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On the Cultural Transmission of Corruption

by Esther Hauk and María Sáez-Martí

IUI, The Research Institute of Industrial Economics
P.O. Box 5501
SE-114 85 Stockholm
Sweden

On the cultural transmission of corruption*

Esther Hauk

Universitat Pompeu Fabra, 08005 Barcelona, Spain.
E-mail: esther.hauk@econ.upf.es

and

Maria Saez-Marti

The Research Institute of Industrial Economics, 11485 Stockholm, Sweden
E-mail: MSM@iui.se

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We provide a cultural explanation to the phenomenon of corruption in the framework of an overlapping generations model with intergenerational transmission of *values*. We show that the economy has two steady states with different levels of corruption. The driving force in the equilibrium selection process is the education effort exerted by parents which depends on the distribution of *ethics* in the population and on expectations about future policies. We propose some policy interventions which via parents' efforts have long-lasting effects on corruption and show the success of intensive education campaigns. Educating the young is a key element in reducing corruption successfully. *Journal of Economic Literature* Classification Numbers D10, J13.

Key Words: corruption; cultural transmission; education; ethics.

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1. INTRODUCTION

Mohammedans are Mohammedans because they are born and reared among the sect, not because they have thought it out and can furnish sound reasons for being Mohammedans; we know why Catholics are Catholics; why Presbyterians are Presbyterians; why Baptists are Baptists; why Mormons are Mormons; why thieves are thieves; why monarchists are monarchists; why Republicans are Republicans and Democrats, Democrats. We know that it is a matter of association and sympathy, not reasoning and examination; that hardly a man in the world has an opinion on morals, politics, or religion that he got otherwise than through his associations and sympathies. **Mark Twain**

In 1974 Hong Kong, a country plagued by corruption for centuries, launched another anticorruption campaign. The success of the new Independent Commission Against Corruption (ICAC) in a country where all previous attempts to fight corruption had failed surprised many observers. The main difference from former reforms was that ICAC combined new incentives with a change in values.[1] In policy debates, Hong Kong became *the* example that socialization programs promoting ethical values against corruption can work. Some empirical studies point out that the perception of corruption as a social problem in Hong Kong depends to some extent on age (and therefore on the time the different groups were exposed to the ICAC). For instance, in 1986, 75.1% of the 15-24 age group (which had been subject to the ICAC's education program for about 13 years) believed that corruption was a social problem, whereas only 54% of the 45-64 age group (who were born and lived their formative years when the ICAC didn't exist) agreed with that. In 1977 32% believed that tipping government employees for prompt service is an offense, compared to 72% in 1986. Similarly, in 1977 38% believed that under-the-table kickbacks is a normal business practice, compared to 7% in 1986. In 1998 and 1999 surveys, about 85% of respondents aged between 15 and 24 said they would not tolerate corruption in both the Government and the business sector.

[1] The declared goals of ICAC were: "To change people's behavior so that they will not engage in corrupt behavior initially for fear of detection (deterrence), later because they cannot (prevention) and yet later because they do not wish to (attitude change)." The main emphasis of the ICAC education program was to "build a strong altruism and a sense of responsibility in oneself and toward the others", de-emphasizing the importance of getting money and getting ahead at the expenses of the others (Clark [10]). Its theme was "Money is not everything". Anticorruption messages were included into the curriculum in primary and secondary schools, and special teachers were trained for this purpose. Inter-school speech contests on moral values and management game competitions were organized. High school service group leaders were sent to training camps on "Business without Corruption". TV dramas and film strips condemning corruption were produced. People were injected with moral values and taught not to tolerate corruption.

In the economic literature on corruption, which is based on incentives and optimizing behavior, values and preferences are taken as given. Thus, the existing corruption literature cannot provide any rationale concerning the reasons why and under which circumstances values educational programs can work. On the other hand, cultural explanations of corruption usually ignore economic payoffs and are often nearly tautological. Higher corruption levels are explained as a result of social norms more favorable to corruption, without addressing the issue of how countries may have such different norms. The present paper combines the cultural with the economic explanation, and thereby fills the gap between the two different types of literature on corruption. This is done by embedding a model of corrupt behavior similar to Tirole [14] in a model of *endogenous* cultural transmission of values based on Bisin and Verdier [5]. Cultural values of corruption are transmitted via education from older agents to new agents; but the incentives of cultural parents to shape the attitudes of new agents towards corruption depend on economic factors and hence directly on the expected payoffs from corrupt acts. In our model, agents are perfectly rational even in the cultural transmission process. Our approach thus allows us to examine the effects of the typical policy measures of the economic literature (changes in payoffs, fines, the effects of increased monitoring) as well as educational anticorruption campaigns. Moreover, economic payoffs (and therefore also technologies and institutional features related to corruption) are shown to affect the pattern of values in society.

We postulate a simple overlapping generation model with a principal-agent relation, rational expectations and random matching. Corruption exists because of asymmetric information and costly monitoring. As in Tirole (1996) in each period every infinitely-lived principal has to assign a project to the agent with whom he is randomly matched. There are two types of projects: Project 1 is socially better than Project 2 if managed with honesty. The reverse is true if the agent behaves dishonestly. The projects can be interpreted as two different public investments, one more costly than the other and with a higher social return if managed correctly. Because more money is channelled through this project, it is more susceptible to corruption (selection of worse materials, manipulation of allocation mechanism such as auctions...). Agents can be of two types: *honest* “moral” agents who suffer some utility loss due to the feeling of guilt when engaging in corrupt activities and *potentially dishonest* agents who only care about monetary payoffs.

In any time period, new agents are born who will become active in the next period. New agents have no preferences but receive them via education. Each new agent is randomly matched to an active agent who becomes his cultural parent. Cultural parents care about the future of their “children” and want to maximize their children’s well-being. When deciding what value to transmit, parents evaluate their child's well-being as if it were their own.[2] Following Bisin and Verdier [5] the cultural parent chooses the "coefficient of cultural transmission", or the education effort i.e., the probability with which the parent's cultural trait is adopted by the child. If the child does not "learn" from the parent, he imitates either a randomly chosen member of the parent's generation or is educated by the state.

We depart from the two-period lived agent assumption in Bisin and Verdier [5] by assuming a Poisson (death and birth) process instead. Agents have a probability of survival equal to λ each period. Since expected life in this case is $1/(1-\lambda)$, a period in the model can be mapped into different real time periods by choosing the parameter λ appropriately and, therefore, a policy measure can have an effect in a short period in real time.

We show that for a certain range of parameters on the relative payoffs of corruption and the technology of corruption monitoring, the economy has two steady states in the absence of public education: a "good" equilibrium with low corruption, little output distortion and wide-spread anticorruption ethics and a "bad" equilibrium with high corruption, high output distortion and little anticorruption ethics. In the long run, corrupt behavior and the values sustaining this behavior are determined jointly. This joint determination generates multiple equilibria and thereby provides an explanation why economically similar countries with the same anticorruption laws might nevertheless end up with very distinct levels of corruption. While multiplicity is not a new result (e.g.Andvig and Moene [1], Cadot [6], Carrillo [7], Casagrande [8,9], Lui [12], Sah [13], Tirole [14]), the existing literature needs complicated nonlinear assumptions to generate this result and requires some form of heterogeneity among economic agents which is exogenous to the model. This is usually modelled as moral costs (cultural attitudes) existing in fixed proportions. In our model cultural attitudes evolve endogenously and no non-linearity assumption is needed. Moreover, in our model any stable steady state is interior since both type of agents choose positive transmission coefficients.

The endogenization of moral values allows us to study both the long run effects and the dynamics of policy measures. We first show that all the typical anticorruption policies proposed in standard economic models work also in the present context: higher wages and higher fines make corruption more costly and therefore reduce the proportion of pure money-maximizers in the good and bad equilibrium. A better monitoring technology also reduces the incentives for corrupt activities. Moreover, it is shown that a temporary increase on spending in monitoring might have permanent

[2] In this context parents cannot be modeled by making them act as a social planner and maximize their child's future payoff because this problem is not well defined: the child's payoff is only defined after parents have made decisions on what values to transmit.

effects and lead the economy from the high corruption steady state to the low corruption steady state. Finally, we discuss temporary public education campaigns. We show that they successfully reduce corruption if and only if they are intensive enough: this means that the public education effort needs to be high enough and the campaign long-lasting. If the campaign is interrupted too early or the public education effort is too low, corruption will return to its initial level. Simulations show that we can roughly match the dynamics of the Hong Kong experience by assuming that the expected length of working life is about 35 years.

The remainder of the paper is organized as follows. In section 2 we introduce the model and characterize the steady states. Policy implications are spelt out in section 3. Section 4 is dedicated to the discussion of public education campaigns. Section 5 concludes.

2. THE MODEL

We propose a principal-agent model similar to Tirole's [14]. We consider a random matching model where each agent can never meet the same principal twice. At each time t $(-\infty < t < \infty)$ every active agent is matched with a new principal. The principal gives the agent one of 2 projects: Project 1 yields a higher payoff to the principal than Project 2 if the agent is honest, but is more conducive to corrupt behavior. The payoffs to the principal are

$$H > h \geq d > D$$

where capital letters denote the payoffs to the principal if project 1 is given. H stands for honest and D for dishonest behavior by the agent.

Agents can be of two types: honest or potentially dishonest. The payoffs to an honest agent are as follows:

honest type		
	Project 1	Project 2
honest	B	b
dishonest	$\bar{B} - e$	$\bar{b} - e$

With $B, \bar{B}, b, \bar{b}, e > 0$, $B > b$, $\bar{B} > \bar{b}$ and

$$e > \bar{B} - B \geq \bar{b} - b \geq 0. \tag{1}$$

If (1) holds, honest agents always behave honestly. Observe that an honest agent suffers from being dishonest. He is endowed with a *moral attitude* which favours "honest" behaviour. On the contrary, potentially dishonest agents only care about monetary payoffs:

Potentially dishonest

	Project 1	Project 2
honest	B	b
dishonest	$\bar{B}$	$\bar{b}$

With these payoffs, a potentially dishonest type acting honestly is indistinguishable from an honest type. However, under (1) potentially dishonest agents are always dishonest. Hereafter, since we assume that (1) holds, we shall refer to potentially dishonest players as dishonest.

The model is a model of overlapping generations. A Poisson birth and death process is assumed, keeping the population size of active agents constant. With probability λ an active agent will be active next period.[3] With probability $(1-\lambda)$ an active agent in t has a child which at the moment of birth does not have any predetermined preferences and becomes active in $t+1$. The child is randomly matched to a cultural parent who shapes the child's preferences via education.[4] The crucial assumption is that the cultural parent cares about his child' welfare and tries to maximize the latter when deciding how much effort to put into his child's education.[5] Given that at the moment of education the new agent does not have any preferences, the parent evaluates his child's future utility through his own eyes. In other words he uses his payoff matrix as if it were his child's, as in Bisin and Verdier [5].[6] Casual empiricism seems to suggest that parents are prone to believe that what works fine for them should also work fine for their children.

The education process works as follows: The parent educates his naive child with some education effort τ. With probability equal to the educa-

[3]This is a major difference to Bisin and Verdier's model where each agent only lives two periods and is only economically active for one period. In their model one period is one generation. In our model the the life expectancy of an active agent is $\frac{1}{(1-\lambda)}$. Hence, in our model the length of one period depends on λ and will typically be shorter than one generation.

[4]Notice that the mathematical structure of the model and the results would be unchanged if we had real parents who educate their own children instead of cultural parents.

[5]This assumption requires some form of imperfect altruism on parts of the cultural parents. Becker [2,3,4] has forcefully supported perfect altruism by parents.

[6]This behavior might seem "paternalistic". "True altruism" would require parents to be able to abstract from their own viewpoint. Given that the child's preferences are not defined before cultural transmission takes place, the only possibility to model this true altruism is to assume that parents are able to make *interpersonal comparisons of utilities,* i.e. each parent would compare the future payoffs for his own type from his own viewpoint to the future payoff of the other type from the viewpoint of the other type and decide to transmit the trade which results in a higher utility. Obviously, the latter would require the use of *cardinal utilities*, which is a problematic concept. Therefore, we prefer the assumption that parents evaluate their child's utility as if it were their own. With this assumption two alternative model interpretations are possible: (i) parents care about their child's behaviour or (ii) parents care about the survival of their own preferences.

tion effort, education will be successful and the child will be like the parent. Otherwise, the child remains naive and gets randomly matched with somebody else whose preferences he will adopt. Consider an honest agent who becomes the cultural parent of a child at time t and chooses education effort τ^a and let p_t^{ij} be the probability that a child of parent i is of type j

$$p_t^{aa} = \tau_t^a + (1 - \tau_t^a) q_t \tag{2}$$

$$p_t^{ab} = (1 - \tau_t^a)(1 - q_t) \tag{3}$$

where q_t is the proportion of honest agents at time t. Similarly, for the dishonest parent we get

$$p_t^{bb} = \tau_t^b + (1 - \tau_t^b)(1 - q_t) \tag{4}$$

$$p_t^{ba} = (1 - \tau_t^b) q_t \tag{5}$$

where τ^b is the dishonest parents' education effort.

2.1. The education choice

Let $C(\tau)$ be the cost of the education effort τ, and assume that $C'(\tau) > 0$ *for all* $\tau \in (0, 1]$, $C(0) = C'(0) = 0$ and $C''(\tau) > 0$. We denote by V^{ij} is the utility a parent with preferences i attributes to his child having preferences j. V^{ij} depends on the policy expectations of the parent. In order to assess V^{ij} a parent of type i uses his own payoff matrix. This means that each parent attributes to his cultural child the utility the parent himself would have gotten in the position of the child. Since honest behavior is optimal for the honest type ($B > \bar{B} - e$ given project 1 and $b > \bar{b} - e$ given project 2) and dishonest behavior is optimal for the potentially dishonest type ($\bar{B} > B$ given project 1 and $\bar{b} > b$ given project 2), $V^{ii} > V^{ij}$ always.[7]

Given a policy expectation, a parent of type i chooses the education effort $\tau \in [0, 1]$ that maximizes

$$p_t^{ii} V_t^{ii} + p_t^{ij} V_t^{ij} - C(\tau_t) \tag{6}$$

where p^{ij} and p^{ii} are defined above. Maximizing (6) with respect to τ we get the following first order condition

$$C'(\tau^i) = \frac{dp^{ii}}{d\tau^i} V^{ii} + \frac{dp^{ij}}{d\tau^i} V^{ij} \tag{7}$$

[7] In section 2.2 we introduce an assumption, namely equation (12) , that guarantees that dishonest behavior for a potentially dishonest agent is also optimal if the principal awards project 1 to people with a clean reputation and project 2 to people that are known to be dishonest.

where we have suppressed the time indicators.

Substituting (2)-(5) in (7), we get the optimal education efforts τ^a and τ^b,

$$C'(\tau^a) = (V^{aa}-V^{ab})(1-q) \tag{8}$$

$$C'(\tau^b) = (V^{bb}-V^{ba})q \tag{9}$$

In order to have interior solutions $\tau \in (0,1)$ we need that $C'(0) = 0$ and that $C'(1) > \bar{B}/(1-\lambda)$, which is the upper bound to agents' payoffs. It follows from (8) and (9) that the optimal effort level is $\tau^i = \tau(q, V^{ii} - V^{ij})$ with

$$\frac{\partial \tau^a(q, V^{aa}-V^{ab})}{\partial q} = -\frac{V^{aa}-V^{ab}}{C''(\tau^a(q, V^{aa}-V^{ab}))} < 0 \quad \text{and}$$

$$\frac{\partial \tau^b(q, V^{bb}-V^{ba})}{\partial q} = \frac{V^{bb}-V^{ba}}{C''(\tau^b(q, V^{bb}-V^{ba}))} > 0.$$

Since $V^{ii} - V^{ij}$ depends on the parent's policy expectations, so does the optimal effort level $\tau^i(q, V^{ii} - V^{ij})$.

We can now characterize the dynamic behavior of q_t:

$$q_{t+1} = \lambda q_t + (1-\lambda)(q_t p_t^{aa} + (1-q_t)p_t^{ba})$$

substituting (2) and (5), we obtain

$$q_{t+1} = q_t + (1-\lambda)q_t(1-q_t)(\tau^a(q_t, V_t^{aa}-V_t^{ab}) - \tau^b(q_t, V_t^{bb}-V_t^{ba}))$$

which can be rewritten as

$$q_{t+1} - q_t = (1-\lambda)q_t(1-q_t)(\tau^a(q_t, V_t^{aa}-V_t^{ab}) - \tau^b(q_t, V_t^{bb}-V_t^{ba})) \tag{10}$$

Given the optimal policies of principals we are going to analyze in sections 2.2 and 2.3 it will be useful to know how (10) behaves under a stationary policy expectation, i.e. if $V_t^{aa} - V_t^{ab} = V^{aa} - V^{ab}$ and $V_t^{bb} - V_t^{ba} = V^{bb} - V^{ba}$ for all t. In this case, (10) has three rest points: *i)* $q = 0$, *ii)* $q = 1$ and *iii)* $q = q^*$,

$$q^* = \frac{V^{aa}-V^{ab}}{V^{bb}-V^{ba}+V^{aa}-V^{ab}} \tag{11}$$

with $\tau^a(q^*, V^{aa}-V^{ab}) = \tau^b(q^*, V^{bb}-V^{ba})$. From (8) and (9) it is easy to see that for given $V^{aa} - V^{ab}$ and $V^{bb} - V^{ba}$ vertical cultural transmission (parents) and oblique cultural transmission (society) are substitutes, namely parents have less incentive to educate their children the more frequent is their trait in the population. In fact with $C'(0) = 0$, honest (dishonest) parents put zero effort when $q = 1$ ($q = 0$). Under cultural substitution the interior rest point is globally stable while the other rest points are unstable (see Bisin and Verdier [5]).

2.2. The principals' choice

Each period a principal has to decide which project to delegate to the agent with whom he is matched. We assume that principals maximize their expected payoffs and that they know the proportion of honest agents in the population, but not the type of a particular agent. We assume that the principal can know with positive probability α whether the agent he is facing is dishonest.[8] An honest agent will never be revealed as dishonest. There is no information leakage across principals.[9] If one principal learns that an agent is dishonest it can still be the case that in the future the same agent is taken for an honest one.

Let σ^s be the *separating strategy* consisting of offering project 1 to seemingly honest agent and project 2 to agents who are found to be dishonest. Assuming that principals follow strategy σ^s, then potentially dishonest player will behave dishonestly if

$$B < (1-\alpha)\bar{B} + \alpha\bar{b},$$

which can be rewritten as

$$\alpha < \frac{\bar{B} - B}{\bar{B} - \bar{b}}. \tag{12}$$

Hereafter we will assume that (12) holds.

Let σ^p be the *pooling strategy* of offering project 2 to everyone. Principals prefer strategy σ^s to σ^p if

$$q_t(H-h) + (1-q_t)(1-\alpha)(D-d) > 0, \tag{13}$$

[8]Tirole [14] assumes that the principal has some imperfect information about each agent's past behaviour: with probability α he knows if the agent has been dishonest at least once in the past. Under this information structure corrupt newborns are indistinguishable from honest agents. With Tirole's story the qualitative results are the same, but the calculations are much more cumbersome. Notice that in Tirole the gain from being corrupt is higher in some cases, since cheating cannot be detected in the first period of a dishonest agent's life.

[9]Information leakage across principals does not affect the qualitative results of the paper.

which can be rewritten as

$$q_t > \frac{(1-\alpha)(d-D)}{(H-h)+(d-D)(1-\alpha)} = \tilde{q}(\alpha). \tag{14}$$

Let $\pi(\sigma, q)$ be the payoff obtained by a principal who chooses strategy σ when the proportion of honest agents is q, and let $\sigma(q_t)$ be the principals' optimal strategy at time t

$$\sigma(q_t) = \arg \max_{\sigma \in \{\sigma^s, \sigma^p\}} \pi(\sigma, q_t) \tag{15}$$

By (14)

$$\sigma(q_t) = \begin{cases} \sigma^s & if \quad q_t > \tilde{q}(\alpha) \\ \{\sigma^s, \sigma^p\} & if \quad q_t = \tilde{q}(\alpha) \\ \sigma^p & if \quad q_t < \tilde{q}(\alpha) \end{cases}$$

2.3. The steady states.

We now characterize the steady states of the economy. The education effort exerted by a parent in t depends on the expectation about the principals' policy in the future. A "policy" is an (infinite) sequence $\{\sigma_z\}_{z=t_1}^{\infty}$, with $\sigma_z \in \{\sigma^s, \sigma^p\}$, for all z. We will denote by $\{\sigma^i\}_{t_1}^{t_2}$, the sequence consisting of the repetition of σ^i from t_1 to t_2 $(t_1 < t_2 \leq \infty)$. Let $V^{ij}(k_t^e)$ be the expected utility a parent of type i attributes to his child born in t (and active in $t+1$) having preferences j when the expected policy is k_t^e and let $\tau^i(q_t, k_t^e) = \tau^i(q_t, V^{ii}(k_t^e) - V^{ij}(k_t^e))$ be the education effort of a parent of type i in t who expects a policy $k_t^e = \{\sigma_z\}_{z=t+1}^{\infty}$.

Lemma 2.1. *Assume $C'(\tau) > 0$ and that condition (12) holds. Then*
1.$\tau^a(q_t, \{\sigma^s\}_{t+1}^{\infty}) \gtreqless \tau^b(q_t, \{\sigma^s\}_{t+1}^{\infty})$, *when* $q_t \lesseqgtr \bar{q}$
2.$\tau^a(q_t, \{\sigma^p\}_{t+1}^{\infty}) \gtreqless \tau^b(q_t, \{\sigma^p\}_{t+1}^{\infty})$, *when* $q_t \lesseqgtr \underline{q}$
3.$\tau^a(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) \gtreqless \tau^b(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\})$, *when* $q_t \lesseqgtr \bar{q} - \lambda^{T-t-1}(\bar{q} - \underline{q})$,
4.$\tau^a(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) \gtreqless \tau^b(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\})$, *when* $q_t \lesseqgtr \underline{q} + \lambda^{T-t-1}(\bar{q} - \underline{q})$, *where*

$$\underline{q} = \frac{e - (\bar{b} - b)}{e} \quad and \ \bar{q} = \frac{e + \alpha(\bar{B} - \bar{b}) - (\bar{B} - B)}{e}. \tag{17}$$

Proof. From (8)-(9) we get that $\tau^a(q_t, k_t^e) > \tau^b(q_t, k_t^e)$ when

$$q_t < \frac{V^{aa}(k_t^e) - V^{ab}(k_t^e)}{V^{bb}(k_t^e) - V^{ba}(k_t^e) + V^{aa}(k_t^e) - V^{ab}(k_t^e)} \tag{18}$$

Computing the right hand side of (18) for the different expected policy profiles we get the values above. □

Observe that $\bar{q} > \underline{q}$ when

$$\alpha > \frac{(\bar{B} - B) - (\bar{b} - b)}{\bar{B} - \bar{b}} \tag{19}$$

Lemma 2.1 compares the education efforts exerted by the two types of parent for four different policy expectations, two of them stationary (cases 1 and 2) and two of them involving a policy change at a future date T (cases 3 and 4) but are stationary from period T onwards. Under stationary expectations, both $V^{aa}(k_t^e) - V^{ab}(k_t^e)$ and $V^{bb}(k_t^e) - V^{ba}(k_t^e)$ are constant.

Proposition 2.1. Assume $C'(\tau) > 0$ for all $\tau \in (0,1)$, $C(0) = 0, C'(0) = 0$, $q_0 \neq \{0, 1\}$, (12), (19) hold, principals follow $\sigma(q_t)$ and agents have rational expectations. Then

1. q_t converges to $\bar{q}$ if $\tilde{q} < \underline{q}$,

2.q_t converges to $\underline{q}$ if $\tilde{q} > \bar{q}$ and

3. when $\underline{q} < \tilde{q} < \bar{q}$, there always exist (stationary) expectations such that

(i)q_t converges to $\bar{q}$ if $q_0 > \tilde{q}$ and

(ii)q_t converges $\underline{q}$ if $q_0 < \tilde{q}$

where $\tilde{q}$ is the minimal proportion of honest agents that make the separating policy optimal for principals.

Proof. See Appendix.

We refer to $\bar{q}$ and $\underline{q}$ as the *low corruption* and the *high corruption* steady states, respectively.

We could have an indeterminacy when $\underline{q} < \tilde{q} < \bar{q}$. Assume for instance that $q_0 < \tilde{q}$ and all agents expect that at some future period there will be a switch in the policy with the principals following the separating strategy, namely $k_t^e = \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^\infty\}$. Such expectations will be fulfilled if at period T it is optimal for the principals to switch to the separating strategy, namely when $q_{T-1} < \tilde{q} < q_T$. Notice, from Lemma 2.1, that under those expectations, honest parents put higher education effort than dishonest parents whenever $q_t < \underline{q} + \lambda^{T-t-1}(\bar{q} - \underline{q})$.[10]

The multiplicity of steady states results from the interplay of collective and individual reputation and the incentives of cultural parents to educate their children. Notice that the optimal education effort of a type-i parent depends positively on the utility gain he attributes to his child being of type i rather than j $(V^{ii}(k_t^e) - V^{ij}(k_t^e))$ and negatively on the proportion of type-

[10] If agents had backward looking expectations, believing that the principals will follow today's strategy thereafter, namely $k_t^e = \{\sigma(q_t)\}_{t+1}^\infty$ proposition 2.1 also holds and, in case 3, q_t converges *always* to $\bar{q}$ if $q_0 > \tilde{q}$ and to $\underline{q}$ if $q_0 < \tilde{q}$.

i agents in the population (substitution effect). The economic environment the child will face in the future, in particular whether or not individual reputation will be taken into account, determines parents' expectations and their perceived utility gain: if principals ignore individual reputation and use the pooling policy, honest individuals suffer from the bad collective reputation and the gain for being honest rather than dishonest is relatively small, since everybody is given the bad project (Project 2). If principals use the separating policy, honest agents will always get the good project (Project 1) whereas dishonest agents will only get the good project with probability $1-\alpha$. In this case the reward for being honest rather than dishonest is relatively large and it is larger the better the monitoring technique (i.e. the higher α). Indeed, with a very efficient monitoring technique (a high α implies a low $\tilde{q}$) the only steady state is the low corruption equilibrium (case 1 in Proposition 2.1). For sufficiently low proportions of honest agents in the population ($q_t < \tilde{q}$), honest agents educate more than dishonest agents despite the pooling strategy being played because of the cultural substitution between the vertical transmission (parents) and oblique transmission (society). For $\tilde{q} < q_t < \overline{q}$ the education effort of honest agents is higher than that of dishonest agents, because honest children will get the good project for sure. For $\overline{q} < q_t$, dishonest agents educate more due to the cultural substitution effect mentioned above (there are few dishonest agents in the population).

On the other hand, with a too inefficient monitoring technique ($\overline{q} < \tilde{q}$) the low corruption steady state $\bar{q}$ can never be reached under rational expectations. Principals will ignore individual reputation most of the time and when they do not (i.e. $q_t > \tilde{q}$), the dishonest agents' education effort is larger than the effort of honest parents whose cultural child is likely to meet the right person should their education fail (substitution effect).

3. POLICY MEASURES.

Under rational expectations the steady state to which the system converges is determined by the relative positions of $\bar{q}$, $\underline{q}$ and $\tilde{q}$; in the case where $\underline{q} < \tilde{q} < \bar{q}$, the initial proportion of honest agents also plays a role. While the position of $\underline{q}$ only depends on the payoff matrices of the agents, $\bar{q}$ and $\tilde{q}$ also depend on the accuracy of the principals' information α. Hence, feasible policy measures will have to affect the remuneration to agents or the accuracy of principals' information or agents' expectations. We shall now discuss the advantages and disadvantages of these measures.

3.1. Improving principals' information

A possibility for controlling corruption is to invest in monitoring. An increase in the accuracy of principals' information α (and thereby in the probability of detecting fraudulent behavior) has the effect of increasing the proportion of honest agents in the low corruption equilibrium and of lowering $\tilde{q}$ (the minimum proportion of honest agents in the population that makes optimal the separating strategy). By shifting the critical value $\tilde{q}(\alpha)$ to a lower value, a higher α increases the basin of attraction of the low corruption equilibrium. The following argument shows that a temporary increase in spending on monitoring will be sufficient to escape the high corruption steady state.

We assume that the initial (so far exogenous) $\alpha = \alpha^*$ corresponds to the probability with which the principal can costlessly detect a dishonest type. Let α^* be such that

$$\bar{q}(\alpha^*)H + (1-\bar{q}(\alpha^*))(1-\alpha^*)D + (1-\bar{q}(\alpha^*))\alpha^* d > \underline{q}h + (1-\underline{q})d$$

where

$$\begin{aligned} \bar{q}(\alpha^*) &= \frac{e + \alpha^*(\bar{B} - \bar{b}) - (\bar{B} - B)}{e} \\ \underline{q} &= \frac{e - (\bar{b} - b)}{e} \end{aligned}$$

Hence principals receive a higher payoff in the low corruption steady state than in the high corruption steady state. Assume further that the accuracy of the monitoring technology can be improved at a cost $C_M(\alpha) > 0$ for all $\alpha > \alpha^*$.

Define the function $\underline{\alpha}$:[0,1]$\rightarrow R$

$$\underline{\alpha}(q) = 1 - \frac{q}{1-q}\frac{H-h}{d-D}$$

$\underline{\alpha}()$ is decreasing in q, $\underline{\alpha}(0) = 1$, $lim_{q\rightarrow 1}\underline{\alpha}(q) = -\infty$. Notice from (14) that $\tilde{q}(\underline{\alpha}(q)) = q$ for all q and that the separating strategy is optimal whenever $\alpha_t \geq \underline{\alpha}(q_t)$. If principals increase their accuracy of information above α^*, choosing $\alpha_t \geq \max\{\alpha^*, \alpha(q_t)\}$ at each time t, the separating strategy σ^s is optimal and seemingly honest people will get project 1. By lemma 2.1 the high corruption steady state will be destabilized if honest agents expect the principals to follow the separating strategy for ever, namely $k_t^e = \{\sigma^s\}_{t+1}^{\infty}$. Notice that the spending on monitoring can decrease as honesty grows. However, there is a trade-off between how long the extra expenditure takes place and how much extra is spent: The higher is α_t, the faster q_t will grow since, for a given q, the gain from being honest (dishonest) increases (decreases) with α, as do the education efforts exerted by the honest (dishonest) parents. More formally, let $\{\alpha'_s\}_{s=t}^{\infty}$ be the sequence which maximizes

$$\sum_{s=t}^{\infty} \delta^{s-t}(q_s H + (1-q_s)(1-\alpha_s)D + (1-q_s)\alpha_s d - C_M(\alpha_s))$$

$$\text{subject to } \alpha_s \geq \max\{\alpha^*, \alpha(q_s)\},$$

where δ is the discount factor, q_s evolve according to (10), and parents correctly anticipate the principals' policy. The principals will implement such a policy if the gains from moving to the low corruption steady state outweigh the costs, i.e. if

$$\sum_{s=t}^{\infty} \delta^{s-t}(q_s H + (1-q_s)(1-\alpha'_s)D + (1-q_s)\alpha'_s d - C_M(\alpha'_s)) \geq \frac{(\underline{q}h + (1-\underline{q})d)}{1-\delta},$$

If this equation is satisfied principals will implement the temporary investment in spending. The policy measure is perfectly credible if agents can observe how much principals spent on monitoring, since at each time t principals behave optimally given the accuracy of their information α_t. In practice it is easy to make spending on monitoring observable.[11]

As in more standard corruption models, improving the principals' information also leads to better outcomes in our model. Instead of investing in monitoring, principals could change their organizational structure and allow for information flows among principals (e.g., by computerizing their information). This reduces the probability that past corrupt behavior goes unnoticed and therefore reduces the expected payoffs to corrupt agents who are very likely to loose project 1 forever. At the same time, since it is less likely that the good project is given to a corrupt person, principals require a lower proportion of honest agents in order to be willing to apply the separating policy.

3.2. Changing the agents' remunerations

Changing the remuneration to the agents will affect equilibrium values directly. From (2.1) it is easy to see that an increase in the payoff when agents behave honestly in project 1 (B) and in project 2 (b) increases the equilibrium proportion of honest players in the low and in the high corruption equilibria, respectively ($\partial\bar{q}/\partial B > 0$ and $\partial\underline{q}/\partial b > 0$). The same is true for a decrease of $\bar{B}$ and $\bar{b}$ ($\partial\bar{q}/\partial\bar{B} < 0$ and $\partial\underline{q}/\partial\bar{b} < 0$). These

[11] By a similar argument, principals could incur a cost by simply choosing the good project in a bad environment ($q_t < \tilde{q}$) to stimulate education efforts of honest parents. In other words, principals would have to apply the separating policy σ^s despite its being sub-optimal in the short run. For this policy to be effective agents would have to believe that principals are willing to ignore their cut-off value over several periods.

results coincide with more standard corruption models where higher wages and higher fines lead to less corruption.[12] Notice, that even though the equilibrium level of corruption changes, the high corruption equilibrium will only be destabilized if the new remunerations to agents when awarded project 2 increase $\underline{q}$ above $\tilde{q}$. In this case Proposition 2.1 part 1 applies: the only attractor is the low corruption steady state $\bar{q}$.

3.3. Coordinating agents' expectations

All policy measures discussed so far have affected the organizational and economic setup. This in turn affected agents' expectations and thereby led to a change in the distribution of moral values. We now consider an alternative policy measure that affects agents' expectations directly: Principals announce a time consistent policy change in the future. This measure exploits the indeterminacy mentioned in section 2.3 and nicely illustrates the driving dynamics in our model.[13]

Assume that the economy is in the high corruption steady state; everyone is getting project 2. In the high corruption steady state no principal has an incentive to give project 1 to anyone. Assume now, that at t principals commit to the policy profile $\{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^\infty\}$; namely, they will offer project 2 to everyone (pooling strategy) until time $T-1$, and from T onwards project 1 will be offered, but only to seemingly honest agents (separating strategy). This policy will be credible if $q_{T-1} \leq \tilde{q} \leq q_T$

The policy announcement raises the value of being honest more than it increases the value of being dishonest, hence the proportion of honest agents grows. The announcement is time consistent, since the proportion of honest players in the population is such that, at the moment of the change, (14) is satisfied and $\{\sigma^s\}_t^\infty$ is the optimal policy sequence from then onwards. Observe that by proposition 2.1, the system converges to the low corruption steady state. Notice that the policy announcement works as a way of coordinating agents' expectations.

Figure 1 shows an illustration of the working of the policy announcement.

The economy is initially in the high corruption equilibrium. The continuous line is the value of $\tilde{q}$. The announcement of the policy change in $T = 15$ increases the honest parents' effort today and q starts growing. Between the moment of the announcement and $t = 14$, the principals follow the pooling strategy (white squares). At $T = 15$ the economy is, for the first time, in the region where the separating strategy is optimal since $\tilde{q}$

[12]In this paper we did not explicitly model fines for corrupt activities. However, we can interpret $\bar{B}$ and $\bar{b}$ as expected payoffs from corrupt activities, taking into account the possibility to be fined. With this interpretation, $\bar{B}$ and $\bar{b}$ decrease if fines increase.

[13]We do not consider this measure as particularly policy relevant since it involves a coordination problem among principals. In order for this scenario to apply principals would have to move as one Stackelberg leader.

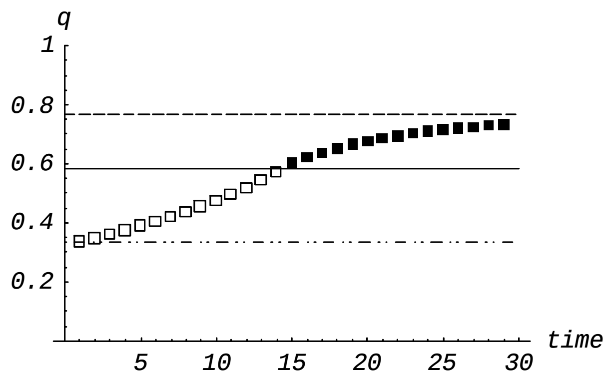

FIG. 1. Coordinating agents' expectations.

has been crossed. From then on it is optimal to start offering project 1 to agents with clean records (bold squares) and the economy converges to the low corruption equilibrium.

4. PUBLIC EDUCATION CAMPAIGN

In the above model, moral education is a purely private issue. We shall now analyze the effectiveness of education campaigns in which the existing public education systems are used to emphasize moral values.

In most countries public education does not begin immediately when a child is born. Usually, children are exposed to the influence of their parents before undergoing public education. To respect this common education structure, we assume that only children who remain naive (i.e. who do not learn their preferences from their parents) can be influenced by public education. An education campaign will be modeled as society (or principals) investing in public moral education by choosing a public effort level ρ to teach honest behavior 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. The new timing of moral education is as follows: As before, the education effort of the parents τ determines the probability with which children adopt the same preferences as their parents. With the complementary probability $(1-\tau)$ children remain naive, in which case the public education effort ρ determines the probability with which children become honest. With probability $(1-\rho)$ public education fails, and children adopt the preferences of a random member of society.

Public education affects the probabilities of honest and dishonest children as follows[14]:

$$
\begin{aligned}
p_t^{aa} &= \tau_t^a + (1-\tau_t^a)(q_t(1-\rho)+\rho) \\
p_t^{ab} &= (1-\tau_t^a)(1-q_t)(1-\rho) \\
p_t^{bb} &= \tau_t^b + (1-\tau_t^b)(1-q_t)(1-\rho) \\
p_t^{ba} &= (1-\tau_t^b)(q_t(1-\rho)+\rho)
\end{aligned}
$$

The first order conditions that determine the private education efforts are now:

$$C'(\tau^a) = [V^{aa} - V^{ab}](1-q)(1-\rho) \tag{20}$$

$$C'(\tau^b) = [V^{bb} - V^{ba}](q(1-\rho)+\rho) \tag{21}$$

The new population dynamics are given by the following difference equation for q_t:

$$
\begin{aligned}
\Delta q \;=\; & (1-\lambda)(1-q)q(1-\rho)(\tau^a(q, V^{aa} - V^{ab}, \rho) - \tau^b(q, V^{bb} - V^{ba}, \rho)) + \\
& (1-\lambda)(1-q)\rho(1-\tau^b(q, V^{bb} - V^{ba}, \rho))
\end{aligned} \tag{21}
$$

This difference equation shows that (i) $q = 1$ is always a rest point of the system, (ii) $q = 0$ is only a rest point if there is no public education ($\rho = 0$), (iii) if an interior solution exists, the education effort of dishonest parents is higher than of honest parents ($\tau^a < \tau^b$). The introduction of public education has two opposite effects: while its direct effect is to increase the proportion of honest agents, its indirect effect is to change the incentives for private education. Honest parents educate less because public education increases the chances of their children getting the right preferences anyway, while dishonest parents educate more. Notice, that if $\rho = 1$ the system converges to $q = 1$ although honest parents do not educate their children at all. Hence, for $\rho = 1$, $\Delta q > 0$ for all $q < 1$. By continuity, there exists a $\bar{\rho}$ such that for $\rho > \bar{\rho}$ $\Delta q > 0$ for all $q < 1$. Indeed, it is easy to see that for $\rho > \tau^b(1, \max V^{bb} - V^{ba}, \rho)$ $q = 1$ is the only attractor.[15]

The above analysis establishes the success of a temporary intensive education campaign with a high enough ρ. Suppose society is in the high corruption steady state and $\tilde{q} < \bar{q}$. The government launches an intensive education campaign with $\rho > \tau^b(\tilde{q}, \max V^{bb} - V^{ba}, \rho)$. The campaign affects

[14] $\rho = 0$ is identical to the case without public education

[15] This is not the cut-off value. A complete analysis of the model becomes very messy and is beyond the scope of the paper. We are only interested in finding some temporary education campaign which is successful.

the population dynamics and the proportion of honest agents increases. The education campaign can be stopped once $q_t > \tilde{q}$; by Proposition 2.1 the system converges to the low corruption steady state $\bar{q}$ if agents expect that the separating strategy will be used from then on.

As in the case of a temporary increase in spending on monitoring, there is a trade-off between how long the education campaign has to be implemented and how much money per period is spent on public moral education. The higher the expenditure on public education in period t (i.e. the higher ρ_t), the faster q_t will grow for a given q. Let the sequence $\{\rho'_s\}_{s=t+1}^{\infty}$ maximize

$$\begin{aligned} & \sum_{s=t}^{\infty} \delta^{s-t}(\pi(\sigma(q_s), q_s) - C_E(\rho_s)) \\ s.t \quad \Delta q_s \;=\; & (1-\lambda)(1-q_s)q_s(1-\rho_s)(\tau^a(q_s, V^{aa}-V^{ab}, \rho_s) - \tau^b(q_s, V^{bb}-V^{ba}, \rho_s)) + \\ & (1-\lambda)(1-q_s)\rho_s(1-\tau^b(q_s, V^{bb}-V^{ba}, \rho_s)) \end{aligned}$$

Principals will choose the public education levels $\{\rho'_s\}_{s=t+1}^{\infty}$ if

$$\sum_{s=t}^{\infty} \delta^{s-t}(\pi(\sigma(q_s), q_s) - C_E(\rho'_s)) \geq \frac{(\underline{q}h + (1-\underline{q})d)}{1-\delta}.$$

Education campaigns work only if the investment in public education is high enough during the period of the campaign and the campaign lasts long enough. Both conditions seem to have been satisfied in the case of Hong Kong. The education effort of the Independent Commission against Corruption (ICAC) had been very high and the project lasted a substantial period of time (12 years). The following simulations show that our model can roughly match the timing of this experience.

Let us consider an average working life of, say, 35 years. The choice for the value of the parameter λ delivers an interpretation of a period in the model as a period in real time. Since average working life is $\frac{1}{1-\lambda}$ (when the probability of dying is $1-\lambda$), if a period in the model is to be interpreted as one (or twelve) year(s), we should choose $\lambda = 0.97$ (or $\lambda = \frac{2}{3}$).

To choose a value for λ, we can consider the following two interpretations on how education works. One is, literally, that what matters for agents' education is the whole time they spent in school. In this case, since our agents are educated in one period, we should interpret a period in the model as 12 years (one fourth of the whole life span) and choose $\lambda = \frac{2}{3}$. A second interpretation is that of "cultural parents" (used in this paper) where children get randomly match to an adult who influences their education. Under this interpretation what matters for the attitudes towards corruption is the last year before the economically active life and we could then interpret one period in the model as one year and take $\lambda = 0.97$.

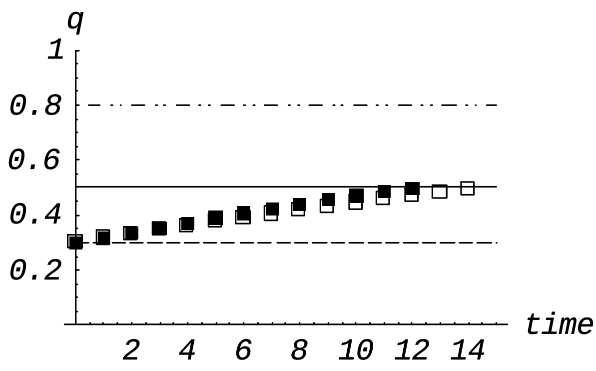

FIG. 2. Public education campaign with rational expectations.

Under the first interpretation any policy takes at least one generation to have any effect at all. The second interpretation allows for a quicker incorporation of new agents and a policy can have an effect after a shorter period of time.

Figure 2 shows the population dynamics for $\lambda = 0.97$. For the simulations the high corruption steady state is $\underline{q} = 0.3$, the low corruption steady state is $\overline{q} = 0.8$ and the minimum proportion of honest types necessary for the separating policy to be optimal is $\widetilde{q} = 0.5$. The values of $\overline{q}$ and $\underline{q}$ are chosen to match the evidence reported in the introduction, taking the responses in 1986 as a proxy of the low corruption steady state and those of 1977 as a proxy for the high corruption steady state. Recall that once $q_t > \widetilde{q}$, public education can be stopped and the system will converge to the low corruption steady state without any further need of intervention. We choose the public education effort as $\rho = 0.95$. We consider two different scenarios. In scenario 1 (which is depicted by the white squares) in Figure 2 all adults can become the cultural parent to a child while in scenario 2 (which is depicted by the bold squares) only the young (those born the previous period) can have cultural children. Though the population dynamics of the latter case is faster since the proportion of honest agents among the young is higher than the population average, the rest points of this dynamics are identical to our original dynamics. Table 1 reports the proportion of agents born under the campaign who are currently alive, the proportion of honest agents among them, and the proportion of honest agents in the whole population under both scenarios. Notice that out of the agents who have been subject to the campaign, more than 80% are honest (under both scenarios) whereas only 30% of those born before the campaign are honest. With $\lambda = 0.97$ the campaign can be stopped after 14 years (every year only

t		Scenario 1[1]		Scenario 2[2]	
	Column 2[3]	Column 3[4]	Column 4[5]	Column 5[6]	Column 6[7]
1	0.03	0.807	0.315	0.816	0.315
2	0.059	0.811	0.330	0.873	0.334
3	0.087	0.816	0.345	0.901	0.352
-	-	-	-	-	-
12	0.306	0.854	0.470	0.952	0.500
13	0.327	0.859	0.483	0.953	0.515
14	0.347	0.863	0.496		
15	0.367	0.867	0.508		

[1]Everybody can have (cultural) children.[2]Only the young can have (cultural) children [3]Agents born under the campaign who are alive. [4]Proportion of honest agents who are born under the campaign and are alive under scenario 1. [5]Honest agents at time t (under scenario 1)[6]Proportion of honest agents who are born under the campaign and are alive under scenario 2. [7]Honest agents at time t (under scenario 2)

the 0.03% of the workforce is renewed!) under scenario 1 and after 11 years under scenario 2 (when only the young educate). By that time the proportion of honest agents is high enough to guarantee convergence to the low corruption steady state without any further need for interventions. When we consider $\lambda = 2/3$, only one period of education (12 years) is needed in both cases.

Convergence could be speeded up by combing different policy tools. This was indeed done in Hong Kong; at least in early years, ICAC combined two policy measures discussed in our model: re-education and a change in remunerations to agents to reduce the profitability of corruption. In words of one commissioner of the ICAC: "With the adult population, we often use the deterrent approach, that is to say, we exploit their fear of punishment. However, in the long term, children and young people must be brought up with the proper attitudes toward corruption."[16]

Under a temporary increase on spending in monitoring principals will always apply the separating strategy; on the contrary, under a public education campaign principals will ignore individual reputation for some period, using the pooling strategy. Therefore, the payoffs from being honest increase less rapidly under public education. Hence, honest agents educate less if public education exists than if monitoring is increased. On the other hand, public education guarantees a certain proportion of honest types. Consequently, it is not clear under which policy measure the proportion

[16]Williams, "Concept of an Independent Organization to tackle Corruption," p. 29. Paper presented at the International Conference on Corruption and Economic Crime against Government, Washington, D.C., October 1983.

of honest people increases more rapidly. Which policy measure is socially optimal is very sensitive to the actual specification of monitoring and education costs. These costs are country-specific and hence an empirical issue which is beyond the scope of this paper.

5. CONCLUSION

There is evidence that corruption is at least partly due to cultural elements. Public opinion does not universally consider corruption - at least small-scale corruption - to be very negative. Sentences like "I was corrupt but so was everybody else" reveal that a generally corrupt environment can serve as a justification for one's own corrupt behavior.

The present paper combines two distinct types of economic models (Tirole [14], Bisin and Verdier [5]) to capture some cultural aspects of corruption and to develop new policy tools. In our model remunerations were chosen such that an agent is either always honest or always corrupt. Analyzing this extreme case allows us to single out the purely educational effects on corruption levels. In order to do so, it was assumed that newborn agents had to form their preferences and were influenced by the education effort exerted by their parent, as well as by the general corruption level of society. The resulting dynamics had the realistic feature that the lower the proportion of a given type the higher its education effort. This feature keeps the steady state off the boundary and avoids a complete elimination of corrupt (or honest) agents. Unlike in Tirole [14] the interiority of the steady states is a result and not an assumption of the model.

Taking the model seriously implies that corruption will never be eliminated completely, a view which is also expressed by Klitgaard [11]. Indeed, there is no country without corruption, although corruption levels vary widely across countries even with similar economic characteristics. The present model found two steady states with different levels of corruption in an otherwise identical economy. This shows the strength of cultural elements in determining the actual corruption levels of a society.

While our steady states are similar to Tirole's [14], the underlying dynamics and therefore also policy implications are very different. In Tirole [14] there is an important asymmetry between the 2 steady states: It is much easier to leave the low corruption steady state than the high corruption steady state. This asymmetry is a direct consequence of Tirole's assumption on principals' information structure, which is such that an opportunistic agent (who in his model is the only agent reacting to economic incentives) will always be corrupt once corrupted.[17] In his policy analysis

[17] Although we do not use this information structure, its use in our model would not produce this asymmetry between the 2 steady states.

Tirole [14] focuses on a one-period shock to corruption, in which all opportunists behave dishonestly. In this case the only effective policy measure[18] is an amnesty, where principals commit to overlook past corrupt activities (individual reputation). This allows opportunistic agents who have been corrupt in the past to switch to honest behavior. In Tirole's [14] model an amnesty only works outside steady states. In our model an amnesty never works. Instead, principals can leave the high corruption steady state by announcing a time consistent future policy change which does not require them to ignore the information they have about individuals. The better world promised for their children changes parents' education effort, which induces an increase in the proportion of moral agents, which makes the announced policy change optimal. Additionally, we show that the high corruption steady state can be destabilized by a temporary increase in spending on monitoring. This policy measure also works by changing the economic prospective of children and thereby the education effort of parents. Finally, we outline the conditions under which a public education campaign can successfully reduce corruption, a policy that is widely used but never has been evaluated in an economic model before. We find that public education campaigns have to be intensive enough in order to successfully reduce the level of corruption.

Controlling corruption imposes a cost on society, since individual behavior must be monitored. If monitoring is common and the technique is reliable, corruption is deterred. This is also true for high fines. Both the present model and more standard models in the corruption literature share this desirable feature. The advantage of the present approach is that it entails additional policy implications that can be cost-saving in the long run. High fines work only as long as they are implemented. If, however, young generations are educated to adopt a moral attitude against corruption, high fines or monitoring can be reduced while low corruption levels are preserved. Educating the young is a key element in reducing corruption successfully.

Appendix

Proof of Proposition 2.1.

Case 1: $\tilde{q} < \underline{q}$

1.a) Consider the expected policy profile $\{\sigma^s\}_{t+1}^{\infty}$.

By lemma 2.1, $\tau^a(q_t, \{\sigma^s\}_{t+1}^{\infty}) \gtreqless \tau^b(q_t, \{\sigma^s\}_{t+1}^{\infty})$ for all $q_t \lesseqgtr \bar{q}$.

[18] Tirole [14] also talks about the possibility of prolonged anticorruption campaigns defined as periods in which the probability of being caught and the resulting penalties are high enough so that being corrupt is a dominated strategy of opportunists. However, this policy measure requires a change in the information structure of principals: it is not consistent with the assumption that a corrupt opportunist will always be corrupt.

$$V_t^{aa}(\{\sigma^s\}_{t+1}^{\infty}) - V_t^{ab}(\{\sigma^s\}_{t+1}^{\infty}) = \frac{e\bar{q}}{1-\lambda} > 0 \tag{23}$$

$$V_t^{bb}(\{\sigma^s\}_{t+1}^{\infty}) - V_t^{ba}(\{\sigma^s\}_{t+1}^{\infty}) = \frac{e(1-\bar{q})}{1-\lambda} > 0 \tag{24}$$

Given $\{\sigma^s\}_{t+1}^{\infty}$, $\bar{q}$ is globally stable. For all $q > \tilde{q}$, $\sigma(q) = \sigma^s$ and $\sigma(q_{t+1})_{t\geq 0} = \{\sigma^s\}_{t+1}^{\infty}$ if $q_t > \tilde{q}$.

1.b) Consider the expected policy profile $\{\sigma^p\}_{t+1}^{\infty}$.

By lemma 2.1, $\tau^a(q_t, \{\sigma^p\}_{t+1}^{\infty}) \gtreqless \tau^b(q_t, \{\sigma^p\}_{t+1}^{\infty})$ for all $q_t \lesseqgtr \underline{q}$.

$$V^{aa}(\{\sigma^p\}_{t+1}^{\infty}\}) - V^{ab}(\{\sigma^p\}_{t+1}^{\infty}\}) = \frac{e\underline{q}}{1-\lambda} > 0 \tag{25}$$

$$V^{bb}(\{\sigma^p\}_{t+1}^{\infty}\}) - V^{ba}(\{\sigma^p\}_{t+1}^{\infty}\}) = \frac{e(1-\underline{q})}{1-\lambda} > 0 \tag{26}$$

Given $\{\sigma^p\}_{t+1}^{\infty}$, $\underline{q}$ is globally stable. We can find a $t > 0$ such that q_t is arbitrarily close to $\underline{q}$.

1.c) Assume now that $q_t < \tilde{q} < \underline{q}$ and consider the expected policy profile $\{\{\sigma^p\}_{t+1}^{\mathrm{T}-1}, \{\sigma^s\}_{\mathrm{T}}^{\infty}\}$

$$\begin{aligned} V_t^{aa}(\{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) - V_t^{ab}(\{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) \ &= \quad (26) \\ \frac{e((1-\lambda^{\mathrm{T}-t-1})\underline{q} + \lambda^{\mathrm{T}-t-1}\bar{q})}{1-\lambda} \ &> \ 0, \quad (27) \end{aligned}$$

$$\begin{aligned} V_t^{bb}(\{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) - V_t^{ba}(\{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) \ &= \quad (28) \\ \frac{e((1-\lambda^{\mathrm{T}-t-1})(1-\underline{q}) + \lambda^{\mathrm{T}-t-1}(1-\bar{q}))}{1-\lambda} \ &> \ 0, \quad (29) \end{aligned}$$

Observe that (28) is decreasing and (30) is increasing in T. This implies that

$$\tau^a(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) - \tau^b(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\})$$

is decreasing in T for all q. For the same initial condition $q_0 < \underline{q}$, q_t is larger the smaller is T for all $t > 0$ and q_T is larger the larger is T. Notice that

$$\begin{aligned} \tau^a(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) - \tau^b(q_t, \{\{\sigma^p\}_{t+1}^{T-1}, \{\sigma^s\}_T^{\infty}\}) \ &> \ \tau^a(q_t, \{\sigma^p\}_{t+1}^{\infty}) > \\ &\quad \tau^b(q_t, \{\sigma^p\}_{t+1}^{\infty}) \end{aligned}$$

for all T. There exist a finite $\hat{\mathrm{T}}$ such $q_{\hat{T}-1} \leq \tilde{q}$, and $F(q_{\hat{T}-1}) \geq \tilde{q}$, since under $\{\sigma^p\}_{t+1}^{\infty}$, $\tilde{q}$ is reached in finite time.

From 1.a) and 1.c) we conclude that $\{\{\sigma^p\}_{t+1}^{\hat{T}-1}, \{\sigma^s\}_{\hat{T}}^{\infty}\} = \sigma(q_{t+1})_{t\geq 0}$, and q_t converges to $\bar{q}$.

Case 2: $\tilde{q} > \bar{q}$

2.a) If $q_t < \tilde{q}$, $\{\sigma^p\}_{t+1}^{\infty} = \sigma(q_{t+1})_{t\geq 0}$ and q_t converges to $\underline{q}$. (see part b) above).

2.b) $q_t > \tilde{q}$. Consider the policy $\{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}$,

$$V_t^{aa}(\{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) - V_t^{ab}(\{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) = \tag{30}$$

$$\frac{e((1-\lambda^{\mathrm{T}-t-1})\bar{q} + \lambda^{\mathrm{T}-t-1}\underline{q})}{1-\lambda} > 0, \tag{31}$$

$$V_t^{bb}((\{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\})) - V_t^{ba}((\{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\})) = \tag{32}$$

$$\frac{e((1-\lambda^{\mathrm{T}-t-1})(1-\bar{q}) + \lambda^{\mathrm{T}-t-1}(1-\underline{q}))}{1-\lambda} > 0, \tag{33}$$

(32) is increasing and (34) is decreasing in T. This implies that

$$\tau^a(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) - \tau^b(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\})$$

is increasing in T for all q. For the same initial condition $q_t > \bar{q}$, q_t is smaller the smaller is T for all $t > 0$ and q_T is smaller the larger is T. Notice that

$$\tau^a(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) - \tau^b(q_t, \{\{\sigma^s\}_{t+1}^{T-1}, \{\sigma^p\}_T^{\infty}\}) < \tau^a(q_t, \{\sigma^s\}_{t+1}^{\infty}) - \tau^b(q_t, \{\sigma^s\}_{t+1}^{\infty})$$

for all T. There exist a finite $\hat{\mathrm{T}}$ such $q_{\hat{T}-1} \geq \tilde{q}$, and $F(q_{\hat{T}-1}) \leq \tilde{q}$, since under $\{\sigma^s\}_{t+1}^{\infty}$, $\tilde{q}$ is reached in finite time.

From 2.a) and 2.b) we conclude that $\{\{\sigma^s\}_{t+1}^{\hat{T}-1}, \{\sigma^p\}_{\hat{T}}^{\infty}\} = \sigma(q_{t+1})_{t\geq 0}$, and q_t converges to $\underline{q}$.

Case 3: $\underline{q} < \tilde{q} < \bar{q}$.

3.a) When $q_t < \tilde{q}$, $\{\sigma^p\}_{t+1}^{\infty} = \sigma(q_{t+1})_{t\geq 0}$ and q_t converges to $\underline{q}$.

3.b) When $q_t > \tilde{q}$, $\{\sigma^s\}_{t+1}^{\infty} = \sigma(q_{t+1})_{t\geq 0}$ and q_t converges to $\bar{q}$.

□

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