1. Introduction

Recent articles have discussed the idea of corruption as a cultural phenomenon[1]; bribery is the result of the cultural attitudes of a people, a sort of institutionalized behaviour matured as time goes by and affecting more and more individuals. In this case particular attention must be devoted to studying the mechanisms of cultural transmission from one generation to the next. The concept of "*frequency dependent equilibria*" illustrates and explains this cultural mechanism. In other words with the increase in the number of corrupt people, honest individuals are induced to adopt corruption; thus, future generations will be more corrupt if levels of corruption were very high in the past (see Sah, 1988; Andvig-Moene, 1990; Andvig, 1991). Whereas in more recent models a specific cultural mechanism is introduced: in Tirole (1996) for example, reputation of past generations affects the behaviour of future generations, while in Hauk-Marti (1999) adults educates children following an education process based on the hypothesis of imperfect empathy, by which parents can perceive the welfare of their children only through the filter of their own preferences (Bisin-Verdier, 1998, 2000a,b, 2001a,b). An important implication of this model is that government can affect the distribution of *ethics* in the population and reduce corruption by announcing a time consistent policy of reforms or exerting an educational effort on new generations. According to the authors, these facts would explain the success of Hong-Kong's anti-corruption measures.

However, could this approach solve the problem of corruption in less developed countries where endemic poverty tragically affects the behaviour of both individuals and institutions? We want to answer this question by reversing the usual approach used in economic theory; that is, as literature consider corruption a factor inhibiting development by affecting investment and productivity(Mauro, 1995; Gupta-Davoodi-Tiogson, 2000; Tanzi-Davoodi, 1997; Gupta-Davoodi-Terme, 1998), we wish to consider the reversed proposal that underdevelopment creates the necessary condition for endemic corruption[2].

In fact a perpetual scarcity of public goods/services produces distortions of an individual's attitudes towards the cost of bureaucratic procedures: even if bureaucracy is not cumbersome, poverty induces people to percieve honesty as too expensive and prefer illegal payments because they cannot completely satisfy their needs following the legal bureaucratic procedures[3].

To theoretically prove our hypothesis we have organised the article as follow: in the first part we propose a bureaucratic game in which clients (agents) and bureaucrats exchange public goods and services. The game has the structure of a *signalling game*, where agents have to manifest their attitudes towards corruption. There are only two possible types of agents: potentially honest and potentially dishonest. They differ from one another in the perception of *transaction costs* related to bureauctratic procedures. Corrupt people perceive these costs as very high an so honesty is never their dominant strategy.

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[1] Corruption is typically defined as the *abuse of public power for private benefit*. In this article we will always refer to this definition, emphasizing the attention on corruption of public officials (bureaucratic corruption).

[2] A similar approach is in Leite-Weidman (1999), where resource abundance creates opportunities for those seeking illicit income and is an important factor in determining a country's level of corruption.

[3] Scarcity and poverty also increase bureaucratic power; bureaucrats can select the demand by arbitrarily increasing the price of goods/services they "sell" imposing the payment of a bribe (see Slaifher-Visny 1993 and Tanzi 1998).

Conversely, honest agents have moral attitudes implying a strong preference for honest transactions; only low *costs of corruption* could lead them to choose bribery[4]. So, according to our approach, bureaucratic costs will be perceived as higher in less developed countries.

A second part introduces the dynamic mechanisms delineating the evolution of social preferences. Individuals "produce" this evolution by trying to transmit their personal attitudes to their children (vertical transmission). On the other hand, the child can assume the preferences of a different randomly chosen agent if the parent's education effort fails (oblique transmission).

Parents evaluate their child's welfare as if it were their own (imperfect emphaty) and choose an educational effort that defines the probability with which the parent's cultural trait is adopted by the child. Moreover a further hypothesis is introduced: we suppose that a honest (corrupt) parent believes a corrupt (honest) child will always choose corruption (honesty)[5]. This particular hypothesis is crucial in the analysis.

The evolution of social preferences will depend strictly on the equilibria of bureaucratic game; moreover each equilibrium is connected to a particular level of corruption costs. Then we introduce a vote mechanism by which population selects an optimal level of such costs (institutions[6]); clearly, this choice will depend on the distribution of agent's preferences, i.e. a majority of corrupt agents will vote for lower corruption costs and vice versa. Therefore, as in Bisin-Verdier (2000), there is a two-way causality between both culture and political outcomes: distribution of preferences affects the choice of corruption costs (political outcomes), but such costs are crucial to define the behaviour of agents (in the bureaucratic game) and consequently the evolution of cultural traits themselves.

The main results of our analysis emphasize the existence of two distinct situations:

a) Developed countries, characterized by weak perception of bureaucratic costs: corruption can be permanently reduced by inducing optimistic expectations on future corruption levels and political reforms or by public education campaigns; *b) Less developed countries, with a tragic perception of bureaucratic costs*: efficacious political reforms are blocked; we can only temporarely reduce corruption by public education campaigns. When campaigns are interrupted, distribution of social preferences will always converge towards a majority of corrupt people. In this case corruption is endemic: we call this situation *the corruption trap*[7].

Finally, we empirically corroborate the model's implications in a cross-country framework, using both corruption indeces and a new data-set which measures the population's expectation of future corruption for each country.

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[4] Theoretically each type could have convenience to manifest a behaviour in contrast with her real attitude. For example, this convenience could derive from excessively permissive institutional rules making honesty more costly than corruption and inducing potentially honest people to prefer manifesting scarce corruption aversion.

[5] In Hauk-Marti, honest people (corrupt) are always honest (corrupt); we shift this rigidity on the agent's belief.

[6] By institutions we intend all formal and informal rules defining the costs of corruption. See North (1990) for a more detailed description.

[7] Like in the prisoner's dilemma, the corruption trap is an inefficient equilibrium solution of the game where honesty is, in evolutionary terms, a dominated strategy and individuals playing such strategy tends to disappear. In the long-run population will be esclusivally composed by dishonest individuals.

2. Bureaucratic Game

Transaction between bureaucrat and client (agent) is modelled like a signalling game (see figure 1). Agents are defined in two types: $T = \{t_1, t_2\}$. With t_1 indicating a *potentially corrupt* individual and with t_2 a *potentially honest* individual. The probability of an agent being corrupt is $prob\{t_1\} = z_t$.

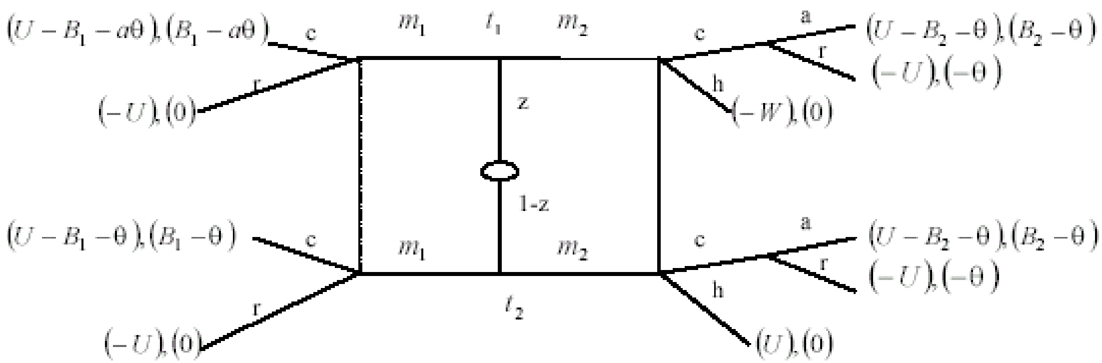
Clients know their types (complete information) and send a message which manifest their attitude to corruption. With the message m_1 agent manifests the will to be corrupt, while with m_2 he shows strong aversion for corruption. Theoretically, an agent can send a message in contrast with his true nature.

Bureaucrats are supposedly neutral, that is they have no natural inclination to honesty or corruption; they will simply observe the message and choose the strategy (corruption or honesty) with the higher payoff. The strategy set of bureaucrat changes according to the message observed. When the message is m_1, the bureaucrat can reject the agent's proposal (*r*) or accept it, choosing corruption (*c*). Instead, with m_2 he has to decide between honesty (*h*) and corruption (*c*); but, in the second case, bribery depends on the final agent's acceptance (*a*) or rejection (*r*) (see the further decisional node of agents at the right and side of the game, after bureaucrat has chosen corruption).

When corruption is the equilibrum strategy of all players (left hand side of the game), the agent's payoff is $(U - B_i - \theta)$ with U the revenue the agent obtains from the public good/service $(U > 0)$, B_i the bribe he pays after he has sent a message m_i $(i = 1,2)$ and θ the cost of corruption $(\theta \geq 0)$[8]. The bureaucrat's payoff has the form $(B_i - \theta)$. When corruption is adopted with a client of type t_1 manifesting scarce aversion to corruption (m_1), the cost of corruption reduces to $a\theta$ with $0 \leq a \leq 1$; "complicity" between bureaucrat and client limits the risk of illegal transaction. This "complicity" is absent with types t_2 and when the message is m_2: in this case players pay the full cost of corruption.

[8] By cost of corruption we intend all costs resulting from punishments (arrest, dismissal, fine etc.) inflicted to a corrupt individual when his illegal behaviour is detected. Of course we implicitly consider the efficiency of monitoring technology such that the stronger monitoring activity the higher corruption costs.

Figure 1. Bureaucratic Game



Considering the left hand side of the game, when the bureaucrat rejects the bribe B_1 proposed by the agent he gains a payoff of zero; the client does not obtain the public good/service and so he pays a cost $(-U)$. Note that when agents manifest scarce aversion to corruption, honesty is not a possible choice of bureaucrat; simply, if the bureaucrat want to act onestly, he will reject the proposal of the client. Contrarily, with message m_2 bureaucrat can opt for honesty, gaining zero or choose corruption by requiring the payment of a bribe B_2. Rejecting this proposal the agent does not obtain the public good/service and pays a cost $(-U)$ while the bureaucrat's payoff is the full corruption cost $(-\theta)$.

An important hypothesis is that considering the "*cost of honesty" for corrupt agents* (W): imagine each agent plays m_2 then, if bureaucrat chooses honesty, agent of type t_1 pays a cost $(-W)$ while the honest agent obtains the revenue (U). The idea is that using the normal bureaucratic procedure (that is, working honestly) could produce very high costs for corrupt agents because of four factors:

1) They would not have access to public good/service in time**;**
2) They would not have the quantity of the desired public good/service;
3) They would not have exclusive access to public good/service;
4) They cannot "buy" (paying a bribe) the right to use the public good/service (in the case the agent has no rights).

Thus we can consider *W* as the *cost of bureaucratic procedure* as perceived by corrupt agents. The hypothesis is that honest people does not pay attention to these costs and honesty is the best result for them. On the other hand, corrupt individuals are strongly aware to these costs, and so they always prefer corruption. However, as we see later, honest agents could prefer to manifest scarce corruption aversion if the *cost of corruption* is very low and bureauctrats are induced to choose bribery independently of the agent's strategy.

Clearly, it is reasonable to suppose high values of *W* when public goods/services are scarce and institutions do not work well, i.e. when we have a low level of economic and institutional development.

2.1 Equilibria

Before studying the game's equilibria we have to make some considerations about the definition of bribe level B_2. We can observe that when the message is m_2 bureaucrats choose corruption only if they are sure the agent accepts it. So the illegal transaction requires a level of bribe B_2 so that $U - B_2 - \theta \geq -U$: riarranging this espression and considering only the equality, we obtain the maximum bribe both type of agents are willing to pay when they play m_2: $B_2 = 2U - \theta$. At this point the payoff structure at the right hand side of the game becomes as shown in figure 2.

Now it is easy to show that the sole equilibria are $Pooling[(m_1, m_1),(c,(c,a))]$ when $U > \theta$ and $Separatig[(m_1, m_2),(c,h)]$ when $U < \theta$. We analyze these possibilities in turn[9].

(1) $Pooling[(m_1, m_1),(c,(c,a))]$: both types of agents manifest scarce corruption aversion (playing m_1). Bureaucrats can accept this proposal but they require a bribe B_1 so that their expected payoff is positive: $(B_1 - a\theta)z + (B_1 - \theta)(1-z) > 0$. From this condition the agent obtain the minum bribe the bureaucrat is willing to accept: $B_1 = \theta(1 - z(1-a))$[10]. Given this equilibrium bribe and the initial condition $U > \theta$, we have to investigate whether at least one agent would benefit from deviation. Deviating, both types of agents obtain $(-U)$ because the bureaucrat chooses corruption (see figure 2), but deviation is an optimal strategy for type t_1 only if $U - \theta(1 - z(1-a)) - a\theta < -U$ and for type t_2 only if $U - \theta(1 - z(1-a)) - \theta < -U$. Given the initial hypothesis $U > \theta$, these conditions are not satisfied; so playing m_1 is the dominant strategy for both types of agents.

(2) $Separatig[(m_1, m_2),(c,h)]$: with $U < \theta$ the bureaucrat "plays" honesty when observing a signal m_2. Then, the honest agent can obtain a payoff $U > 0$ playing m_2 while the corrupt agent keeps playing m_1 because honesty has a cost W and by hypothesis we suppose $U - B_1 - a\theta > -W$[11]; we can conclude that no agent deviates from this equilibrium. Reversing this relation, i.e. with $U - B_1 - a\theta < -W$, we can have a further pooling equilibrium, where all agents play m_2 and buraucrats choose honesty. Such hypothesis is not considered because it implies the unrealistic situation of the absence of bureaucratic corruption. Empirical evidence, in fact, shows that no country is exempt from corruption although corruption levels vary widely across countries (see Klitgaard, 1988; Hauk-Marti, 1999).

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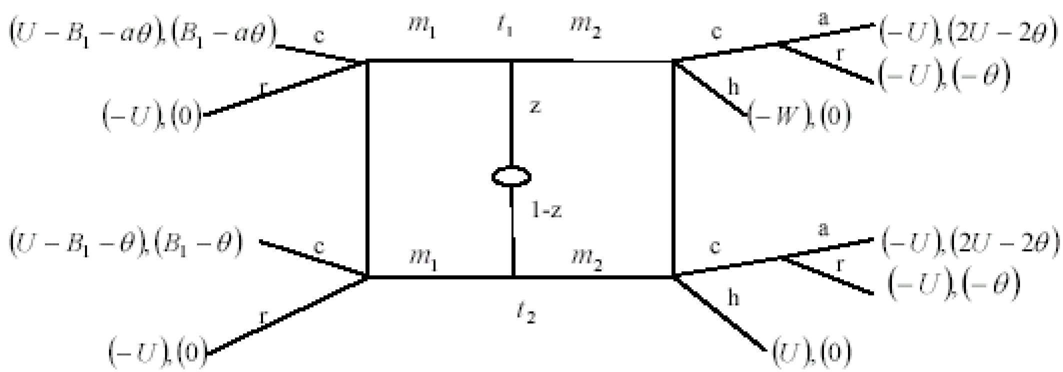
[9] The notation $[(m', m''),(n', n'')]$ means that types t_1 and t_2 play respectively m' and m'' while the bureaucrat chooses n' if he observes a message m' and n'' if the message is m''.

[10] Minimum bribe is defined such that the bureaucrat is indifferent between accept or reject it. Precisely, the agent offers this minimum bribe plus a quantity $\varepsilon \approx 0$. For simplicity this quantity is omitted.

[11] With separating equilibrium bureaucrat knows that m_1 is played only by the agent t_1; then, the minimum bribe he accepts is $B_1 = a\theta$.

However we cannot totally exclude momentary situations where the above relation is satisfied. This can occur when the cost of corruption (θ) tragically and exogenously increases (institutional shock) inducing even corrupt people to prefer honesty. The Italian "revolution" of "mani pulite" (clean hands) is an example of such institutional shock. We will discuss this in section 7.

Figure 2. Modified Bureacratic Game



Summarizing, a very low cost of corruption, such that $U>\theta$, implies an increse of bureaucratic power; in this situation bureaucrats prefer corruption even if agents manifest bribery aversion, inducing the honest to play m_1, against their true nature.

Differently, when $U<\theta$, a "portion" of society begins to express uneasiness: as we will see later, this has important implications on the evolutionary dynamics of population cultural traits.

From now on we label with θ_1 and θ_2 different levels of corruption cost so that rispectively $U>\theta$ and $U<\theta$. We also suppose that in normal conditions the cost of corruption has a "natural" upper boundary $\bar{\theta}$ (we can consider $\bar{\theta}$ as defined by technological limits in detecting corruption). However in section 7 we consider the hypothesis of a traumatic increase of θ, due to exogenous institutional shocks that do not depend on the voting mechanism. In that case we cannot exclude the possibility to have $U-B_1-a\theta<-W$, even if we consider it as transitory.

3. Dynamics of social preferences
3.1 Imperfect emphaty

Now we expand the model adding the temporal dimension and considering an overlapping generational mechanism by which parents and society transmit cultural traits to future generations. To do it we consider each agent (client) living two periods. In the first period he/she is a child and he/she has no specific preferences; in the second he/she becomes an adult with a definite attitude against corruption, plays the *bureaucratic game* and has a child (so that population is constant). Preferences are transmitted to the child by the education effort of the parent (vertical transmission) and by the cultural influence of society (oblique transmission): if the child does not learn from the parent, he/she adopts the preferences of a randomly chosen adult.

Parents want to maximize their child's future well-being, but they evaluate the welfare of their childs through their own preferences structure according to the hypothesis of imperfect empathy. Empathy is the psychological process that consists in directly absorbing the emotional condition of another person; the imperfection we attribute to this process consists in a sort of myopic behaviour of a parent who evaluates the future choices of his child without considering the child's effective attitude but exclusively using the one's own. Moreover we suppose that each type of agent has a specific belief about the message the opposite type normally sends.
Precisely, it is supposed that a type t_i is convinced that an agent t_j always sends a message m_j, with $i \neq j$.

Then, indicating with $\Pi(t_i, m_k, b)$ the payoff a type t_i $(i = 1,2)$ obtains when he sends the message m_k $(k = 1,2)$ and the bureaucrat chooses *b,* and with $V^{i,j}(\theta_k)$ the expected utility from the economic action of a child of type t_j $(j = 1,2)$ as percieved by a parent of type t_i when he expects a corruption cost θ_k $(k = 1,2)$, we can state the following formal definition of imperfect emphaty:

- Definition -

Imperfect emphaty: *1)* for the type t_1, $V^{1,2} = \Pi(t_1, m_2, b)$ with the belief that $m_2 = \arg\max \Pi(t_2, m, b)$, $b \in \{c, h\}$; *2)* for the type t_2, $V^{2,1} = \Pi(t_2, m_1, b')$ with the belief that $m_1 = \arg\max \Pi(t_1, m, b')$, $b' \in \{c, r\}$.

3.2 The educational process

At time *t* each adult of type t_i $(i = 1,2)$ has a child and chooses an effort τ_t^i to educate him.

This effort is the probability the child will adopt parent's preferences $(0 \leq \tau^i \leq 1)$. Now, letting be $P_t^{i,j}$ the probability that a child of parent t_i is of type t_j and considering a corrupt adult, we can write

$$P_t^{1,1} = \tau_t^1 + (1 - \tau_t^1) z_t$$
$$P_t^{1,2} = (1 - \tau_t^1)(1 - z_t)$$

where z_t is the proportion of corrupt adults at time *t.* Similarly, for the honest adult we get

$$P_t^{2,2} = \tau_t^2 + (1 - \tau_t^2)(1 - z_t)$$
$$P_t^{2,1} = (1 - \tau_t^2) z_t .$$

Given these probabilities, we can characterize the dynamic behaviour of z_t:

$$z_{t+1} = z_t P_t^{1,1} + (1 - z_t) P_t^{2,1}$$

substituting $P_t^{1,1}$ and $P_t^{2,1}$ we obtain

$$z_{t+1} = z_t + z_t (1 - z_t)(\tau_t^1 - \tau_t^2).$$

As we can see, the dynamic of population's preferences depends on the parent's educational effort. Precisely, a parent of type t_i chooses the educational effort $\tau \in [0,1]$ that maximizes

$$\Gamma = \beta \left(P_t^{i,i} V_t^{i,i}(\theta_k) + P_t^{i,j} V_t^{i,j}(\theta_k) \right) - C(\tau^i)$$

where β is the discount rate and $C(\tau_t)$ the cost of educational effort. We assume that $C(\tau^i)$ is twice continuosly differentiable and strictly convex with $C(0) = 0$, $C'(0) = 0$ and that for all τ $C'' > C' > 0$[12]. In order to assess $V^{i,j}$ a parent of type t_i uses his own payoff structure (imperfect emphaty), therefore we must have $V^{i,i}(\theta_k) \geq V^{i,j}(\theta_k)$.

Solving the maximization problem and suppressing the time indicators, we obtain the following conditions:

$$\frac{\partial \Gamma}{\partial \tau^1} = 0 \Rightarrow \beta \left(V^{1,1} - V^{1,2} \right)(1 - z) = C'(\tau^1)$$

$$\frac{\partial \Gamma}{\partial \tau^2} = 0 \Rightarrow \beta \left(V^{2,2} - V^{2,1} \right) z = C'(\tau^2)$$

Using the implicit function theorem we can write

$$\frac{\partial \tau^1}{\partial z} = -\frac{\beta \left(V^{1,1} - V^{1,2} \right)}{C''(\tau^1)} \leq 0$$

$$\frac{\partial \tau^2}{\partial z} = \frac{\beta \left(V^{2,2} - V^{2,1} \right)}{C''(\tau^2)} \geq 0$$

[12] Note that $C(\tau)$ must be sufficiently convex such that the solution of the maximization problem is $\tau < 1$.

The educational effort of type t_1 decreases as the proportion of corrupt agents increases. In fact, higher values of *z* mean a higher probability the child assumes the same preferences as the parent simply by socializing with a member of society; this induces the parent to reduce the educational effort. For the same argument, if the proportion of corrupt agents increases, the honest parents must intensify their educationl effort.

4. The choice of institutions

Given the subjective nature of "*bureaucratic procedure cost*" *W* (it depends on the corrupt agents' perception) we can consider the "*corruption cost"* θ as the main parameter describing institutional efficency[13]. Moreover, from the bureaucratic game we note that each type of agent has an exact preference about the level of this parameter: type t_1 (the corrupt agent) prefers a low level of corruption cost such that $U > \theta$ because he would obtain a payoff $(U - 2\theta_1) > (U - 2\theta_2)$ while type t_2 (the honest agent) wants $U < \theta$ to realise a payoff $(U) > (U - 2\theta_1)$[14]. Then we can suppose that in each period adults have to decide the degree of institutional efficency by voting the preferred level of θ. If the fraction z_t of individuals of type t_1 is larger than $\frac{1}{2}$, then corrupt agents have the majority and they will vote for a θ_1 such that $U > \theta$. On the other hand when z_t is less than $\frac{1}{2}$, the level of θ will be decided by honest agents and they will vote for a θ_2 such that $U < \theta$.

Summarizing, we can write

$$\theta(z_t) = \begin{cases} \theta_1 & if \quad z_t > \frac{1}{2} \\ \theta_2 & if \quad z_t \leq \frac{1}{2} \end{cases}$$

The vote mechanism we have introduced allow us to formalise the idea that corruption spreads when there is not sufficient social aversion to it.

5. The steady states

We can now characterize the steady states according to the expected corruption costs.

Lemma 1

1) if $\theta^e = \theta_1$ then $\tau^1 > 0$, $\tau^2 = 0$;

2) if $\theta^e = \theta_2$ then $\tau^1 \gtrless \tau^2$ when $z_t \lessgtr z^*$

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[13] Of course, the cost *W* also depends on the level of redtape, but in this context we esclusively emphasize the role of agent's perceptions.

[14] We can say that honest and corrupt agents prefer rispectively separating and pooling equilibrium.

where $z^* = \frac{V^{1,1}(\theta_2) - V^{1,2}(\theta_2)}{V^{1,1}(\theta_2) - V^{1,2}(\theta_2) + V^{2,2}(\theta_2) - V^{2,1}(\theta_2)}$.

Proof.

1) When agents expect a corruption cost θ_1, the equilibrium of bureaucratic game is pooling and each type plays m_1. Given the imperfect empathy hypothesis we have that $V^{1,1}(\theta^e = \theta_1) > V^{1,2}(\theta^e = \theta_1)$ and $V^{2,2}(\theta^e = \theta_1) = V^{2,1}(\theta^e = \theta_1)$; consequently, by the first order condition (f.o.c.) of parent's maximization problem, $\tau^1 > 0$, $\tau^2 = 0$.

2) When the expected cost is θ_2, separating equilibrium in bureaucratic game and imperfect emphaty assure that $V^{1,1}(\theta^e = \theta_2) > V^{1,2}(\theta^e = \theta_2)$ and $V^{2,2}(\theta^e = \theta_2) > V^{2,1}(\theta^e = \theta_2)$; by f.o.c. each type of agent chooses a positive educational effort, $\tau^1 > 0$ and $\tau^2 > 0$. To obtain the point z^* we have to consider that $\tau^1 > \tau^2$ implies $C'(\tau^1) > C'(\tau^2)$. Then $\beta(\Delta^1)(1-z) > \beta(\Delta^2)z$ and so $z < \frac{\Delta^1}{\Delta^1 - \Delta^2}$, with $\Delta^i = V^{i,i}(\theta_2) - V^{i,j}(\theta_2)$, $i, j = 1,2$ and $i \neq j$.

***Corollary*:** By $\Delta^1 = (U - 2\theta_2) - (-W)$ and $\Delta^2 = (U) - (U - 2\theta_2)$ we have $z^* = \frac{\Delta^1}{\Delta^1 + \Delta^2} = 1 - \frac{2\theta_2}{U + W}$: if corrupt agents have a very adverse perception of bureaucratic procedure costs $(i.e., W \to +\infty)$ then z^* "converges" to 1.

Proposition 1: Suppose that $z^* < \frac{1}{2}$ and $U - 2\overline{\theta} > -W$. Then there exists a unique $\bar{z} > \frac{1}{2}$ and $\hat{z} < \frac{1}{2}$ such that: *1)* if $z_0 > \bar{z}$ then for all *t*, z_t converges monotonically to 1; *2)* if $\hat{z} < z_0 < \bar{z}$ then for all *t*, either z_t converges monotonically to 1 or z_t converges to z^*; *3)* if $z_0 < \hat{z}$ and $z^* < \hat{z}$ then z_t converge to z^*; *4)* if $z_0 < \hat{z}$ and $\hat{z} < z^* < \frac{1}{2}$ then either z_t converges monotonically to 1 or z_t converges to z^*.

(**Proof.** See appendix)

When type t_2 individuals are in a small enough minority $(i.e., z_0 > \bar{z})$, whatever their socialisation effort, they will always remain in minority in the next generation. This means that each agent's rational expectation is $\theta^e = \theta_1$; so by lemma 1 only agents of type t_1 will choose a positive educational effort $(\tau^1 > 0)$ and population will converge monotonically to 1. On the other hand when type t_2 individuals are in a sufficently high majority $(i.e., z_0 < \hat{z})$ they will remain in majority also in the next period, inducing all agents to expect $\theta^e = \theta_2$ and, by lemma 1, to choose a positive effort; the population will converge to a uniquely stable steady state $z = z^*$ if $z^* < \hat{z}$ (see appendix). On the other hand, when $\hat{z} < z^* < \frac{1}{2}$ we have equilibria with self-fulfilling expectations: once $\hat{z} < z_t < \frac{1}{2}$, expectations of agents will be confirmed. Suppose population is in z^* and agents expect $\theta^e = \theta_2$. Then, by lemma 1, $\tau^1 = \tau^2$ and population remains in $z^* < \frac{1}{2}$ self-confirming the initial expectations. Differently, if $\theta^e = \theta_1$ by lemma 1 only corrupt agents choose a positive effort, and population moves toward 1; given that $\hat{z} < z^* < \frac{1}{2}$, then $z_{t+1}(z^*) > \frac{1}{2}$ and this of course self-confirms the initial expectations. By the same arguments we have self-fulfilling expecations when $\frac{1}{2} < z_0 < \bar{z}$.

Proposition 2 (corruption trap): Suppose that $z^* > \frac{1}{2}$ and $U - 2\overline{\theta} > -W$. Then for all *t*, z_t converges monotonically to 1.

(**Proof.** See appendix)

When corrupt agents have a tragic perception of the costs of bureaucratic procedures $\left(i.e., z^* > \frac{1}{2}\right)$, population dynamics always move towards lower proportion of honest agents $\left(i.e., z_t > \frac{1}{2}\right)$. Honesty has a very high cost for types t_1 and they will tend to choose an higher effort $\left(i.e., \tau^1 > \tau^2\right)$ when $z_0 < z^*$. On the other hand, with $z_0 > z^*$ the optimal effort of types t_2 does not allow to reach a $z_t < \frac{1}{2}$. Then corrupt agents will always have majority in the process of institutional choice, and the population will converge to 1.

We call this situation "*the corruption trap*" because sooner or later, whatever the initial point z_0, the dynamics of population will reach a proportion of corrupt agents ables to affect the process of institutional choice. When this occurs, expectations will always be $\theta^e = \theta_1$ and even honest agents will prefer to manifest scarce aversion to corruption, playing m_1 and not bothering to educate their children $\left(\tau^2 = 0\right)$. In such sense we can note the strict analogy between typical externality in public goods supply (free riding problem) and the corruption trap. Efficient institutions can be considered as public goods and corruption the negative externality obstructing a virtuous evolution of institutions, just as in the free riding problem where the free rider creates conditions for an insufficient quantity of public good.

By propositions 1 and 2 we can state the same facts about cross country levels of corruption. Precisely, less developed countries must show higher levels and homogeneity of corruption indicators; on the other hand, by proposition 1, richer countries should experiment either high level or low levels of corruption. Again, expectations of future corruption must appear as more pessimistic in poorer than in richer countries. In section 8 we use avoilable data on cross country corruption levels and population expectations to have a first confirmation of the model's predictions.

6. Exogenous education campaigns

In Hauk-Marti (1999), government can "solve" the problem of corruption adopting intensive education campaigns and investing in moral education. Formally, it chooses a public effort ρ to teach honest behaviour at school. "Similar to private education efforts, the public education effort represents the probability with which a child who did not learn from his parents adopts honest preferences in school".

As before, τ^i is the education effort of a parent of type t_i; with probability $\left(1-\tau^i\right)$ child remains "naive" and in that case he again has a probability ρ to assume preferences t_2. With probability $\left(1-\rho\right)$, public education fails and the child learns preferences from a randomly choosen adult in the society.

Then we can rewrite the probabilities $P^{i,j}$:

$$P_t^{1,1} = \tau_t^1 + \left(1-\tau_t^1\right)z_t\left(1-\rho\right);$$

$$P_t^{1,2} = \left(1-\tau_t^1\right)\left[\left(1-\rho\right)\left(1-z_t\right)+\rho\right]$$

$$P_t^{2,2} = \tau_t^2 + \left(1-\tau_t^2\right)\left[\left(1-z_t\right)\left(1-\rho\right)+\rho\right]$$

$$P_t^{2,1} = \left(1-\tau_t^2\right)\left(1-\rho\right)z_t\,.$$

Consequently, maximization problem of parents becomes

$$\max\ F = \beta\left(P_t^{i,i}V^{i,i} + P_t^{i,j}V^{i,j}\right) - C\left(\tau^i\right) \qquad i,j=1,2$$

with first order conditions (f.o.c.)

$$\frac{\partial F}{\partial \tau^1} = 0 \Rightarrow \beta\left(V^{1,1}-V^{1,2}\right)\left(1-z\left(1-\rho\right)\right) = C'\left(\tau^1\right)$$

$$\frac{\partial F}{\partial \tau^2} = 0 \Rightarrow \beta\left(V^{2,2}-V^{2,1}\right)\left(1-\rho\right)z = C'\left(\tau^2\right)$$

The education effort of type t_1 increases with ρ because the probability that a child assumes different preferences is higher. On the other hand, the education effort of type t_2 decreases when ρ increases, because public education can compensate a lower effort made by honest parents.

The dynamic equation becomes

$$z_{t+1} - z_t = z_t\left\{\left(\tau_t^1 - \tau_t^2\right)\left(1 - z_t\left(1-\rho\right)\right) - \left(1-\tau_t^2\right)\rho\right\};$$

where $z=0$ is a rest point while $z=1$ is a rest only if $\rho = 0$; interior solutions requires that $\tau^1 > \tau^2$. We need to find a level of ρ which allows us to converge towards lower levels of corruption. Such convergence is possible if

$$\left\{\left(\tau_t^1(z) - \tau_t^2(z)\right)\left(1 - z_t\left(1-\rho\right)\right) - \left(1-\tau_t^2(z)\right)\rho\right\} < 0$$

Hauk-Marti show that with a $\rho > \tau^{1}(0)$ population will converge to $z = 0$ [15].

This mechanism works well, producing permanent improvements in terms of diffused honesty, when $z^{*} < \frac{1}{2}$. It is sufficient to mantain a pubblic effort ρ until the population reaches a $z_t < \hat{z}$; at that point, the system automatically converges to z^{*} with higher corruption costs.

Problems arise when the population is in the "corruption trap". By public effort, government can move population preferences towards higher levels of honesty, but this effort must be sustained permanently. When it is interrupted, infact, the population begins converging to 1 again. In this situation honesty is only a temporary state, relying solely on public effort. This result is very important to study the problem of corruption in countries where individuals have a strong aversion to bureaucratic costs (i.e., $z^{*} > \frac{1}{2}$) and reforms[16] are obstructed by hostile social and political attitudes: without a serious change in perception of bureaucratic costs, the ideological education of new generations only costitutes a temporary solution to the problem of corruption.

Formally, we have to modify the perception of bureaucratic cost *W*, so that $z^{*} < \frac{1}{2}$. This perception is of course conditioned by the number of steps and permits in bureaucratic procedures but it fundamentally depends on scarsity and essentiality of public goods/services, in other words on the economic status of country. The removal of cumbersome red tape would not significantly reduce *W* if poverty and scarsity are diffused; individuals would continue to enjoy limited access to goods/services and perceive normal bureaucratic procedure as too expensive even if it has been drastically reduced. This would explain the enormous difficulties in fighting bribery in developing countries whereas lower levels of corruption are noted in richer economies, even with a strong presence of bureaucracy in political and economic life.

7. Institutional shocks and the Italian experience

So far we have supposed that $U - B_1 - a\overline{\theta} > -W$, with the result that corrupt agents never prefer honesty to corruption. We justified this hypothesis by considering corrupt people as having a tragic perception of bureaucratic costs. However, as we have mentioned above, we cannot totally exclude momentary situations where the above relation is reversed. This can occur when the cost of corruption (θ) tragically and exogenously increases producing an "institutional shock" and inducing even corrupt people to prefer honesty. According to the Bureaucratic Game, when this occurs, we would have a further pooling equilibrium, with all types of agents playing m_2 and bureaucrat choosing honesty. Of course, this produce the unrealistic situation of the total absence of corruption, but we consider it as purely momentary.

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[15] From Hauk-Marti (1999): "Notice that if $\rho = 1$ the system converges to $z = 0$ although honest parents do not educate their children at all. Hence, for $\rho = 1$, $\Delta z < 0$ for all $z > 0$. By continuity, there exists a $\overline{\rho}$ such that for $\rho > \overline{\rho}$ $\Delta z < 0$ for all $z > 0$. Indeed it is easy to see that for $\rho > \tau^{1}(0)$ $z = 0$ is the only attractor".

[16] By reforms we intend a significant increase in corruption costs such that $\theta^{e} = \theta_2$.

The Italian “revolution” of *mani pulite* was an important example of this type of institutional shocks. In early ’90s a judicial enquiry into bureaucratic and political corruption revealed that bribery was a diffused and endemic phenomenon in all aspects of institutional life. The enormous scaldals produced an immediate and unexpected (exogenous) increase in corruption costs, so that for some years corruption seemed to have been defeated[17]. Unfortunately, nowadays the re-emerging of widespread corruption in politcs and bureaucracy is evident, demostrating the “Italian institutional revolution” was a transitory phenomenon[18].

In term of our model, the Italian experience can be explained by using the idea of institutional shock. The unespected judicial enquiry produced a strong exogenous increase (shock) in corruption cost θ so that $U - B_1 - a\theta < -W$; at this point the dominant strategy for all agents and bureaucrats was honesty. Using the same approach as in Lemma 1 we can show that if all agents play m_2 then $\tau^1 = 0$, $\tau^2 > 0$ for all *t* and by the dynamic equation of population we have $\Delta z = z(1-z)(-\tau^2)$, i.e. population monotonically converges to $z = 0$.

Unfortunately, Italy started from a very high level of corruption, that is $z \approx 1$; thus, as the shock effects begun to disappear we probably had again $\bar{z} < z_t < 1$. Now, convergence to $z = 0$ stops and, by propositions 1 and 2, population moves to $z = 1$, with the consequent increase in corruption levels.

8. Some simple evidence

We can summarize the predictions of the model in three points:

1) *Less developed countries have higher corruption levels.*
2) *In general, richer countries must show greater heterogeneity in CPI (corruption perception Indeces) than poorer countries.*
3) *Poorer countries population expects higher levels of corruption in the future.*
4) *Given the corruption trap, poorer countries show a higher “stability” of corruption levels.*

The first hypothesis is widely documented in literature (see Mauro 1995, Bardhan, 1997). We can confirm it using a cross-country update data-set of *Corruption Perception Indices* (CPI) [19] provided by “*Transparency international*” and comparing them with the level of country development, using as proxy the pro-capita *Gross National Income* (GNI).

The source of GNI is the World Bank data set. The indicators of CPI and GNI refer to 92 countries and include the period from 1998 to 2002[20].

Figure 3 shows the relation between the level of corrupion and country development (measured by GNI); it is evident a positive relation (point 1). Moreover, the Plot seems to confirm the second hypothesis that more developed countries can show either high or low levels

[17]This evident reduction in corruption levels was strictly connected to the reduction of corruption opportunities (for example by interruption of tenders) and to the extreme fear diffused among officials, bureaucrats and politicians.

[18] Newspapers daily report cases of growing corruption in bureaucracy, procurement and public services. Informations on renewed corruption in Italy is avoilable on the web page www.transparency.it.

[19] Higher values of CPI mean lower levels of corruption.

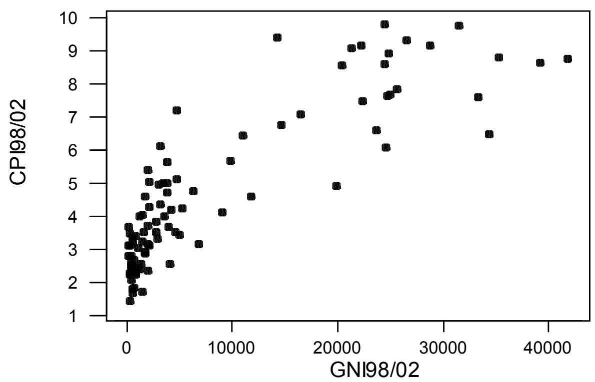
[20] With CPI98/02 and GNI98/02 are indicated the simple mean of both CPI and GNI on the period from 1998 to 2002.

of corruption. Observing the sample we note a significant number of developed countries with high levels of corruption but not the reverse; very important examples are Italy, Greece, South Korea, Spain. These countries have relatively high level of GNI pro-capita but a low corruption index (that is a high corruption); on the other hand, poorer countries always converge to a high level of corruption (low level of CPI index). Infact, observing the plot, less developed countries present a relevant "concentration" around low values of CPI while we have a higher variance in CPI indicators for richer countries. With poorer countries we intend those with an average *GNI* of less than 3000. This allows us to divide the sample in 46 poor countries and 46 rich countries: the variance of the average CPI for poorer and richer countries is respectively 0,75 and 4,5. As was expected, richer countries show a higher "dispersion" around the mean CPI while the evident poorer countries corruption index stability seems to confirm our hypothesis of "the corruption trap" (point 4).

Again, *Transparency International* provides cross-country data on population expectations about future level of corruption[21]. We can use them to verify the third prediction of the model. The second plot (figure 4) compares the percentage of population expecting a higher level of corruption in the future (*lot02*) with the level of *GNI* pro-capita (data are avoilable only for 2002 and for 43 countries). This simple evidence reveals a negative relation between corruption expectations and level of development, as our model predicts. For more details see " *Transparency international global corruption barometer*" on the official web-page of *Transparency International.*

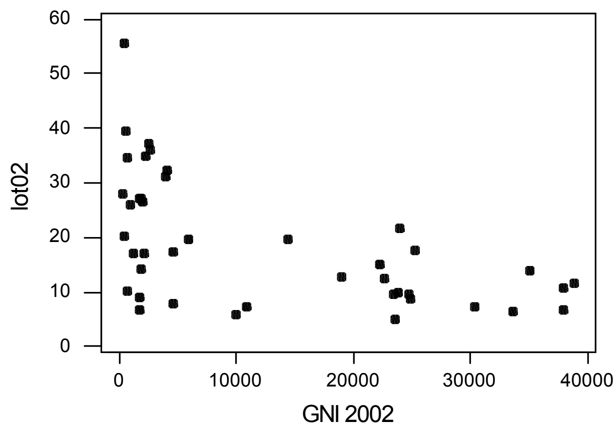
[21] Data are avoilable consulting the "*Transparency international global corruption barometer"* on the official web-page of *Transparency International,* www.transparency.org.

Figure 3- Development and Corruption



Source: Transparency International and World Bank

Figure 4 - Development and Expectations



Source: Transparency International and World Bank

9. Conclusion

In this paper we analyzed how social preferences interacts with both the choice of institutions and levels of bureaucratic corruption. By a bureaucratic game we model the behaviour of different types of agents. Their choices are crucially affected by the level of corruption costs fixed in each period by a simple direct majority voting mechanism. Given the general hypothesis of a "tragic perception" of bureaucratic costs, we identify two possible equilibria of bureaucratic game: *1)* a *pooling equilibrium* with all types of agents manifesting scarce aversion to corruption, and so allowing bureaucrat to practise corruption in all transaction; *2)* a *separating equilibrium* with corruption when the agent is corrupt and honesty with honest agents.

However, a third equilibrium, with all types of agents choosing honesty, is possible if we remove the hypothesis on the perceived level of bureaucratic cost. We consider this can occurs through an exogenous institutional shock consisting in a temporary strong increase in corruption costs. The Italian experience of "*mani pulite*" seems to confirm this approach.

Each equilibrium produces different dynamics in the evolution of social preferences: *1)* convergence to a completely corrupt society when all types of agents prefer corruption (pooling equilibrium). This occurs because only corrupt agents exert a positive education effort; *2)* convergence to a mixed distribution of preferences if the equilibrium is separating. In this case all agents exert positive education efforts, favouring the convergence to an internal steady state.

According to the "position" of the internal steady state we can distinguish between typical situations of underdevelopment from that of developed countries. This because we hypothesize that in developed economies agents have a weaker perception of bureaucratic costs, inducing lower education efforts of corrupt parents. Relevant are the implications in terms of anticorruption policies. In developed countries, public education campaigns produce efficacious results, premanently reducing the level of corruption. Moreover, if the proportion of corrupt agents is sufficiently low we have self-fulfilling equilibria; then optimistic agents' expectations can positively affect the future composition of social preferences, producing an effective reduction in both the number of corrupt agents and corruption costs (institutional change).

On the other hand, if we consider an underdeveloped country, corruption appears as a permanent state. Optimistic expectations can not emerge spontaneously and the only relevant anticorruption intervention consists in public education campaigns. However, also in this case, we simply obtain a temporary reduction of corruption. This situation is called "corruption trap".

To definitively solve the problem we have to reduce the agent perception of bureaucratic costs; this means we must create conditions for economic development. Simple empirical evidence seems to confirm our hypothesis about the relationship between corruption and development.

In particular, the corryption indices for poorer countries show both a strong stability along time and a "significant" concentration around lower levels: this fact could be explained by the existence of "the corruption trap" which prevents efficient reforms and reduces the population aversion to corruption.

Appendix

First we have to show that when $\theta^e = \theta_2$ then z^* is the unique stable steady-state of population. Considering the dynamic equation of population $z_{t+1} = z_t + z_t(1 - z_t)(\tau_t^1 - \tau_t^2)$ we note that it has three rest points: *i)* $z = 0$, *ii)* $z = 1$ and *iii)* $z = z^*$ with $\tau^1 = \tau^2$.

Deriving the dynamic equation with respect to z_t we obtain $\frac{\partial z_{t+1}}{\partial z_t} = 1 + (1 - 2z_t)(\tau^1 - \tau^2) + z_t(1 - z_t)\left(\frac{\partial \tau^1}{\partial z_t} - \frac{\partial \tau^2}{\partial z_t}\right)$.

Then

$$\left.\frac{\partial z_{t+1}}{\partial z_t}\right|_{z_t=0} = 1 + \tau^1 > 1 \quad \text{given that } (z_t = 0) \Rightarrow (\tau^2 = 0)$$

$$\left.\frac{\partial z_{t+1}}{\partial z_t}\right|_{z_t=1} = 1 + (-1)(-\tau^2) > 1 \quad \text{given that } (z_t = 1) \Rightarrow (\tau^1 = 0)$$

then points $z = 0$ and $z = 1$ are not stable.

To evaluate the stability of point z^*, rewrite the derivative of dynamic equation as

$$\frac{\partial z_{t+1}}{\partial z_t} = 1 + (1 - 2z_t)(\tau^1 - \tau^2) + z_t(1 - z_t)\left(\frac{-\beta\Delta^1}{C''(\tau^1)} - \frac{\beta\Delta^2}{C''(\tau^2)}\right)$$

given $\Delta^1 = \frac{C'(\tau^1)}{\beta(1 - z)}$ e $\Delta^2 = \frac{C'(\tau^2)}{\beta z}$;

then

$$\frac{\partial z_{t+1}}{\partial z_t} = 1 + (1 - 2z_t)(\tau^1 - \tau^2) + \left(z_t \frac{-C'(\tau^1)}{C''(\tau^1)} - (1 - z_t)\frac{C'(\tau^2)}{C''(\tau^2)}\right).$$

Evaluating this derivative in $z_t = z^*$, that is considering $\tau^1 = \tau^2$ and given $C' < C''$ $\forall \tau$ we have

$$\left.\frac{\partial z_{t+1}}{\partial z_t}\right|_{z_t=z^*} = 1 - \left(\frac{C'(\tau)}{C''(\tau)}\right) \in (0,1)$$

and conclude that $z_t = z^*$ is locally stable. ■

Following the same arguments we can show that with $\theta^e = \theta_1$ the unique stable steady state is $z = 1$. Infact, given $\tau^2 = 0$, the dynamic equation becomes $z_{t+1} = z_t + z_t(1 - z_t)(\tau^1)$; then $\frac{\partial z_{t+1}}{\partial z_t} = 1 + \tau^1(1 - 2z_t)$ and $\left.\frac{\partial z_{t+1}}{\partial z_t}\right|_{z=1} = (1 - \tau^1) \in (0,1)$. Conversely, the other rest point $z = 0$ is not stable, given that $\left.\frac{\partial z_{t+1}}{\partial z_t}\right|_{z=0} = (1 + \tau^1) > 1$. ■

Proposition 1: we subdivide the proof of proposition 1 in four parts:

Proof A: Suppose that $z^* < \frac{1}{2}$, $z_0 > \frac{1}{2}$ and $\theta^e = \theta_2$. By Lemma 1 $(\tau^1 - \tau^2) < 0$ and $\frac{\partial z_{t+1}}{\partial z_t} < 0$ (population converges to z^*); this implies that $z_{t+1}(z_t = \frac{1}{2}) < \frac{1}{2}$. Then there exists a $\bar{z} > \frac{1}{2}$ such that for all $z_t > \bar{z}$ we have $z_{t+1}(z_t) > \frac{1}{2}$. Moreover, $z_t < \bar{z}$ implies $z_{t+1}(z_t) < \frac{1}{2}$.

Proof B: Suppose that $z^* < \frac{1}{2}$, $z_0 < \frac{1}{2}$ and $\theta^e = \theta_1$. By Lemma 1 $\tau^1 > 0$, $\tau^2 = 0$ and $\frac{\partial z_{t+1}}{\partial z_t} > 0$ (population converges to 1); this implies that $z_{t+1}(z_t = \frac{1}{2}) > \frac{1}{2}$. Then there exists a $\hat{z} < \frac{1}{2}$ such that for all $\hat{z} < z_t < \frac{1}{2}$ we have $z_{t+1}(z_t) > \frac{1}{2}$. Moreover, $z_t < \hat{z}$ implies $z_{t+1}(z_t) < \frac{1}{2}$.

Proofs A and B prove *2)*. ■

Proof C: Suppose that $z_0 < \hat{z}$ and $z^* < \hat{z}$; even if $\theta^e = \theta_1$ we have $z_{t+1}(z_t) < \frac{1}{2}$ then the unique reasonable expectation is $\theta^e = \theta_2$ and population converges to z^*; by the same arguments, if $\hat{z} < z^* < \frac{1}{2}$ and $z_t < \hat{z}$, population tends converge to z^*: however, for z_t close enough to z^*, we will have $\hat{z} < z_t < \frac{1}{2}$ falling within the case analyzed in proof B.

Proof C proves *3)* and *4)*. ■

Proof D: Suppose that $z_0 > \bar{z} > \frac{1}{2}$; also with $\theta^e = \theta_2$ we have $z_{t+1}(z_t) > \frac{1}{2}$, then the unique reasonble expectation is $\theta^e = \theta_1$ and population converges to 1.

Proof D proves *1)*. ■

Proposition 2 (corruption trap): When $z_0 < \frac{1}{2}$, z_t increases towards $z^* > \frac{1}{2}$ or $z = 1$ according to the expected θ. Then population will reach a z_t such that $z_{t+1}(z_t) > \frac{1}{2}$ for all *t*; at that point the unique reasonable expectation is$\theta^e = \theta_1$ and population will converge to $z = 1$. By the same arguments, when $z_0 > \frac{1}{2}$, $z_t > \frac{1}{2}$ for all *t* and population will converge to $z = 1$. ■

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