Corruption and Social Norms

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Introduction

Inquiries into the intricate and multifaceted problem of corruption abound. Two observations are particularly important. First, as Samuel Huntington once noted,

> **Corruption may be more prevalent in some cultures than in others, but in most cultures it seems to be most prevalent during the most intense phase of modernization (Huntington, 1968, p. 59).**

Anecdotal studies seem to support his observation, however most fail short of explaining its root causes. Second observation frequently expressed in the literature is that it may take years or even decades to bring corruption down to the former level after a one-time surge in its prevalence. This lack of successful anti-corruption campaigns is partly due to limited knowledge related to asymmetric information and lack of political will on the part of government, but also because distant past appears to be more important than current polices in many countries (Andvig et al. 2001). The mechanism, through which this works, however, is also not yet clarified.

This paper is an attempt to explain both of these phenomena within a dynamic evolutionary framework assuming the existence of social norms prohibiting corruption. How these are related to corruption and its surges in transforming countries? Most social codes of behavior demand costly actions from people who obey them. This gives individuals an incentive to break social norms in exchange for pecuniary advantage. According to most definitions, corruption is an action breaching certain social rules of behavior for private gain and thus perfectly fits the above setting. It is less noted, however, that if social customs change, public perception of which action is considered corrupt would also have to change.

However, many questions on the topic remain unresolved. A basic insight that emerges from many studies of corruption is its self-enforcing nature. In an environment where corruption is the norm, it tends to persist. If people see that others are violating norms regarding corruption, will they still comply with them? According to most of the anthropological literature on social norms—they will not. If one can observe individuals violating the norm, it will undermine his belief in the code of behavior and he will become disillusioned with it.[1] Moreover, if the number of people acting according to the rule is lower, there are fewer people standing on moral high ground to impose criticism and ostracism to the individuals who break the norm. The reputation cost is lowered and more people decide to behave along the new lines too. That further undermines the social norm, which prevents the spread of corruption, and results in a vicious cycle of breaking the norm and undermining it.

Therefore, a one-time upward surge of corruption due to economic transformation/modernization and carrying over of old codes of behavior pictured earlier may start out dynamic effects. These effects may result in the economy ending with high/persistent corruption. However, this does not occur without any non-pecuniary cost to the individual. Breaking a social norm usually involves ostracism and loss of reputation. This loss of reputation and ostracism is more painful to the individual if more people act according to this code of social norms, since more people are engaged in enforcing the costly norm. Therefore, the cost of breaking a social norm will crucially depend on the number of code believers. Furthermore, if the person breaking the norm actually believes in the given code of behavior, she will suffer from additional moral costs. This notion lies at the core of the analysis of corruption in transformation/modernization carried out in this paper.

1. Model Specification

1.1. Introduction

While the scope paper is not limited just to economics, we feel that explaining the issue of corruption calls for an economic approach. However, in this paper rather than focusing on the individual choice processes of firms, we take an aggregate point of view on the bureaucracy and study how the existence of a given pattern of administrative corruption influences an asymmetric information relationship between the government and the bureaucracy. In particular, we investigate the effect of an exogenous social norm of administrative corruption on the incentives to be corrupt for bureaucrats that participate in the non-cooperative principal-agent game. This setting leads to many density dependent effects: i.e., critical population thresholds, which separate equilibriums with low levels of corruption from equilibriums with high levels of corruption. However, arriving at a multiple-equilibrium model leaves us only with path-dependency as an explanation of current equilibrium, while leaving out the transition mechanism from one equilibrium to another.

[1] The mechanism of undermining a social norm assumed in this paper is as simple as in the following example of paying bribes for health services. People ask themselves: “If everybody pays to get the service done, why should I not pay?”

In order to counter the problem of multiple equilibriums evolutionary game theory is employed into the analysis. This means that people are no longer assumed able to be perfectly rational. Rather, they adopt strategies on the basis of trial and error, adapting their behavior on the basis of its 'success' with the result that they gravitate towards the relatively most successful type of behavior. As a result, we characterize the emergence of an equilibrium behavioral pattern within the population of bureaucrats as a social convention arising under the assumption that they tend to imitate relatively more rewarding behaviors. Another interpretation could be that this phenomenon is caused by 'learning from experience' in dynamic interactions. Another interpretation is that there is no rationality at all: progenitors transmit their strategy to their progenies.

The assumption that bureaucrats behave as imitators rather than rational optimizers may seem arbitrary. It is however fairly justified on factual and theoretical grounds. The existence of a substantial correlation between economic and social underdevelopment and the systemic diffusion of corruption is widely acknowledged. Furthermore, the economic and sociological literature on organizations suggests that bureaucratic decisions in underdeveloped countries are strongly adaptive. This contrasts with the fact that most of corruption is deeply concealed. None of the parties of the corrupt deal has the incentive to inform anyone else about it since corruption is nothing to be proud of and/or illegal. This observation applies even if one of the parties has been forced to engage in a corrupt activity. Furthermore, corruption usually takes the form of complex transactions taking place in large hierarchies to which outsiders have no access. It usually involves informational asymmetries and therefore its observation is very indirect. Nonetheless, rumors spread among people willing to obtain bureaucracies authorization and there are many instances of unofficial listings of exactly how much should be paid to "get things done" in various bureaucracies. These payments are unofficial, yet somehow their expected value becomes common knowledge. The origin of that knowledge is probably based on "trial and error" and therefore this observation fits perfectly to the evolutionary setting.

The core of the formal model presented in this paper is a simplified version of a highly stylized principal-agent framework of a hierarchical government shown in Goczek (2007b).

1.2. The Bureaucrats

All governments are hierarchical structures in the form of tiers. The highest tier is a government (the principal); the lower tier is a non-benevolent bureaucracy (his agent). The government wants to regulate firms in order to achieve social optimum. While a given regulatory policy may be socially optimal, it may incur costs to a given firm. The government lacks the necessary information to carry out the regulation successfully on its own and has to rely on the information supplied by the bureaucracy. The bureaucracy is better informed than the government. It is so, because the former has the time, resources, and specialized knowledge dedicated to gaining the information on the firm. This gives rise to asymmetric information relationship and moral hazard/hidden information problem. Each of the regulated firms has the incentive to bribe the bureaucracy. This way the firms will guarantee themselves, that the bureaucracy will supply the government with information, which will benefit them.

Bureaucrats are heterogeneous in their propensity to be bribed, however, this is also unobserved by the principal. Each of the bureaucrats perceives his actions non-individualistically. If one of them is corrupt, the loss of reputation is lower for others in the next period; they revise their posterior beliefs about their own cost of being bribed. At the same time, the decision of each bureaucrat to be corrupt means, that there is less of the informational rent available to other corrupt bureaucrats.

It is assumed that all contracts between the bureaucracy and the firms are fully enforceable. This may not always be true. In reality a firm bribing a bureaucrat does not have any certainty that he will act according to the contract. Neither side of the contract has the incentive to go to court upon its breach, because of illegality and/or immorality usually associated with corruption.[2] However, quasi-enforcement exists and both sides tend to stick to the agreement. The bureaucrats have full bargaining power[3]. Monetary equivalent of one unit of currency received by the bureaucracy costs the firm $(1 + k)$. It is so, because the government could notice an open transfer and therefore the sides of the agreement have to incur costs to hide the transaction. All changes in the law-environment of corruption are captured by this exogenous cost k. All agents in the economy are risk neutral.

The government cannot regulate without resorting to services provided by his bureaucracy. There exists a large finite discrete population of N bureaucrats and M firms. Each bureaucrat receives a payment of w. The bureaucrats can also be employed in the private sector, earning w^*. All bureaucrats quit work if $w^* > w$, so in each state of nature the government has to pay them at least w^*. Their participation constraint is given by:

$$U_{\mathrm{i}}(w) = w_i - w^* \qquad i = 1, \ldots, N \tag{1}$$

The bureaucrat i receives an informational signal α about a j firm's technology parameter β. The parameter β is privately known to the firm and is referred to as her 'type'. The type space is given by the discrete set $\Theta = \left\{\underline{\beta}, \overline{\beta}\right\}$ where $\overline{\beta} > \underline{\beta}$. The under bar and over bar describe 'low' and 'high'

[2] For instance, the bureaucrat may demand additional bribes, blackmailing the firm, without granting the side-contract. If he wants to fulfill the side-contract, he may not have enough influence if higher authority questions his decision.

[3] This simplifying assumption does not influence the results of the model.

cost respectively. Let ϕ denote the cost difference $\overline{\beta} - \underline{\beta}$. Therefore, the parameter $\underline{\beta}$ carries a rent ϕ accruing to the firm if the bureaucrat reports untruthfully. The prior belief that the type is efficient, i.e. $\beta = \underline{\beta}$, is given by probability v. With exogenously given probability ζ the bureaucrat learns the true technology $\alpha = \beta$. With probability $(1 - \zeta)$ the bureaucrat is unable to obtain any information $\alpha = \varnothing$. There are four states of nature:

$$\zeta v \qquad \alpha = \underline{\beta} \wedge \beta = \underline{\beta} \tag{i}$$

$$(1-\zeta)v \qquad \alpha = \varnothing \wedge \beta = \underline{\beta} \tag{ii}$$

$$(1-v)\zeta \qquad \alpha = \overline{\beta} \wedge \beta = \overline{\beta} \tag{iii}$$

$$(1-v)(1-\zeta) \qquad \alpha = \varnothing \wedge \beta = \overline{\beta} \tag{iv}$$

The following asymmetry of information has been incorporated into the analysis. The government observes neither α or β, but receives a report r from the bureaucracy. The report can be $r \in \{\alpha, \varnothing\}$. If the bureaucracy fails to observe anything, that is $\alpha = \varnothing$, then it does not report anything and $r = \varnothing$. If the bureaucracy learns the true cost, that is $\alpha = \beta$, then:

a) it can provide the government with information and send a report $r = \alpha$;
b) it can claim that it has failed to learn the true signal and send a report $r = \varnothing$.

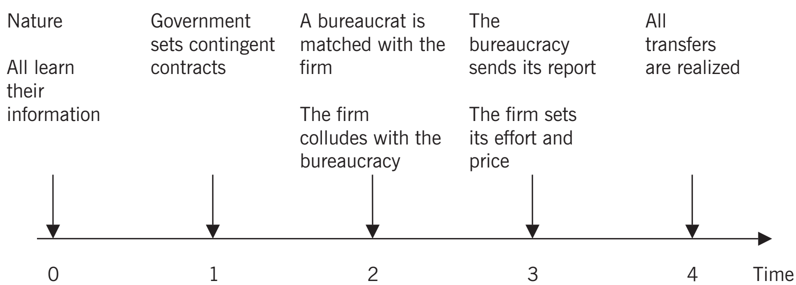

Figure 1.

Time sequence of moves in the game

The game has n periods, which consist of four subperiods played with inverse Stackelberg game. In the zero periods, all agents learn their information. The firms learn their β, the bureaucracy learns α. It is assumed that the firms are also informed about α.[4] The government learns the distribution of

[4] This can be because the bureaucrat has the incentive to inform the firm if there is possibility for collusion.

$\left[\overline{\beta}, \underline{\beta}\right]$ and sets contingent contracts w so as to maximize expected welfare. Then the firms collude with the bureaucracy in order to cheat the principal. Then the bureaucracy sends its report r. The firms set their effort and price. In the last period, all contracts are realized and all transfers are operated.

1.3. Reputation

In this section, the model is extended with the cost of breaking a social norm. First, it is assumed that there exists a code of behavior that a fraction $\mu \in [0, 1]$ of population does not believe in. Second important assumption is that the bureaucrats are interested in the way they are seen. In other words, they are interested in being regarded as people obeying the code. Therefore the utility function of a given bureaucrat is:

$$U_i = w + R - d^C d^B \overline{C} + d^B \frac{\phi}{1+k} \tag{2}$$

where:
R is the reputation cost
d^C is a dummy variable representing non-compliance with the norms in the code of behavior. If the bureaucrat breaks the norm, it takes the value of one and zero otherwise.
d^B is a dummy variable representing belief in the code of behavior. If the bureaucrat breaks the norm, it takes the value of one and zero otherwise.
$\overline{C}$ is a disutility cost that a bureaucrat breaking the norm incurs.

Reputation of each bureaucrat depends on acting in compliance with the norm and popularity of the norm in the society given by μ. The more people believe in a given norm, the larger loss of reputation caused by breaking it. Hence, the reputation can be rewritten as:

$$R_i = -d^C(1-\mu)\overline{R} \tag{3}$$

If the bureaucrat breaks the norm and accepts a bribe, he incurs a cost of a lost reputation $R = -(1-\mu)\overline{R}$; if he does not accept the bribe, then $R = 0$, where $(1-\mu) \in [0, 1]$ is a fraction of the population which believes the given norm and $\overline{R}$ a positive constant. The utility function becomes:

$$U_i = w - \mu\overline{R} - \mu\xi\overline{C} + \xi\frac{\phi}{1+k} \tag{4}$$

The model may be criticized on the ground of being too simplistic. Some norms have other strong moral or motivational justifications like the hope of reciprocity or other evolutionary/biological factors. One cannot expect that all norms will diminish over time only if it is deemed profitable. This, however, cannot be said about norms regarding corruption. Still, the assumption is proposed for its simplicity, rather then in the hope of catching all the complex phenomena that arise around breaking of social norms. This assumption although admittedly simple is sufficient to show how non-individualistic behavior may result in a different equilibrium then traditional economic approach to corruption.

1.4. Heterogeneity of norm breaking

It is assumed that there are two types of bureaucrats, in order to catch heterogeneity of norm breaking. With probability ζv (the probability of $\alpha = \underline{\beta} \wedge \beta = \underline{\beta}$) the risk of collusion between the bureaucrat and the firm occurs. The first type, which is matched with the firm with probability μ, will not collude with the firm if he is paid at least the stake of collusion discounted by the transaction cost of corruption less reputation loss:

$$\underline{w} = w^* + \frac{\phi}{1+k} - d^C(1-\mu)\overline{R} \tag{5}$$

With probability 1 – μ the bureaucrat fears breaking the norm besides loosing wage and reputation and a lower payment such that:

$$\underline{w} = w^* = \frac{\phi}{1+k} - d^C(1-\mu)\overline{R} - d^C d^B \overline{C} \tag{6}$$

is sufficient to prevent him from taking a bribe. The bureaucracy then reports truthfully $\alpha = \underline{\beta} \wedge \beta = \underline{\beta}$.

The government can design two types of incentive schemes. One is to pay the amount (5) in order to root out corruption completely. Second is to allow corruption amongst fraction μ of bureaucrats, because fraction 1 – μ can remain honest at a lower cost (6). It is assumed that the government does not know who actually believes in the code of behavior and therefore cannot distinguish between the two types of bureaucrats. What matters for the analysis is that individuals' total payoffs are private information, because the government cannot distinguish between believers and non-believers. Therefore, the two types of bureaucrats facing the same situation may behave differently and the government is unable to design an optimal contract.

Paying the bureaucracy extra to root out corruption is costly because of dead-weight losses caused by taxation and therefore it is not always optimal.[5] In the first incentive scheme there is ineffectiveness of government transfers to the bureaucracy, because fraction 1 – μ of bureaucrats believes the code of behavior and will be honest even if their wage is lower by $\overline{C}$. Hence, an alternative to over-paying and overtaxing is to allow for some corruption.[6]

It is easy to see, that the effort of the ineffective firm is lower in the second incentive scheme. The rent is paid more frequently with probability $1 - \zeta + \mu\zeta$

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[5] As in Besley and McLaren (1993: p. 119–141).

[6] Like in most of the literature, the bribe itself is not included in the welfare function. It is so, because the bureaucracy gains on corruption, so bribes are just redistributive transfers. Taking it into account just increases welfare loss and lowers, even more the effort of the ineffective firm, but does not influence general direction of results.

instead of 1 – ζ, and the payment to the bureaucrat less often $\phi/(1+k)$ with probability (1 – μ) z instead of ζ. The expected payment is now:

$$\phi(1-\zeta)+\mu\zeta+\frac{\zeta(1-\mu)}{1+k} \tag{7}$$

Rewriting it:

$$\phi(1-\zeta)+\frac{k\zeta(\mu-1)}{1+k} \tag{8}$$

It is higher for $\mu > 0$. Welfare with no possibility of corruption would be independent of $\overline{C}$, but in our case it is increasing in $\overline{C}$. For sufficient high cost of breaking the norm, it is so cheap to obtain honest behavior from some of the bureaucrats that it is best for the benevolent government to let corruption happen. Two propositions can be formulated based on this observation.[7]

Proposition 1: Greater fraction of people who believe the code of behavior increases welfare.

The proof has the following intuition. The government can give less incentive to the bureaucracy if the bureaucrats believe in the code of behavior. Their honesty can be bought at a lower price.

Proposition 2: Greater fraction of people who believe the code of behavior increases corruption in the sense that $\left(d\overline{C}^{*}/d\mu\right)<0$.

The proof has the following intuition. Increasing the number of non-corrupt bureaucrats enlarges the domain of parameters where it is best to let corruption happen.

1.5. Evolutionary equilibrium

In every period, a new firm j is regulated and in every period the government randomly assigns a bureaucrat i to the regulated firm. Firms and bureaucrats are randomly matched to play the game repeatedly. For simplicity, it is assumed that neither firms nor bureaucrats are exposed to retaliation for offering bribes. This modification does not alter the general results, since it would only change probabilities of gaining and loosing when taking bribes.

What is focus on here is that members of organizations such as the bureaucracy face problems associated with collective reputation. Hence, the welfare of each bureaucrat depends not only on his individual decisions, but also on decisions of other members of the bureaucracy. Let $\overline{R}$ be the marginal rate of disutility caused by collective reputation loss when a higher fraction of bureaucrats are corrupt. Let μ be the probability that a given bureaucrat will

[7] Detailed proofs can be found in (Goczek 2007b).

take the whole firm's informational rent as a bribe on the assumption that he has full bargaining power. Note that $\frac{\phi}{(1+k)}$ is the marginal rate of utility from being corrupt. Let θ be the expected average firms' perception of μ, meaning that this is their perceived probability of being assigned with a corrupt bureaucrat. Let ξ be the second order belief of bureaucrats of their corruption i.e. their own estimate of θ. $\overline{C}$ is the marginal rate of individual disutility from corruption given firms' perception that all bureaucrats are corrupt i.e. "moral costs of engaging in corruption". Expected utility function of each bureaucrat now becomes:

$$U_i = w + \mu_i \frac{\phi_j}{(1+k)} - \mu_i \xi_i \overline{C} - \overline{R}\frac{\sum_{i=1}^{n} \mu_i}{N} \tag{9}$$

The subscripts will be omitted further on in order to save on notation.

In equilibrium, homogenous bureaucrats adopt the same strategy and choose the same corruption level. In this case, the public has an accurate estimate of probability of corruption θ; the bureaucrats have a correct second order belief of their own corruption—ξ. Two cases are possible. In the first case, the bureaucrats prefer the full honesty equilibrium, however the N-bureaucrats prisoner's dilemma they face causes them to be corrupt. In the second case, the bureaucrats prefer the full corruption equilibrium, however, the prisoner's dilemma they face (perverse to the first case) causes them to be honest. In the next two sub-sections, equilibriums in two cases will be analyzed.

In the first case—the bureaucrats prefer the full honesty equilibrium to the full corruption equilibrium. If $\frac{\phi}{1+k} < \overline{R}$ bureaucrats prefer to be all honest to the state where every one of them is corrupt. In this case, we will have three equilibriums. In the first equilibrium (For $\mu = 1$) every bureaucrat is corrupt and the firms correctly expect him or her to be corrupt ($\xi = 1$). Then:

$$U = w + \frac{\phi}{1+k} - \overline{C} - \overline{R} \tag{10}$$

In the second equilibrium for $\mu = 0$ every bureaucrat is honest, the firms correctly expect them to be honest, so ζ is equal to zero.

$$U = w \tag{11}$$

The bureaucrats would prefer the second equilibrium if they were able to choose collectively. This does not mean that they will be honest. Each of them has an individual incentive to be corrupt, because of the collective reputation dilemma they face. In this case, the bureaucrats have a dominant strategy if:

$$\frac{\delta U}{\delta\mu} = \frac{\phi}{1+k} - \xi\overline{C} - \frac{\overline{R}}{N} \quad \text{and} \quad \frac{\delta U}{\delta\mu} > 0 \tag{12}$$

This leaves us with condition:

$$\frac{\frac{\phi}{(1+k)}N - \overline{R}}{\overline{C}N} > \xi \tag{13}$$

The bureaucrats will be corrupt above the cutoff ζ. The gain from being corrupt will exceed their collective reputation loss, because of the N-bureaucrats prisoner dilemma.

In the third equilibrium, a proportion $\mu = \frac{\frac{\phi}{(1+k)}N - \overline{R}}{\overline{C}N}$ of bureaucrats are corrupt. This is correctly anticipated by the firms i.e. they have a correct expectation of corruption and $\mu = \zeta$.

$$u = w + \mu\frac{\phi}{(1+k)} - \mu^2\overline{C} - \overline{R}\mu \tag{14}$$

Rewriting it, we get:

$$U = -\mu^2\overline{C} + \mu\left(\frac{\phi}{(1+k)} - \overline{R}\right) + w \tag{15}$$

In the second case, the bureaucrats prefer the full corruption equilibrium to the full honesty equilibrium. In contrast to the first case, the bureaucrats now would prefer the second equilibrium (full corruption) if they were able to choose. This does not mean that they will be corrupt. Each of them has an individual incentive not to be corrupt. Bureaucrats now face a perverse prisoner's dilemma and all of the results from the case presented earlier are reversed. In contrast to the previous result, every bureaucrat has the incentive to be honest, however, public expectations force her to be corrupt. The three equilibriums shown earlier are now reversed. The mechanism we have introduced allows us to formalize the idea that corruption spreads when there is not enough of social aversion towards it.

1.6. Existence of equilibrium

We will now seek necessary conditions for ending up in a given equilibrium. Note that we consider only those situations for which the risk of collusion occurs (Recalling previous discussion: the risk of collusion does not occur when the bureaucrat does not find anything or he finds higher costs). For equilibrium type one, in which every bureaucrat is corrupt, we have a probability equal to $P\left[\xi > \tilde{\xi}\right] = P[\mu = 1]$ the necessary condition of existence of equilibrium is that $\xi \geq 0$:

$$\frac{\frac{\phi}{1+k}N-\overline{R}}{\overline{C}N}\geq 0 \tag{16}$$

Solving it for N we get:

$$N\geq\frac{\overline{R}(1+k)}{\phi} \tag{17}$$

For equilibrium type two, in which not even one bureaucrat ever accepts bribes, the probabilities are $P\left[\xi>\tilde{\xi}\right]=P[\mu=0]$ and the necessary condition of existence is $\xi\leq 1$, which gives:

$$\frac{\frac{\phi}{(1+k)}N-\overline{R}}{\overline{C}N}\leq 1 \tag{18}$$

Solving it for N we get:

$$N\leq\frac{\overline{R}}{\frac{\phi}{(1+k)}-\overline{C}}\Leftrightarrow\frac{\phi}{(1+k)}-\overline{C}>0\vee N\leq\frac{\overline{R}}{\frac{\phi}{(1+k)}-\overline{C}}\Leftrightarrow\frac{\phi}{(1+k)}-\overline{C}<0 \tag{19}$$

For equilibrium type three, in which some bureaucrats are corrupt and some are honest, $P\left[\xi=\tilde{\xi}\right]=P\left[\mu=\frac{\frac{\phi}{(1+k)}N-\overline{R}}{\overline{C}N}\right]$, the necessary condition is $\xi\in(0, 1)$.

Which leaves us with:

$$\frac{\overline{R}}{\frac{\phi}{(1+k)}}>N>\frac{\overline{R}}{\frac{\phi}{(1+k)}-\overline{C}} \tag{20}$$

This set of conditions can be plotted onto two graphs (shown in Figure 2.)

The full honesty equilibrium becomes more prevalent as the number of bureaucrats, N, increases if the marginal gain in utility from being corrupt is greater then the marginal disutility caused by moral costs. If the marginal gain in utility from being corrupt is smaller then the marginal disutility caused by moral costs, then the full corruption equilibrium becomes more prevalent as the number of bureaucrats, N, increases. Therefore, the size of the bureaucracy may have an ambiguous effect on corruption. The level of corruption in a given bureaucracy depends rather on the incentive system (size of informational rent on one hand and belief in the social norm of not engaging in corruption on the other), than on the sheer number of employed bureaucrats.

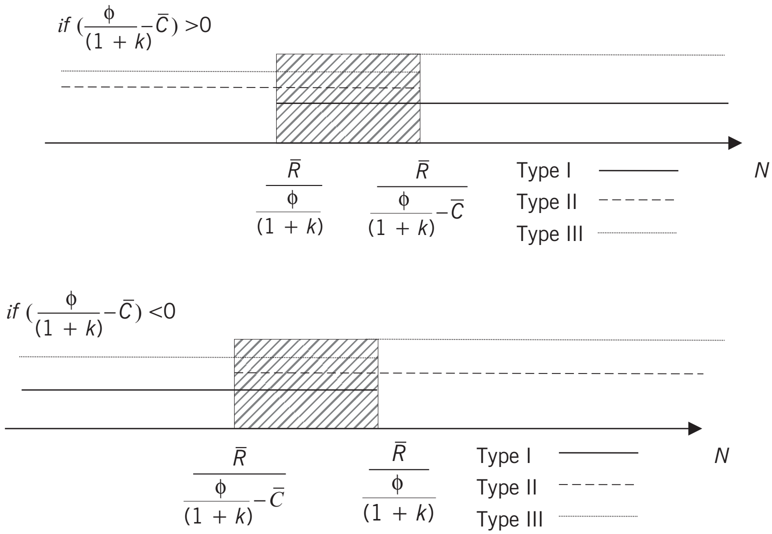

Figure 2.

The upper part of the figure shows the three equilibriums if the marginal gain in utility from being corrupt is greater than the marginal disutility caused by moral costs; the lower part the three equilibriums if the marginal gain in utility from being corrupt is smaller than the marginal disutility caused by moral costs.

1.7. Evolutionary dynamics

Now the discussion turns to evolutionary dynamics of the model. There is a following replicator dynamic in the model. The population share of strategy, C, which stands for "being corrupt" μ, grows at a rate equal to the difference between the average payoff to strategy C and the average payoff of all strategies in the population:

$$\frac{\dot{\mu}}{\mu} = U - U_{average} \tag{21}$$

If $\frac{\delta U}{\delta \mu} > 0$ then the fraction of corrupt bureaucrats, μ, increases and so does the firms' perception θ. If $\frac{\delta U}{\delta \mu} < 0$ then the fraction of honest bureaucrats increases and so does the firms' perception θ. In other words, strategies that do better than average increase their fraction over time and strategies that do worse decrease theirs. The greater the deviation in payoffs from the average, the faster does the population share increase or decrease. One can think of the evolutionary model as a competition between strategies. Strategies that do well are imitated and thus they multiply themselves. Poorly doing strategies cease to exist.

The distinguishing feature of evolutionary game theory is that it sees behavioral patterns as an outcome of a process of adaptation, in which behaviors that do better thrive. The process of adaptation might reflect biological selection, or it might represent learning or imitation as agents switch to strategies that are observed to do better. Honest bureaucrats dissatisfied with prevalent corruption may leave a corrupt organization or decide to be corrupt too; corrupt bureaucrats may be thrown out of the organization or learn to refuse bribes.

At every period mutations (irrational strategies) occur, meaning that some bureaucrat behaves honestly or corruptly even though she does not have the incentive to do so. Now we assume that the entire bureaucracy plays a strategy "C" which stands for being corrupt. In other words, C is the incumbent strategy. The strategy C is evolutionarily stable, if a small group of players using a different strategy "H", for being honest, cannot persist in the population. In other words, if we call a small group of players using different strategy mutants, an evolutionarily stable strategy (ESS) is robust to mutations. To be uninvadable (nie ma takiego słowa) in this way, an evolutionarily stable strategy must earn a higher expected payoff than any mutant strategy. In formal terms, this implies that a strategy "C" is evolutionarily stable if these two conditions hold:

$$U(C, C) > U(H, C) \tag{22}$$

$$U(C, C) = U(H, C) \Rightarrow U(C, H) \Rightarrow U(H, H) \tag{23}$$

The first conditions says that an ESS C must earn at least as high payoffs against itself as does any mutant strategy H against C. The second conditions says that if a mutant strategy H does as well against C, as does C, then C must do strictly better against the mutant H than the mutant does against itself. These two conditions imply that an ESS must be a best reply to itself and therefore it must be Nash equilibrium (NE):

$$\text{C is an ESS} \Rightarrow U(C, C) \text{ is a NE} \tag{24}$$

An evolutionarily stable strategy is asymptotically stable under the replicator dynamics. If you start in a situation in which almost everyone is playing an ESS, the replicator dynamics will lead you to the state in which everyone plays the ESS. Let A be the set of pure strategies and *S* be the set of mixed strategies. A strategy C is evolutionary stable (ESS) if there exists $\tilde{\xi}$ such that for all $\xi \in \left(0,\ \tilde{\xi}\right]$ and for all H:

$$\begin{gathered} U\left(\mathrm{C}, (1-\xi)\mathrm{C} + \mathrm{H}\right) > U\left(\mathrm{H}, (1-\xi)\mathrm{C} + \xi\mathrm{H}\right) \\ \frac{\delta U}{\delta \mu} = \frac{\phi}{(1+k)} N - \xi \overline{C} - \frac{\overline{R}}{N} \end{gathered} \tag{25}$$

Now note, that $\frac{\delta U}{\delta \mu}$ is decreasing in ξ. If one chooses to be corrupt if $\frac{\delta U}{\delta \mu} > 0$, she suffers utility losses. If initially $\xi < \widetilde{\xi}$, the net gain from being corrupt is positive, corruption grows and ξ rises gradually until it reaches 1 and C is an ESS. If initially $\xi < \widetilde{\xi}$, the net gain from being corrupt is negative, corruption diminishes and x falls gradually until it reaches zero (Figure 3) and H is an ESS. It is important to note that this result is irrespective of whether corruption is in the collective interest of the bureaucracy or not. There exist two evolutionary equilibriums (0 and 1) dependent on bureaucrat's second order belief of what other bureaucrats do. If he believes that the firms continuously expect the bureaucracy to be corrupt, the whole bureaucracy will be corrupt. If he believes that the firms continuously expect the bureaucracy to be honest, the whole bureaucracy will be honest.

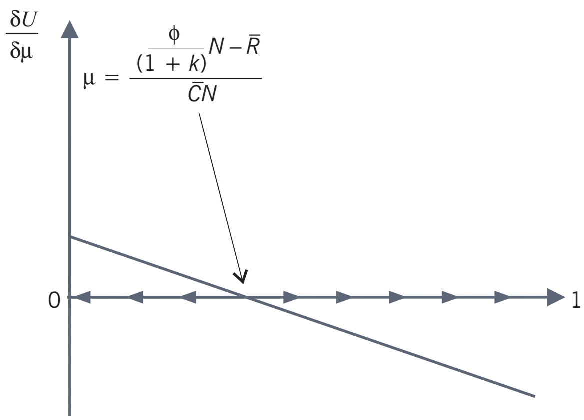

Figure 3.
Multiple equilibriums—full corruption equilibrium on the right, no corruption on the left

Self-fulfilling expectations are a strong sociological and economical force. When corrupt bureaucrats are a small enough minority, meaning that $\mu < \frac{\frac{\phi}{(1+k)}N - \bar{R}}{\bar{C}N}$, they will always remain in minority in the next generation. This means that their fraction in the population will converge monotonically to 0 and the expectation will be that the society will expect the bureaucrats to be honest. This expectation will induce reputation costs if the social code of behavior would be broken, so the equilibrium will be stable. On the other hand when corrupt individuals are in a sufficiently high majority (i.e. $\mu < \frac{\frac{\phi}{(1+k)}N - \bar{R}}{\bar{C}N}$,) they will remain a majority in the next period. This means that the population will converge to a steady state where all bureaucrats are corrupt. The expectation will be all bureaucrats are corrupt, so they will not incur reputation costs, and it will be more rewarding for them to stay corrupt. This means that we will have "corruption trap" and "honesty trap". Hence we can see that expectations of future corruption must appear more pessimistic in poorer than in richer countries, therefore corruption in less developed countries is more difficult to eradicate.

The probability of ending up in each state will depend on the position of the cutoff, which is governed by the principal—the government and the people. If the government is not benevolent, meaning that it seeks to raise information rents ϕ, this means that the cutoff will move to the right, towards the full corruption equilibrium. Therefore, a corrupt government is likely to end up with a corrupt bureaucracy.

2. Conclusions

Our model shows, that self-fulfilling expectations are a strong sociological and economical force in the prevalence of corruption. This mechanism explains both its persistence and increases, when "rules of the game" change. For instance people expecting corruption to rise, as in intense phases of modernization or transformation will lower reputation costs of corruption and force bureaucrats into it. Consider the rapid economic transformation of the former post-communist countries. During that process, a formerly non--existent free market emerged and took charge of economic allocation in place of former bureaucratic decisions. Nevertheless, one would expect the social norms regarding economic allocation to change much slower and some actions to carry over from the old bureaucratic system. Some actions that used to violate old bureaucratic norms will not go against new market ones and some actions that violate the new market ones would not have been against the old ones. It could be hypothesized, that old rules will have stronger impact the faster the transformation. As a result, a sudden drop in number of people believing and acting according to any given norm will occur. Therefore, one would expect the number of actions perceived to be corrupt to increase, since the non-pecuniary cost of breaking the norm will fall. This will move the given bureaucracy to the "corruption trap" in which it will remain for a possibly long time. Only drastic change in incentives would be effective in moving out of this full corruption equilibrium, because of the self-reinforcing nature of social norms.

The described mechanisms have the potential to make corruption self-reinforcing and to generate multiple equilibriums whereby organizations or countries with the same characteristics can experience very different corruption levels. This gives a role to history as a major determinant of corruption and explains its persistence. Countries are "stuck" in density dependent equilibriums; the level of corruption in a country moves towards either a high or a low equilibrium depending on the initial situation. This suggests that a 'big push' is needed to reduce corruption levels in societies where corruption is pandemic.

There are two possibilities for extension of the research. First, one could permit explicit punishment possibilities as part of the interaction, for instance by adding a stage to the game in which punishment in the form of costly sanctions may be imposed on others. Second, one could allow for the possibility that individuals interact selectively, rather than randomly, with others in the population, or condition their behavior on some potentially observable property that identifies a group to which their opponent belongs. Both approaches will give us the same result: the mixed equilibrium (some bureaucrats corrupt/some not) will become the most probable.

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Abstract

Corruption and Social Norms

The paper investigates the effect of an exogenous social norm of administrative corruption on the incentives to be corrupt for bureaucrats that participate in the non-cooperative principal-agent game. This setting leads to many density dependent effects: i.e., critical population thresholds, which separate equilibriums with low levels of corruption from equilibriums with high levels of corruption. In order to counter the problem of multiple equilibriums evolutionary game theory is employed into the analysis. This means that people are no longer assumed able to be perfectly rational. Rather, they adopt strategies on the basis of trial and error, adapting their behavior on the basis of its ‘success’ with the result that they gravitate towards the relatively most successful type of behavior. As a result, we characterize the emergence of an equilibrium behavioral pattern within the population of bureaucrats as a social convention arising under the assumption that they tend to imitate relatively more rewarding behaviors.