$$\frac{\partial\left(\frac{(Z-2\xi F)\delta p(1-\xi)}{1-\delta p(1-\xi)}-\frac{E}{qp}\right)}{\partial \delta}=\frac{(Z-2\xi F)p(1-\xi)}{(1-\delta p(1-\xi))^2}\geq 0$$

As δ decreases, the officer discounts the future more, thereby valuing a one-off higher gain today more than possible higher gains in the future. Thus, as expected, he would have more incentive to deviate.

As q, the expectation of the client about the probability of meeting a corrupt officer, increases, the participation constraint becomes more likely to hold (due to the higher bribe level obtained from the client). As E increases, the officer has more incentive to deviate since the bribe level he would otherwise collect at each period will decrease.

From the model, it is therefore apparent that high fines, and high probability of being caught, are both very important policy tools to prevent corrupt dealing from even starting. This is not to forget that increasing job rotation of the public officers and creating a cleaner image for public office are also factors that discourage corruption. Thus, for small enough levels of ξF and E, and high enough levels of Z, p, δ and q, the infinitely repeated game has a subgame perfect equilibrium where clients prefer to make a connection-building investment.

Results of the proposition 1 can be extended to forgiving trigger strategies. See appendix for the proof of existence of forgiving trigger strategies.

2.3. The case with intermediaries

The existence of an intermediary facilitates corrupt dealings between the client and the officer by requiring only one connection-building investment from which many clients can then benefit. Therefore, using intermediaries is more cost efficient than every client making separate connection-building investment by themselves. When intermediaries exist in the market, the game changes as follows: first, the intermediary decides whether to make the initial connection building investment to the officer, then he determines his commission level, K, and the corrupt officer determines the bribe, b, to demand from the intermediary, bargaining with each other. After learning about the fee of the intermediary (equal to comission + bribe), the client decides whether to apply to the intermediary, or to go directly and incur the connection-building costs herself. If the client decides to go directly to the officer, the game is the same as in the case without intermediaries. On the other hand, if the client gets the service through the intermediary, the intermediary uses the connection he established with the officer before, so the client does not need to establish any connection. Since the intermediary has a long-term perspective in the market, and so is careful about her reputation. We can assume that, when the officer in question is an honest one, the intermediary gives this information to the client. They then both wait for the next officer to take office. That is, the intermediary prefers not to manipulate clients, because he needs to maintain a reputation in the market. If he deceives any client, next time he will lose all clients. Moreover, since the service in question is an illegal one, there is no way for intermediary making the job done if the officer is honest. If the corrupt dealing is discovered by the authorities, all parties of the corrupt transaction receive the same penalty, F, which occurs with probability ξ, as before.

Different clients may have different valuations about the service that will be given and, in contrast to the first case, this time the intermediary and the officer do not have intense relationships with the client; thus they do not know the valuation of each client while deciding on the commission and the bribe respectively. Both the intermediary and the officer think that the valuations of the clients are distributed according to a continuous distribution G on [0,1]. This uncertainty makes the game a Dynamic Game with Incomplete Information.

When the transaction is made through intermediaries, the officer no longer has access to the information about how much utility the client gets from the service. This helps overcome the time inconsistency problem by making exploitation by the officer difficult. Moreover, intermediaries are long run players and value their reputations. As we will see, these facts, together with the intermediary's initial investment costs decreasing role, are the most important factors that allow an intermediary to overcome the time inconsistency problem inherent in the game.

The strategy space of the officer, which is the level of bribe he demands from the intermediary, is defined as $S_O \in [0,\infty)$, and the strategy space of the intermediary is defined as $S_I \in \{(E, K), Not\}]$ where $K \in [0,\infty)$, is the commission of the intermediary. Correspondingly, the strategy space of a client is $S_C = [f: [0,\infty) x\{(E, K), Not\} \rightarrow \{(GI,GD), (GI,N) (GD,GD), (GD,N), (N,GD), (N,N)\}]$, first entry representing the strategies in her decision node after intermediary makes the connection building investment and the second entry represents client's decision node after intermediary decides not to invest. The client in strategy (GI,GD) goes to the intermediary (GI) if intermediary invests and goes directly to the officer if intermediary does not invest (GD), or in her strategy (GI,N) she can go to intermediary if intermediary invests and do nothing if intermediary does not invest (N), or she may play one of the other among six strategy pairs corresponding to her decision nodes following intermediary's decision. We can again assume that the behavior of honest officers is as given; they never accept a bribe and report the client to the law enforcement authorites if a bribe is demanded from them (S_H =[f: (E, K)→{Reject-Report}]). If the officer that the intermediary (or the client) invested in turns out to be honest, or gets replaced, the intermediary (or the client) receives –E. Otherwise, *per client* utility function of the intermediary, if makes the connection building investment, is defined as follows:

$$U_I(E,K,s_C) = \begin{bmatrix} 0 & if \quad s_C \in \{(N,GD),(N,N)\} \\ K - \xi F & if \quad s_C \in \{(GI,GD),(GI,N)\} \\ 0 & if \quad s_C \in \{(GD,N),(GD,GD)\} \end{bmatrix} \tag{8}$$

If the intermediary does not do the connection building investment, he will get zero utility and go to his best alternative job.

Per client utility function of the corrupt officer is defined as follows:

$$U_O(E,b,\beta,s_C) = \begin{bmatrix} 0 & if \quad s_C = (N,N) & \\ 0 & if \quad s_C = (N,GD) & and \quad S_I = (E,K) \\ \beta - \xi F & if \quad s_C = (N,GD) & and \quad S_I = N \\ b - \xi F & if \quad s_C = (GI,N) & and \quad S_I = (E,K) \\ 0 & if \quad s_C = (GI,N) & and \quad S_I = N \\ b - \xi F & if \quad s_C = (GI,GD) & and \quad S_I = (E,K) \\ \beta - \xi F & if \quad s_C = (GI,GD) & and \quad S_I = N \\ \beta - \xi F & if \quad s_C = (GD,N) & and \quad S_I = (E,K) \\ 0 & if \quad s_C = (GD,N) & and \quad S_I = N \\ \beta - \xi F & if \quad s_C = (GD,GD) & \end{bmatrix} \tag{9}$$

The utility function of the client is defined as follows:

$$U_C(E,\beta,K)=\begin{bmatrix} 0 & if \quad s_C=(N,N) & \\ 0 & if \quad s_C=(N,GD) & and \quad S_I=(E,K) \\ -E & if \quad s_C=(N,GD) & and \quad S_I=N \\ Z-K-b-\xi F & if \quad s_C=(GI,N) & and \quad S_I=(E,K) \\ 0 & if \quad s_C=(GI,N) & and \quad S_I=N \\ Z-K-b-\xi F & if \quad s_C=(GI,GD) & and \quad S_I=(E,K) \\ -E & if \quad s_C=(GI,GD) & and \quad S_I=N \\ -E & if \quad s_C=(GD,N) & and \quad S_I=(E,K) \\ 0 & if \quad s_C=(GD,N) & and \quad S_I=N \\ -E & if \quad s_C=(GD,GD) & \end{bmatrix} \quad (10)$$

Proposition 2: In the unique Weak Perfect Bayesian Equilibrium of the game, the clients who have valuations, Z (where we assume Z ~UN[0,1]), above $\frac{1+3\xi F}{2}$ go to the intermediary, and others do not participate. None of the clients make a connection-building investment themselves. The intermediary charges a fee of (1+ξF)/2 to the clients applying to him and then shares this with the officer in proportions $K=\frac{(1-s)(1+\xi F)}{2}$ and $b=\frac{s(1+\xi F)}{2}$, where "s" is share of the officer and remaining part constitutes the commission of the intermediary. Bargaining power of the parties determine the magnitude of shares.

Proof : To determine the Weak Perfect Bayesian Nash Equilibrium[7] of the game, I begin by analysing the last stage of the game. At that point, the client has no incomplete information, knows exactly at which point in the game tree he is. The client knows that, if she tries to establish direct contact, the game becomes the same as the case without intermediaries. Since the officer has monopoly power, he will take all her surplus as the bribe, and since the initial investment, E, is a sunk cost, the client will lose this as well. Even if the game has an infinitely repeated structure, he will get, at best, zero utility. Therefore, the client should prefer an intermediary, so long as doing so gives a positive utility. If she goes to the intermediary, she pays K,

[7] The three requirements of a weak Perfect Bayesian Equilibrium can be defined as such : i)At each information set, the player with the move must have a belief about which node in the information set has been reached by the play of the game, ii) Given their beliefs, the players' strategies must be sequentially rational. That is, at each information set, the action taken by the player with the move (and the player's subsequent strategy) must be optimal given the player's beliefs at that information set and the other players' subsequent strategies, iii) At information sets on the equilibrium path, beliefs are determined by Bayes' rule and the players' equilibrium strategies.

the intermediary's commission plus the bribe, b, that the officer has demanded through the intermediary, and she bears the risk of being caught and punished. Thus, the client goes to the intermediary as long as:

$$Uc=Z-b-K-\xi F\geq 0 \quad \rightarrow \quad Z\geq b+K+\xi F$$

Calculating the decision problem of the clients as much as they can, a bargaining between the officer and the intermediary occurs, and the total surplus from the process can be shared according to the bargaining powers of the parties. Bargaining between the officer and intermediaries is not important for our purposes, we will just assume that they share the total surplus in proportion to their bargaining power, without going into the details of how bargaining occurs and exactly how much share each gets. At this point, both officer and the intermediary has incomplete information about the valuations of the potential clients, Z. They know just that, Z is distributed according to a continuous distribution, G, between [0,1].

The officer and the intermediary will try to the maximize total surplus, M, they receive from the clients and then share it according to their bargaining powers (where M=K+b):

$$\max_{K,b} \quad U_S=(K+b-2\xi F)(1-G(b+K+\xi F))=(M-2\xi F)(1-G(M+\xi F)) \quad (11)$$

$$\frac{\partial U_s}{\partial M}=1-G(M+\xi F)-g(M)[M-2\xi F]=0 \quad (12)$$

From equation (12), we obtain optimal M=K+b as an implicit function.

To simplify, I will assume that G is a uniform distribution between [0,1]; however, our results can easily be generalized to other types of distributions.

$$\max_{K,b} \quad U_S=(K+b-2\xi F)(1-G(b+K+\xi F))=(M-2\xi F)(1-M-\xi F)$$

where M=K+b (13)

$$\frac{\partial U_s}{\partial M}=1-M-\xi F-M+2\xi F=0 \quad \Rightarrow \quad M=\frac{1+\xi F}{2}=K+b \quad (14)$$

M is shared between the officer and the intermediary in proportion to the bargaining power of each. Say the officer gets a share of "s" and the intermediary gets the remaining "1-s".

$$K=\frac{(1-s)(1+\xi F)}{2} \qquad b=\frac{s(1+\xi F)}{2}$$

When we put K into the utility function of the intermediary, the intermediary's per client expected profit (excluding the sunk cost, E) is calculated as

$$U_I=(\frac{(1-s)(1+\xi F)}{2}-\xi F)(1-(\frac{1+\xi F}{2}+\xi F))=(\frac{1-s-\xi F-s\xi F}{2})(\frac{(1-3\xi F)}{2}) \tag{15}$$

Similarly, when we put b into the utility function of the officer, the officer's per client profit is calculated as

$$U_O=(\frac{s(1+\xi F)}{2}-\xi F)(1-(\frac{1+\xi F}{2}+\xi F))=(\frac{s+s\xi F-2\xi F}{2})(\frac{1-3\xi F}{2}) \tag{16}$$

The clients' utility is calculated as

$$U_C=Z-b-K-\xi F=\frac{2Z-1-3\xi F}{2} \tag{17}$$

Thus, as stated in Proposition 2, in the Weak Perfect Bayesian Equilibrium of the game played each period, clients for whom $U_C \geq 0$ go to the intermediary, and the others do nothing. This means the clients who have valuations above $\frac{1+3\xi F}{2}$ go to the intermediary, and others do not participate. None of the clients make a connection-building investment themselves. The intermediary charges a fee of $(1+\xi F)/2$ to the clients applying to him and then shares this with the officer. Equilibrium utility levels of the players are as given in equations (15), (16) and (17). Q.E.D.

As expected, an increasing valuation of the service encourages corrupt dealings. The discouraging role of the threat of punishment and the independent probability of being caught is also apparent. Any increases in the expected penalties decrease the utility of both the officer and the intermediary.

This analysis, however, only applies for each client provided that the intermediary made the connection building investment and the intermediary and the officer agreed on a rule for sharing. To be able to comment on whether it is profitable for an "intermediaries sector" to be established, we should examine the long-run participation contraints. In the next part, the long run participation constraints of the officer and the intermediary are defined.

2.4. Long run participation constraints

The intermediary takes into consideration the effect of E for her long-term career (!) plans. In the long run, given that she has to pay the cost, E, each time a change in the officers occur, and given that when an officer turns out to be honest, the intermediary gains nothing so long as the honest officer remains in office, the intermediary calculates her long run participation constraint as follows. If corrupt transaction is detected by the law enforcement agencies, the officer is fired and an independent new game begins with a new officer. I assume that if the intermediary works in her best alternative job, she can earn W. Thus,

U_I=pq(K-ξF)(1-G(K+b+ξF))-E+(1-pq) δU_I +(1- ξ) qpδ[p(K-ξF)(1-G(K+b+ξF))+(1-p) δU_I]+ (1- ξ)^2 qp^{2}δ^2 [p(K-ξF)(1-G(K+b+ξF))+(1-p) δU_I]+…………≥W (19)

should hold for the intermediary not to prefer her best alternative job over being an intermediary. This means (for ease of exposition we set R=(1-G(K+b+ξF)) and m=δp(1-ξ)

$$U_I = pq(K-\xi F)R - E + (1-pq)\delta U_I + \frac{mq\left[p(K-\xi F)R + (1-p)\delta U_I\right]}{(1-m)} \geq W \qquad (20)$$

$$U_I = \frac{pq(K-\xi F)R - (1-m)E}{1-m-\delta+pq\delta+m\delta-mq\delta} \geq W$$

or, in its most open form (remember also we found equilibrium levels of $K = \frac{(1-s)(1+\xi F)}{2}$ $b = \frac{s(1+\xi F)}{2}$)

$$U_I = \frac{pq(1-s-s\xi F-\xi F)(1-3\xi F)/4 - (1-(1-\xi)p\delta))E}{1-(1-\xi)p\delta-\delta+pq\delta+(1-\xi)p\delta^2-(1-\xi)pq\delta^2} \geq W$$

Here, as in all cases, increasing the penalty level and rate of inspections are discouraging. Increasing clients' valuations of the illegal service increases the profitability for the intermediaries, as expected. People who discount the future less (high δ) have more incentive to become intermediaries. Increasing the profitability of outside job alternatives decreases the number of people who decide to become intermediaries. Increasing share of the intermediary (1-s), encourages him to enter the game, as expected.

To see effect of the probability of the officer will be in the office next term on the participation constraint, we take derivative of it with respect to p (where k=(1-ξ)δ):

$$\frac{\partial U_I}{\partial p} = \frac{q(1-\delta)(1-s-s\xi F-\xi F)(1-3\xi F)/4 + (q\delta-kq\delta)E}{\left[1-(1-\xi)p\delta-\delta+pq\delta+(1-\xi)p\delta^2-(1-\xi)pq\delta^2\right]^2} \geq 0$$

The derivative is positive. As the probability that the officer will be in office next term (p) increases, the participation constraint of the intermediary is more likely to hold.

If we look at the effect of a change in perceived probability of facing a corrupt officer, q (where m=(1-ξ)δp):

$$\frac{\partial U_I}{\partial q}=\frac{p(1-\delta)(1-mp)(1-s-s\xi F-\xi F)(1-3\xi F)/4+E\delta(1-m)(p-m)}{\left[1-m-\delta+pq\delta+m\delta-mq\delta\right]^2}\geq 0$$

The effect of altering the perceived probability of the proportion, q, of corrupt officers in the public office is also positive. We found in the previous section that increasing the perceived proportion of honest officers in the public office has a corruption discouraging effect in the infinitely repeated game without intermediaries. As comparative statics show, it also discourages intermediaries to enter the picture to facilitate corrupt transactions. The same is valid for p. As the corrupt officer's probability of remaining in office next term increases, the participation constraints of both the intermediary and the officer in the infinitely repeated game becomes more likely to hold. Image improving studies of the public office, by decreasing q, is helpful in reducing corruption even in the case with intermediaries. Results show that the primary anti-corruption policies work in the same direction in the games with intermediaries and in the infinitely repeated game without intermediaries.

As E, the required level of initial investment rises, the intermediary's participation constraint becomes less likely to hold. Remember, we have shown that in the infinitely repeated game without intermediaries, as E increases, the officer has more incentive to deviate to exploitative behavior, which will in turn stop corrupt dealings in subsequent periods. Here, increasing E also has a discouraging role for intermediaries. In this article, E is taken as given. The factors determining level of E may be the subject of a future article.

The participation constraint of the corrupt public officer is defined similarly (honest public officers always reject bribes, so they always have zero utility). In defining participation constraint of the officer, we should also take into consideration the fact that if the officer is caugth by law enforcement agencies, he is fired.

$$U_O=p(b-\xi F)(1-G(K+b+\xi F))+p^2\delta(1-\xi)(b-\xi F)(1-G(K+b+\xi F))+\ldots\ldots\geq 0 \quad (23)$$

$$U_O=\frac{p(b-\xi F)(1-G(K+b+\xi F))}{1-\delta p(1-\xi)}\geq 0 \quad (24)$$

If we write it in its most open form (putting into its places equilibrium levels of comission and bribe, $K=\frac{(1-s)(1+\xi F)}{2}$ $b=\frac{s(1+\xi F)}{2}$) we get :

$$U_O=\frac{p(s+s\xi F-2\xi F)(1-3\xi F)/4}{1-\delta p(1-\xi)}\geq 0$$

As p and s increase, the utility of the officer increases as expected. That is, as the probability of remaining in the office and the amount of bribe share increases, the officer becomes more willing to participate in corruption. Conversely, increasing penalties again has a discouraging role. The results show that two important tools can be used by law enforcement authorities to prevent officers from entering into corrupt agreements: high expected penalties and high probability of job rotation.

Although this study does not explore the bargaining problem between the officer and the intermediary, it is apparent that long-term participation constraints will serve as disagreement points, thereby becoming important factors affecting the relative bargaining powers of the parties. The bargaining problem between the intermediary and the officer may be the subject of a future study.

3. Policy suggestions and conclusion

The results from this study suggest that intermediaries may make feasible corrupt transactions which are so risky that clients prefer not to initiate them individually. In particular, corrupt dealings regarding illegal activities involve serious risks, require connection-building investments and include time inconsistency problems. Clients may therefore not find it worthwhile to make such transactions individually, but the existence of intermediaries can solve the basic time inconsistency problem for clients in their corrupt dealings with officers.

In all versions of the model, increasing detection probability and increasing penalties have a discouraging role on the establishment of corrupt transactions. Specifically, it turns out that regular inspection of intermediaries may be more effective for public authorities trying to curb corruption. Usually intermediaries appear publicly to be just helping clients to deal with the legal requirements of applications, to fill in necessary forms, submit necessary documents etc. However, some intermediaries secretly help corrupt dealings. Increasing inspections and penalties for intermediaries may increase the risks for them and so drive them out of business. Since intermediaries play a key role in illegal transactions, just driving some corrupt intermediaries out of business may prevent many corrupt transactions, especially if the game is not infinitely repeated.

Another factor that is important for the paticipation decision of the intermediaries is W, the intermediary's expected revenue from his best alternative job. As W increases, fewer intermediaries will find it profitable to work as an intermediary. In competitive economies with plenty of job and entrepreneurship opportunities, fewer intermediaries should exist. This may be an explanation for the greater frequency of corruption cases in developing economies. Another possibility is that people who have less talent in other areas of the economy are more likely to become intermediaries of corrupt transactions.

The infinitely repeated game without intermediaries gives very similar results to the case with intermediaries. An infinitely repeated game structure may also encourage profitable corrupt transactions which clients would otherwise not find worthwhile. An infinite perspective usually solves time inconsistency problems, prevents exploitative behavior by the officer, thus facilitating corrupt transactions. This means that governments should take this into consideration while designing the procedures necessary for obtaining government services. For example, requiring (unnecessary) periodic renewal of transactions, approvals etc. from public offices may increase corruption cases, even where intermediaries do not exist.

A clean image of the public office is very helpful to prevent corruption, both in the case of the infinitely repeated game without intermediaries and in the case with intermediaries. A higher rational expectation of facing honest officers discourages clients, and therefore decreases the amount of bribes collected by corrupt officers and the commissions obtained by intermediaries. This makes their participation constraints less likely to hold in both cases.

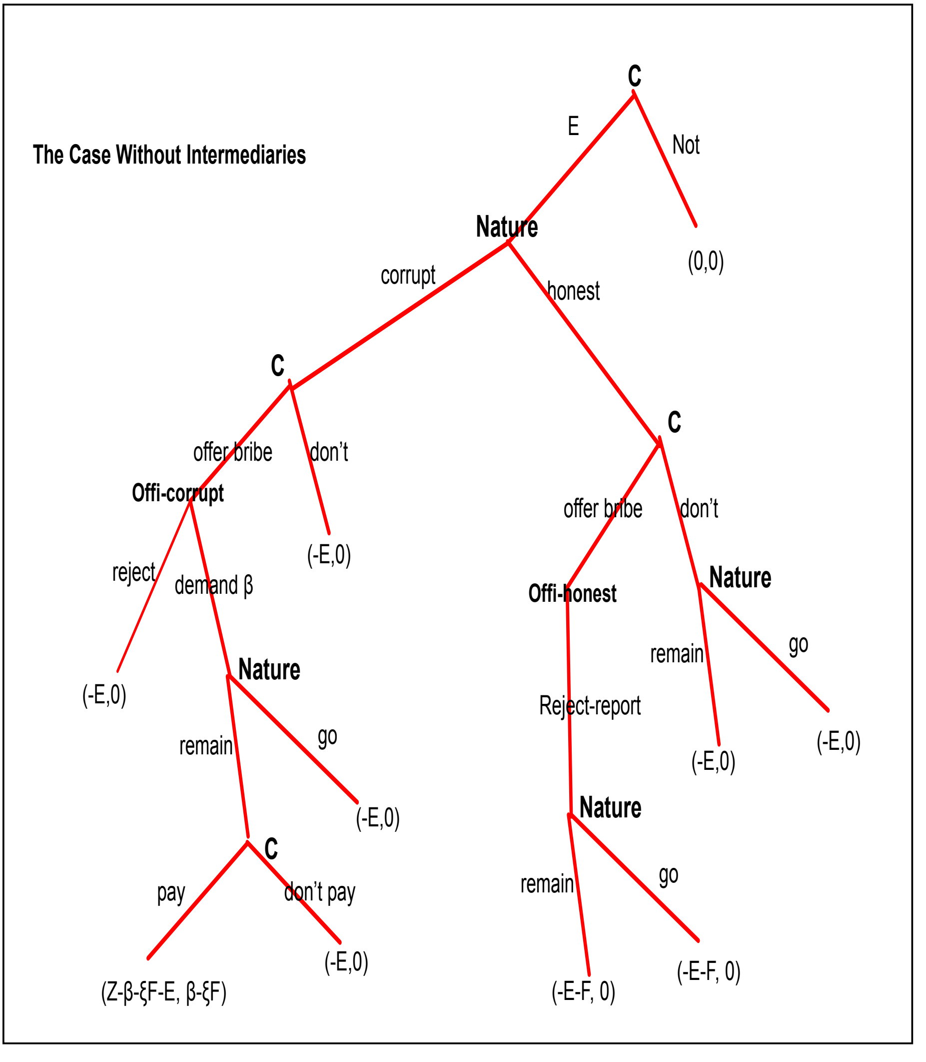
In the infinitely repeated game without intermediaries, staff rotation turns out to be one of the tools to decrease the amount of bribe in the corrupt transaction. Increasing the probability of the officer's being replaced next term weakens the cooperative incentives of all players. In the extreme case, corrupt dealing may not begin at all. It turns out that decreasing the probability of the officer's being in office in the next term also discourages the intermediaries and the officers in the case with intermediaries. As the public officer changes increasingly frequently, at some point the intermediary will find that making connection-building investments over and over again is unprofitable. Thus, we can say that staff rotation can be an effective anti-corruption policy tool, both with or without intermediaries.

However, there is an important caveat to this last point that we ignored in the models used in this study: the negative effect frequent staff rotation may cause to the productivity of the public office. As public officers change frequently, none of them can accumulate the necessary knowledge, experience and skills for performing their jobs efficiently and effectively. Thus, the organization may become less productive. Subject of next study may be to examine the mechanism design problem of the managers of the organization. An interesting task of such a study would be to find the optimum design which takes into consideration both the decrease in corruption cases gained by staff rotation and the harm caused by officers' not getting enough experience on the job.

In the infinitely repeated game without intermediaries, increasing the required initial connection building investment by the client, E, raises the deviation incentives of the officers, which in the next term causes the corrupt equilibrium to collapse. In the case with intermediaries, increasing E is also a discouraging factor for the establishment of an intermediaries sector. Discouraging intermediaries can prevent corruption, at least in the non-repeated game setting. Thus, we can say that, as E rises, corrupt transactions become less likely to occur. Since we assumed in this study that E was given, the question of how it is formed lies outside the scope of this article. The factors determining levels of E may be subject of another article. For example, E may be higher for more risky illegal activities and lower for less risky ones. Therefore, if the law enforcement agencies can increase the level of E, they could gain another important tool for combating corruption.

Appendix I

The Game Tree



Appendix II

Forgiving Trigger Strategy in the Infinitely Repeated Game

Proposition 3 (Forgiving Trigger Strategy): Results of the proposition 1 can be extended to forgiving trigger strategies. For some parameter values, the infinitely repeated game has a forgiving cooperative subgame perfect equilibrium, and in that equilibrium there is no exploitation by the officer. There is an equilibrium at β=β*, for patient enough players with high enough discounting (δ) levels, and long enough punishment periods, where the client remains indifferent between paying the bribe or not, covering the initial connection-building investment. That is, there is a SPNE in the forgiving trigger strategy: each time the client applies to the officer, the officer demands the non-exploitive optimal bribe of β= $\beta^* = Z - \xi F - \dfrac{E(1-\delta p(1-\xi))}{qp}$. If the officer demands an exploitative bribe of level β>β*, which leaves the client not covering the sunk cost, the client pays the bribe for that period, but for T subsequent periods trust has been broken, so the client does not apply to the officer for T periods, if the officer stays in the office. After T periods, the game returns to the cooperation phase until officer deviates again. If the officer is rotated, a completely new and independent game begins with the new officer. If the client learns that an officer is honest, she waits until rotation.

Proof : As in proposition 1, for the client not to have the incentive to deviate from the given cooperative strategy, the client's expected utility from making the connection-building investment must be positive under the cooperative strategy:

$Uc\ (E, \beta, S_O) \geq 0$

The bribe level which makes this inequality just hold can be calculated from (3) as:

$$(1-q)(-E)+q(1-p)(-E)+qp(Z-\beta-\xi F-E)+\delta qp(1-\xi)\left[p(Z-\beta-\xi F)+(1-p)0\right]+\delta^2 qp^2(1-\xi)^2(Z-\beta-\xi F)+\ldots\geq 0$$

$$\beta^* \leq Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp} \qquad \text{(A1)}$$

We know that at this maximum bribe level, β*, the client has no incentive to deviate. We should now check whether, at this maximum bribe level, the corrupt officer has an incentive to deviate to the exploitation case (the case where β=Z-ξF). We know that, if the officer demands β* given in equation (A1), he can capture the net surplus of the client (after the expected penalty and initial connection-building investment are deduced). Otherwise, if the officer deviates to the exploitation case and begins to a demand bribe more than β*, he may gain a higher profit in the first period. However, in T subsequent periods, the client will not apply to him because mutual trust would have been broken. Consequently, the officer will gain zero profit in that periods. Afterwards, the game again returns to cooperation phase. Thus, as long as the expected utility of the officer is higher under β* than if he deviates, the officer will demand β*. When the officer deviates, he would obviously deviate to his best response bribe level, ignoring cooperation, so he would set β=Z-ξF.

$$\frac{Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}-\xi F}{1-\delta p(1-\xi)} \geq Z-\xi F-\xi F+0+\ldots 0+$$

$$+\delta^{T+2}p^{T+2}(1-\xi)(Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}-\xi F)+\delta^{T+3}p^{T+3}(1-\xi)^2(Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}-\xi F)+\ldots$$

This inequality holds as long as

$$(1-\delta^{T+2}p^{T+2}(1-\xi))\frac{Z-\xi F-\frac{E(1-\delta p(1-\xi))}{qp}-\xi F}{1-\delta p(1-\xi)} \geq Z-\xi F-\xi F \qquad \text{(A2)}$$

Thus, as long as (A1) and (A2) hold, there is a SPNE of the forgiving trigger strategy. Under forgiving trigger strategy, the game has a subgame perfect equilibrium, for low discount rates (high δ), where clients prefer making connection building investment, when faced with a corrupt officer, offer a bribe and corrupt officer demands non-exploitive level of bribe $\beta^* = Z - \xi F - \frac{E(1-\delta p(1-\xi))}{qp}$ and the client pays. If faced with a honest officer, the client does not offer a bribe, waits for the rotation of the officer. Q.E.D.

Similar comparative static exercises to the one done in proposition 1 can also be done here, with very similar conclusions, just effect of all variables on the holding of the inequality decrease; at each parameter values the officer will have higher incentive to deviate in the case with forgiving. Obviously, as the punishment period, T, extends the inequality gets more likely to hold and as T→∞, the results converge to the one in grimm trigger strategy.

References

ABBINK, K. (2004), Staff Rotation As an Anti-Corruption Policy: An Experimental Study, *European Journal of Political Economy*, 20, 887-906.

ANDVIG, J. C. (1991), The Economics of Corruption : a survey, *Studi Economica*, 46 (1), 55-94.

BAÇ, M. (2001), Corruption, Connections and Transparency: Does a Better Screen Imply a Better Scene?, *Public Choice*, 107 (1-2), 87-96.

BARDHAN, P. (1997), Corruption and Develeopment: A Review of Issues, *Journal of Economic Literature*, 35, 1326-1346.

BAYAR, G. (2005), The Role of Intermediaries in Corruption, *Public Choice*, 122(3), 277-298.

BAYAR, G. (2009), Corruption and Intermediaries-A Game Theoretical Approach, Middle East Technical University Studies in Development, 36(1), pp. 25-49.

BIGLAISER, G. (1993), Middlemen as Experts, *RAND Journal of Economics*, 24(2), 212-223.

CHOI, J. P., & Thum, M. (2003), The Dynamics of Corruption with the Ratchet Effect, *Journal of Development Economics*, 87, 427-443.

COSIMANO, T. F. (1996), Intermediation, *Economica*, 63, 131-143.

GEHRIG, T. (1993), Intermediation in Search Markets, *Journal of Economics and Management Strategy*, 2(1), 97-120. "The Effect of Corruption on Administrative Performance"

GOULD, D. J., REYES, J.A.A. (1983), """THE EFFECT OF CORRUPTION ON ADMINISTRATIVE Performance", *World Bank Staff Working Paper* NO. 580.

KLITGAARD, R. (1991), Gifts and Bribes, *Strategy and Choice*, ed. R., Zeckhauser, MIT Press, Cambridge, MA.

LAMBERT-MOGILIANSKY, A., MAJUMDAR, M., RADNER, R. (2007), Strategic Analysis of Petty Corruption : Entrepreneurs and Bureaucrats, *Journal of Development Economics*, 83, 351-367.

LAMBERT-MOGILIANSKY, A., MAJUMDAR, M., RADNER, R. (2009), Strategic Analysis of Petty Corruption with an Intermediary, *Review of Economic Design*, 13, 45-57.

LAMBSDORF, J. G. (2001), "How Corruption in Government Affects Public Welfare A Review of Theory", *Center for Globalization and Europeanization of the Economy Discussion Paper,* No.9.

LIZZERI, A. (1999), Information Revelation and Certification Intermediaries, *Rand Journal of Economics*, 30(2), 214-231.

MASTERS, A. (2008), Unpleasant Middlemen, *Journal of Economic Behavior and Organization*, 68, 73-86.

MAURO, P. (1995), Corruption and Growth, *Quarterly Journal of Economics*, 110(3), 681-712.

MAURO, P. (1998), Corruption: Causes, Consequences and Agenda for Further Research *Finance & Development 35(1)*, 11-14.

HASKER, K, and ÖKTEN, Ç. (2008), Intermediaries and Corruption, *Journal of Economic Behavior and Organization*, 67, 103-115.

ROSE-ACKERMAN, S. (1999), *Corruption and Government*, Cambridge University Press, Cambride, UK.

RUBINSTEIN, A. and WOLINSKY, A. (1987), Middlemen. *Quarterly Journal of Economics,* 581–593.

SCHEVCHENKO, A. (2004), Middlemen, *International Economic Review*, 45(1), 1-24.

SHLEIFER, A., VISHNY, R.W. (1993), "Corruption", The Quarterly Journal of Economics, 108, 519-617.

TRANSPARENCY INTERNATIONAL (undated), *Anti- Corruption Handbook*, Web site : (http://transparency.org/policy_research/ach/public_sector/public_sector_codes_of_conduct_discussion/good_practice, reached : 04.01.2009).

UNITED NATIONS. (1989), *Corruption in Government*, United Nations, New York.

Özet

Yolsuzluklarda personel rotasyonunun, bağlantı kurmanın ve aracıların etkisi

Yolsuzluk tarih boyunca pek çok toplumda önemli bir sorun olagelmiştir. Yolsuzluğu caydırma yolları konusunda geniş bir literatür bulunmaktadır; personel rotasyonu bu yollardan biridir. Bu makale temelde, personel rotasyonunun yolsuzluk üzerine etkilerine yoğunlaşmaktadır. Diğer taraftan, kamu görevlileri ile bağlantı kurmak ve aracılar gibi yolsuzluğu kolaylaştıran diğer faktörlerin etkisi de göz önünde bulundurulmaktadır. Personel rotasyonunun, bağlantı kurmanın ve aracıların rolleri üç farklı senaryoda ele alınmıştır: aracıların bulunmadığı tek sefer oynanan bir oyun, aracıların bulunmadığı sonsuz tekrarlanan bir oyun ve aracıların bulunduğu bir oyun. Model sonuçları, personel rotasyonunun, cezaların artırılmasının ve kamunun temiz bir imajının olmasının etkili yolsuzluk karşıtı politika araçları olduğunu göstermektedir. Aracıların var olması veya kamu görevlilieri ile vatandaşların uzun vadeli bir ilişki içinde olmaları zaman tutarsızlığı sorunlarını çözmekte ve böylece, öncesinde gerçekleştirilemeyen yolsuzluklar gerçekleştirilebilir hale gelmektedir.

JEL Sınıflaması: K42, C72, D73.

Anahtar Kelimeler: Yolsuzluk, Personel Rotasyonu, Aracılar, Bağlantı, Rüşvet.