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Do "Clean Hands" Ensure Healthy Growth? Theory and Practice in the Battle Against Corruption

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Abstract

This paper analyzes the existing relation between corruption and economic growth and examines the possible outcome of a reform implemented by the State to weed out or reduce corruption. It will be stressed that the reform against corruption tends, if not deemed by the operators to last in time, to curb most productive investments and therefore involves a time in which less corruption is paradoxically associated with less economic growth. This model is supported by econometric analysis of the Italian case. Italy has arguably been plagued by corruption. In the late 80s and early 90s several scandals that erupted quickly led to well-known inquiries (under the name of Clean Hands) and were followed (temporarily) by the an increased monitoring to prevent such practices. A dynamic panel data approach to economic growth based on data of 20 Italian regions allows to estimate a non-linear effect of corruption on economic growth.

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1 Introduction

Most economic researchers now attach great importance to corruption because of its significant negative impact on the economic conditions of a country, as shown by data. As stated by Mauro (1998):

"A country that improves its standing on the corruption index, say, 6 to 8, (0 being the most corrupt, 10 the least) will experience a 4 percentage point increase in its investment rate and a 0.5 percentage point increase in its annual GDP growth rate".

Less importance was attached to the fact that not only the level, but also the volatility of corruption may be detrimental to the well-being of a society. As stated by Campos, Lien, and Pradhan (1999), in fact:

"it is not only the level of corruption that affects investment but also the nature of corruption. Corruption regimes that are more predictable – in the sense that those seeking favours from the government do obtain those favours – have less negative impact on investments than those that are less predictable". pp. 1059

This statement has obvious implications for policies meant to eradicate corruption: a reform perceived as temporary, uncertain or not credible might actually do more harm to the economy than its absence.

This paper attempts to find theoretical consistency between these phenomena, by analyzing the existing relation between corruption and economic growth and the possible outcome of a reform implemented by the State to weed out or reduce corruption.

The modern analysis of corruption (starting from the works of Rose-Ackerman of 1975 and 1978) places such phenomenon within a principal-agent scheme. In fact, the existence of corruption is subject to an agency relationship between an individual in charge of making decisions (the agent) and the owner of the interests (principal) he represents. A third party (in our model the entrepreneur) should then be involved to influence the agent's discretional decisions to his own benefit, upon the payment of a bribe. Following the assumptions of most recent works (e.g. Shleifer and Vishny, 1993), the agency relationship between the bureaucrat (agent) and the Government (principal) will not be analyzed, but focus will only be made on the possible relation between the bureaucrat and the entrepreneur (third party) in order to better highlight the mechanisms through which such relations develop, as well as the effects of such behaviours on the economy.

In section 2, the relation between the monitoring level of bureaucrats by the State, corruption, and economic growth is reviewed. A non-linear relation is observed between monitoring level and economic growth, as well as between corruption level and economic growth. At low monitoring levels, the economy experiences widespread corruption and medium growth rates, at higher monitoring levels – say intermediate – no corruption occurs, but low growth rates are recorded, whereas at high monitoring levels no corruption occurs and high growth rates are recorded.

Based on such non-linear relation, the possible outcome, in terms of viable growth, of a reform implemented by the State to weed out corruption is reviewed in section 3. As noted, a reform aimed at weeding out corruption, but not deemed by the agents to last in time, curbs most productive investments, and therefore involves a time in which less corruption is associated to less productive investments, and therefore to less economic growth.

Some of the implications resulting from the theoretical model are tested in section 4 for the Italian case in the 1971-1996 period. Italy although not isolated is, among Western democracies, one which has known one the highest levels of corruption and has experimented the severity of its political repercussions.[1] In fact, as stated by Della Porta and Vannucci (1999):

> *"the Italian case may be seen as a sort of 'magnifying glass' used to review the mechanisms of hidden exchange, as well as the ability of the civil society and of the political and institutional system to react to corruption. The 'Tangentopoli' matters provided a ground for a clash between the legal power and the political class, as well as a unique opportunity to reform the very rules of the political game*". pp 12

The results confirm the thrust of the message of the theoretical model. Section 5 concludes.

2 Theoretical model

Let us consider an economy producing a single homogeneous good. There are two distinct categories of individuals in such economy. First bureaucrats, who cannot invest in the production activity, and second the entrepreneurs, who may invest their total capital in the modern sector or in the traditional one. There is a continuum of bureaucrats and entrepreneurs and their number is normalized to 1 for both the categories. A third agent is the State who

[1]Within the European Union, Italy ranks last before Greece in *Transparency International*'s 2003 classification of countries' "low perception of corruption" index. It is preceded also by the USA, Australia, Canada, Japan, and its overall rank is 33^{rd}.

controls entrepreneurs and bureaucrats behaviour in order to weed out or reduce corruption. Economic agents are risk-neutral.

Firms manufacture a homogeneous product Y using either of two technologies with constant return to scale: the modern sector's technology and the traditional sector's technology. Each entrepreneur is assumed below to have the same quantity of capital k. The product may be either manufactured for consumption purposes C or for investment purposes $\dot{k}$.

The bureaucrats issue, to the entrepreneur submitting a project, the licence required to access the modern sector's technology. The bureaucrats receive a salary $W = R$. It is assumed that no arbitrage is possible between the public and the private sector and that therefore there is no possibility for the bureaucrats to become entrepreneurs, even if their salary W were lower than the entrepreneur's net return[2]. The bureaucrats, if indifferent to whether to ask or not ask for a bribe, will prefer to be honest.

The modern sector's technology is:

$$Y = a_M k$$

whit

$$a_M > 1$$

Thus the technology of the modern sector works with constant return to capital, equal to a_M. The entrepreneurs in the modern sector need to obtain a licence from the government to access the technology. In order to obtain such licence, they need to submit a project to the Public Administration. With no corruption in place, such project ensures that the licence is obtained, but this involves an implementation cost of sk. [3]

The profit resulting from the investment in the modern sector referred to as Π_M:

$$\Pi_M = a_M k - sk$$

The entrepreneur may access the traditional sector without any licence being issued by the Public Administration. In this case the output is:

$$Y = a_T k$$

[2]This happens because L_b individuals in the population have no capital, but only a job, and therefore may not become entrepreneurs, but should be satisfied with working as bureaucrats and receiving a salary W.

[3]The cost for project submission to the Public Administration is a function of the investment. The underlying assumption is that, as the size of the investment grows, the costs for the entrepreneur's bureaucratic practices also grow.

$$1 < a_T < a_M$$

Thus the return from the investment in the traditional sector is:

$$\Pi_T = a_T k$$

From here on, it will be assumed that $(a_M - s) > a_T$ and therefore that the modern sector is more profitable than the traditional sector.

The bureaucrat receives an income W from his job:

$$\Pi_B = W$$

In this model, the bureaucrat may decide to only issue a licence in exchange for a bribe. The entrepreneur will assess the expected return in both sectors and will choose to invest in the sector that provides a higher return *ex ante*. Since, with no corruption in place, $\Pi_M > \Pi_T$, the entrepreneur may find it convenient to offer a bribe to the corrupted bureaucrat in view of obtaining the necessary licence to access the modern sector. The bureaucrat[4] will be assumed to have a monopolist power (which means that, given the submitted project, he is the only one that may issue the licence required for that project) and a discretional power (i.e. he may refuse to issue the licence with no need to provide any reasons or explanations) in granting the licence. The bureaucrat may decide not to ask for a bribe and to issue the licence to all those that submit a project to the Public Administration, or he may decide to ask for a bribe in exchange for such licence. The State controls the bureaucrats in such a way that they have a probability q (monitoring level) of being detected. A corrupted bureaucrat accepting a bribe from an entrepreneur, if detected while performing the extortion, incurs a cost (either monetary, moral, or criminal) equal to mk[5] and the entrepreneur incurs a

[4]The modern analysis of corruption (starting from the works of Rose-Ackerman of 1975 and 1978) places such phenomenon within a principal-agent scheme. In fact, the existence of corruption is subject to an agency relationship between an individual in charge of making decisions (the agent) and the owner of the interests (principal) he represents. A third party (in our model the entrepreneur) should then be involved to influence the agent's discretional decisions to his own benefit, upon the payment of a bribe. Following the assumptions of most recent works (e.g. Shleifer and Vishny, 1993), the agency relationship between the bureaucrat (agent) and the Government (principal) will not be analyzed, but focus will only be made on the possible relation between the bureaucrat and the entrepreneur (third party) in order to better highlight the mechanisms through which such relations develop, as well as the effects of such behaviours on the economy.

[5]The punishment for the detected bureaucrat is not a constant, but rather a function of the investment level. This is because, following Rose –Ackerman (1999):

"The official's penalties should be tied to the size of the payoffs they receive and the

cost (either monetary, moral, or criminal) equal to ck[6], where $m, c > 0$.

2.1 Game description

The previous problem can be described by following three-period game:

(1) At stage one of the game, the entrepreneur should decide in which sector to invest, i.e. whether to invest his capital in the modern or in the traditional sector. Such decision is tantamount to the decision of whether to submit the project to the Public Administration, considering that a licence is needed to invest in the modern sector. Project submission does not result into the automatic issuing of the licence by the bureaucrat, in that the bureaucrat may refuse to grant the licence unless a bribe b is paid.

If the entrepreneur decides not to submit the project (invest in the traditional sector) the game ends. If the entrepreneur decides to submit the project to the Public Administration, incurring a cost, he asks the bureaucrat to issue the licence. In this case the game continues to stage two.

(2) At this stage (stage 2), the bureaucrat, facing an entrepreneur that has submitted a project to the Public Administration, may decide not to

*probability of detection. If penalties are not a function of the size of the bribe, an anticorruption drive would quickly confront a paradox. A high fixed penalty will lower the incidence of corruption but increase the size of the bribes paid. If the penalty is high, the officials must receive a high return in order to be willing to engage in bribery. Thus the expected penalty should increase by more than one dollar for every dollar increase in the size of the bribe."*pp. 54

In the suggested model, since the paid bribe is a function of k, the punishment is assumed to be a function of the bribe.

[6]The punishment for the entrepreneur, as for the bureaucrat, is not a constant, but rather a function of the investment. In this case too, based on the statements of Rose - Ackerman (1999):

"On the other side of the corrupt transaction, a fixed penalty levied on bribers will lower both the demand for corrupt services and the level of bribes. However, it will have no marginal impact once the briber passes the corruption threshold. To have a marginal effect, the penalties imposed on bribe payers should be tied to their gains (their excess profits, for example)". pp. 55

the punishment for the entrepreneur is considered as a function of the investment determining the size of the profits.

ask for a bribe ($b^d = 0$) to issue the licence; then the game ends with the payoffs W for the bureaucrat and $(a_M k - sk)$ for the entrepreneur; or he may negotiate the payment of a bribe ($b^d > 0$) with the entrepreneur to issue the licence. The game continues to stage three.

(3) At stage three the entrepreneur should decide whether to negotiate the bribe to be paid to the bureaucrat or to refuse to pay the bribe. Should he decide to carry out a negotiation with the bureaucrat, the two parties will find the bribe corresponding to the Nash solution to a bargaining game (b^{NB}) and the game ends. The payoffs will depend on whether the bureaucrat and the entrepreneur are detected (with probability q) or not detected (with probability $1 - q$).

Thus, if the entrepreneur decides to pay[7] the bribe b^{NB} the expected payoff for the bureaucrat will be equal to $W - mkq + (1 - q)b^{NB}$,while the expected payoff for the entrepreneur will be equal to $(a_M - s)k - (1 - q)b^{NB} - ckq$.

If the entrepreneur decides not to negotiate with the bureaucrat, the latter will refuse to issue the licence; thus the game ends with the bureaucrat receiving with certainty salary W and, having denied licence issuing to the entrepreneur, the latter will have to invest in the traditional sector, with a payoff equal to $(a_T k - sk)$, where $(a_T k)$ stands for the profits of the traditional sector and sk is the cost of project submission to the Public Administration.

2.2 The solution to the game

This is a dynamic game, which may be solved by using the method of backward induction, starting from the last stage of the game. Prior to the solution of the game, the bribe resulting as the Nash solution to a bargaining game in the last subgame should be determined. This bribe is the outcome of a nego-

[7] In this case, in fact, the payoff for the bureaucrat, if detected, is equal to $W - mk$ where W is the paid salary and mk is the cost incurred by the bureaucrat when found to accept a bribe. The payoff for the entrepreneur if detected is equal to $(a_M - s - c)k$ where $(a_M - s)k$ are the profits achieved from operating in the modern sector and ck is the cost incurred by the entrepreneur if found to offer a bribe to the bureaucrat. The payoff for the bureaucrat if not detected is equal to $W + b^{NB}$ i.e. the salary plus the negotiated bribe. The payoff for the entrepreneur if not detected is equal to $(a_M - s)k - b^{NB}$, i.e. the profits less the bribe paid to the bureaucrat.

tiation between the bureaucrat and the entrepreneur, who will be assumed to share a given surplus on an equal basis.

Let $q \neq 1$[8], then there exist a unique positive equilibrium bribe b^{NB}, as the Nash solution to a bargaining game[9] in the last subgame, given by[10]:

$$b^{NB} = \left[\frac{(a_M - a_T)k - ckq + mqk}{2(1-q)}\right]$$

i.e., the entrepreneur gives half of the surplus to the bureaucrat, such surplus being the difference in the return on the investment in the two different sectors (modern and traditional), net of half of the entrepreneur's expected cost for being detected and plus half of the bureaucrat's expected cost for being detected in a corrupted transaction.

2.3 Static equilibrium

2.3.1 Outcome

From the backward solution (described in Appendix A) of the game, 3 perfect Nash equilibria are obtained in the subgames, according to the parameter conditions, summarized in Table 1.

An attempt is now made to give an assumption for the three parameter conditions as related to the equilibria they allow to achieve.

If

$$q \geq \frac{a_M - a_T}{c + m} = q_2$$

(equilibrium **A**) applies, once the entrepreneur has decided to submit the project to the Public Administration, what the entrepreneur himself obtains in addition from the modern sector compared to the traditional one is not enough to make up for the expected cost for the entrepreneur and for the bureaucrat for being corrupted and detected, and for the project implementation cost. With this in mind, the bureaucrat will not ask the entrepreneur

[8] If $q = 1$ we are not at this stage of the game.

[9] Cfr. Binmore K., - Rubinstein A., - Wolinsky A., (1986).

[10] The bribe associated to the Nash solution to a bargaining game turns out as a solution to the following maximum problem: $\max_{b \in \Re^+} Max[a_M k - sk - (1-q)b - ckq - (a_T k - sk)][W + (1-q)b - mqk - W]$
where $[(a_T k - s), W]$ is the point of disagreement, i.e. the payoffs that the entrepreneur and the bureaucrat respectively would obtain if they did not come to an agreement.

for a bribe. The entrepreneur, in turn, will find it convenient to submit the project to the Public Administration, and will obtain the licence without paying any bribe.

If condition

$$0 \leq q \leq \frac{(a_M - a_T) - 2s}{(c + m)} = q_1$$

(equilibrium **C**) applies, the entrepreneur finds it convenient to submit the project. The difference in profits between the modern sector and what is obtained from the traditional sector is such as to make up for the expected cost of one's corruption, of the bureaucrat's corruption, and for the project submission cost. Thus the surplus to be shared between the entrepreneur and the bureaucrat will keep a negotiation going, whose outcome is the bribe corresponding to the Nash solution to a bargaining game.

If

$$q_1 = \frac{(a_M - a_T) - 2s}{(c + m)} < q < \frac{(a_M - a_T)}{(c + m)} = q_2$$

(equilibrium **B**) applies, once stage 2 is achieved, the bureaucrat will still find it convenient to ask for a positive bribe and the entrepreneur, at stage 3, to start a negotiation. But at stage 1 the entrepreneur knows that what he would obtain from project submission is less than what he would obtain by investing in the traditional sector, and therefore will not submit the project and the game will end in equilibrium B, where there is no corruption but all entrepreneurs invest in the traditional sector.

Below (figures 1 and 2) is a graphic description of such non-linear relations between monitoring level and output, and between corruption and output.

Table 1: Parameter conditions: the three Nash equilibria.

q value	$0 \leq q \leq q_1$	$q_1 < q < q_2$	$q_2 \leq q \leq 1$
Stage 1	The entrepreneur submits the project	The entrepreneur does not submit the project	The entrepreneur submits the project
Stage 2	The bureaucrat asks for a bribe	The bureaucrat asks for a bribe	The bureaucrat does not ask for a bribe
Stage 3	The entrepreneur starts a negotiation	The entrepreneur starts a negotiation	The entrepreneur does not start a negotiation
Equilibrium	C	B	A
Corruption	widespread	none	none
Resulting output	$(1-L_b)a_M k$	$(1-L_b)a_T k$	$(1-L_b)a_M k$
Entrepreneur's payoff	$\frac{(a_M+a_T)k}{2} - sk - \frac{(m+c)kq}{2}$	$a_T k$	$a_M k - sk$
Bureaucrat's payoff	$W + \frac{(a_M-a_T)k}{2} - \frac{(c+m)kq}{2}$	W	W

Figure 1: Corruption and income level.

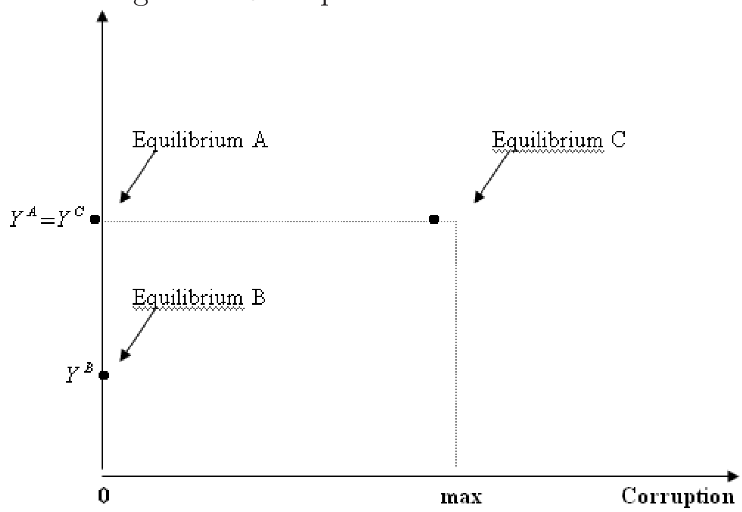
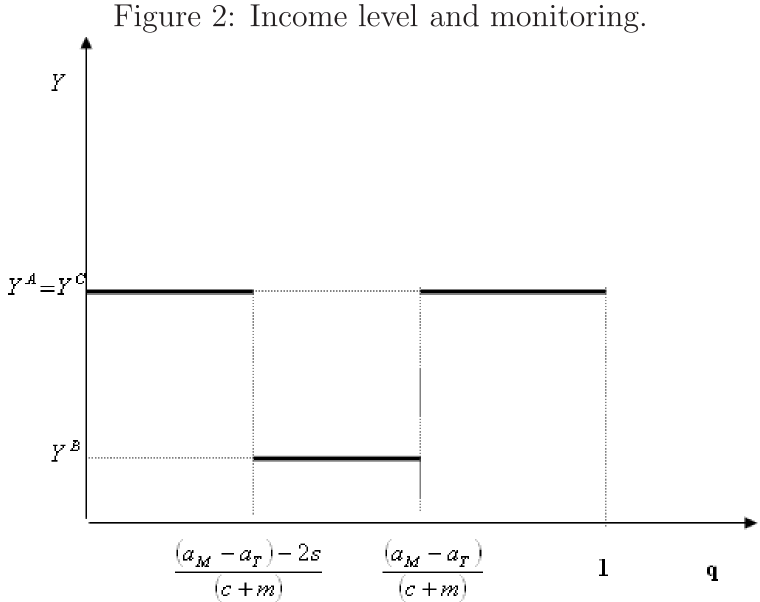


Figure 2: Income level and monitoring.



2.3.2 Welfare implications

A State wishing to lead the economy towards one of the three viable equilibria, by setting a given monitoring level, should compare the three equilibrium. The comparison highlights that equilibria A and C imply a higher output than equilibrium B. Equilibria A and C allow to obtain the same output, even if they are significantly different in terms of corruption level (which is highest in C and nonexistent in A).

Thus the State will be indifferent to whether it should set monitoring at zero and keep the economy at equilibrium C with corruption or set such a high monitoring level as to lead the economy to equilibrium A. In a static perspective, corruption only performs a reallocating effect, i.e. it influences the sharing of the "cake" but not its size, and a State that only aims at "cake" sharing has no kind of incentive to lead the economy to equilibrium A, since monitoring is expensive. If, however, other elements prevail in assessing whether one equilibrium is "more desirable" than another, or if political elements are considered that either privilege the entrepreneurial class or the bureaucrats, different conclusions would be drawn.

In fact, consider a social function is considered as the weighted sum of the payoffs of the bureaucrat and of the entrepreneur:

$$F_s = \lambda\Pi_I + (1-\lambda)\Pi_B$$

where Π_I are the entrepreneur's profits and Π_B are the bureaucrat's revenues, λ and $(1-\lambda)$ are the weights attributed by the government to the entrepreneurs' and to the bureaucrats' earnings respectively.

The values that this function may take change according to the values of q that lead the economy to the different equilibria, and according to the different weights the State attributes to the payoffs.

If the government, encouraged by lobbies, only privileges the bureaucrats $(\lambda = 0)$, then the result would be

$$F_S^C > F_S^A$$

if $q \leq \frac{(a_M - a_T)}{(c+m)}$. Because this condition applies at equilibrium C, in this case $(\lambda = 0)$ equilibrium C is more desirable than equilibrium A.

In the opposite case, where the State is only keen on the well-being (payoffs) of the entrepreneurs $(\lambda = 1)$, the result is always

$$F_S^A > F_S^C > F_S^B$$

and therefore equilibrium A is always more desirable than either equilibrium C or equilibrium B.

2.4 Dynamic equilibrium

The game perspective is now expanded to review the dynamic consequences of corruption on growth and, therefore, on investments, while analysing the entrepreneurs' behaviour in this respect.

As noted, a manufactured product Y may be either consumed (C) or invested $\dot{k}$.

In this economy, the allocation of resources to consumption and capital accumulation is affected by corruption. Agents derive satisfaction from consumption according to a simple constant elasticity utility function[11]:

$$U = \frac{C^{1-\sigma} - 1}{1 - \sigma}$$

Each entrepreneur maximizes utility over infinite time subject to a budget constraint. This problem is formalized as:

$$\max_{c \in \Re^+} \int_0^\infty e^{-\rho t} U(C) dt$$

sub

$$\dot{k} = \Pi_I - C$$

where C is consumption, ρ is the discount rate in time.

Since the return on the investment for the entrepreneur Π_I is different in each of the three equilibria, the problem is solved for the three cases. In the equilibrium with corruption (equilibrium C), the entrepreneur's profit is:

$$\Pi_I^C = (\frac{a_M + a_T}{2})k - sk - (m + c)\frac{kq}{2}$$

thus the constraint is:

$$\dot{k} = (\frac{a_M + a_T}{2})k - sk - (m + c)\frac{kq}{2} - C$$

The Hamiltonian function is:

$$H = e^{-\rho t}\frac{C^{1-\sigma} - 1}{1 - \sigma} + \lambda \left[(\frac{a_M + a_T}{2})k - sk - (m + c)\frac{kq}{2} - C \right]$$

where λ is a costate variable. Optimization provides the following first-order conditions:

$$e^{-\rho t} C^{-\sigma} - \lambda = 0 \quad (1)$$

11

e

$$\dot{\lambda} = -\lambda[\frac{(a_M + a_T)}{2} - s - (c+m)\frac{q}{2}] \quad (2)$$

By deriving the first condition (1) and substituting it into the second one (2), the consumption growth rate is obtained:

$$\gamma_C^C = \frac{1}{\sigma}[\frac{(a_M + a_T)}{2} - s - (c+m)\frac{q}{2} - \rho]$$

In equilibrium A, the entrepreneur's profit is:

$$\Pi_I^A = a_M k - sk$$

Thus the constraint is:

$$\dot{k} = a_M k - sk - C$$

The Hamiltonian function is:

$$H = e^{-\rho t}\frac{C^{1-\sigma} - 1}{1-\sigma} + \lambda[a_M k - sk - C]$$

Optimization provides the following first-order conditions that allow to obtain the consumer growth rate:

$$\gamma_C^A = \frac{1}{\sigma}[a_M - s - \rho]$$

In equilibrium B, the entrepreneur's profit is:

$$\Pi_I^B = a_T k$$

thus the constraint is:

$$\dot{k} = a_T k - C$$

The Hamiltonian function is:

$$H = e^{-\rho t}\frac{C^{1-\sigma} - 1}{1-\sigma} + \lambda[a_T k - C]$$

where λ is a costate variable. Similarly as for the other cases, the consumption growth rate is obtained:

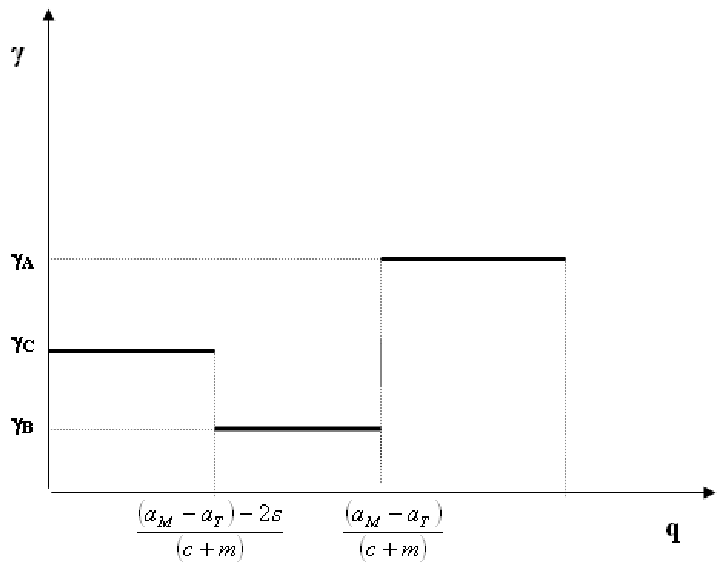
$$\gamma_C^B = \frac{1}{\sigma}[a_T - \rho]$$

It can thus be stated that there is an order for the consumption growth

$$\gamma_C^A > \gamma_C^C > \gamma_C^B$$

It may be further easily demonstrated[12] that the capital and the income also have the same growth rate and therefore equilibrium A, from the dynamic viewpoint, is the equilibrium that allows greater economic growth. Thus a far-sighted State, with long-term objectives, will be encouraged to implement a reform to weed out corruption by leading the economy from equilibrium C to equilibrium A. Figure 3 shows this in terms of income and investment growth.

Figure 3: Growth rate and monitoring.



[12]At a steady state, everything grows at the same rate and therefore $\frac{\dot{k}}{k}$ is constant. At equilibrium C we know that $\frac{\dot{k}}{k} = (\frac{a_M + a_T}{2}) - s - (m + c)\frac{q}{2} - \frac{C}{k}$. Since $\frac{\dot{k}}{k}$ is constant, then the difference between both terms on the right should also be constant, and because a,s,c, q and m are constant, then C and k should grow at the same rate. Similarly, since $Y = a_M k$, at a steady state the income grows at the same rate as the capital. The same applies in the case of equilibria A and B.

3 The Reform

The State may decide to implement a reform to weed out or reduce corruption. But implementing a reform implies a serious dilemma[13]. On the one hand, the entrepreneurs and the bureaucrats should respond to the signals generated by the reform in order to ensure some degree of success of the same; on the other, rational individuals will not respond to the reform in the desired manner unless no uncertainty exists about the successful outcome of the reform. In this case, any uncertainty about the successful outcome of the reform may cause worse damage than the situation *ex ante* if it raises doubts on its permanence in time.

This simple intuition is applied in our model with corruption to show how reforms that seem to be desirable for economic growth could turn out harmful if they raise doubts about their opportunity for implementation and permanence in time. In this context, a reform aimed at weeding out corruption may indeed result into a lower growth rate than in case of corruption if economic agents do not believe that such reform will last in time. The State's reform aimed at reducing corruption translates into a greater probability q of being detected while performing a corrupted transaction. The State announces that a higher monitoring level will be implemented, and one by which the probability q of being detected while performing a corrupted deed increases from q to q' with $q' > q$. The economy is assumed to be at a equilibrium characterized by widespread corruption, i.e. at equilibrium C. Thus the following inequality applies:

$$0 \leq q \leq \frac{(a_M - a_T) - 2s}{(c+m)}$$

With this reform, the State wants to promote greater economic growth, i.e. to reach equilibrium A. To this end, it raises the probability of being detected to q' with

$$q' \geq \frac{(a_M - a_T)}{(c+m)}.$$

[13]Cfr Rodrik.'91

3.1 The operators' trust in the reform

Our model assumes that the operators may express expectations on the actual permanence of the reform in time. In particular, the economic agents are assumed to estimate that there is a given probability $(1 - \pi)$ to revert to the previous monitoring level. It is further assumed that an information asymmetry exists, in that the State is unaware of the belief of the economic agents, i.e. of the probability estimated by the operators that the reform is not implemented. When a reform is announced, the economic agents define an expected probability of being detected (q), weighted according to the probability estimated by them that the reform will or will not last in time: it should be considered, in fact, that the reform will last in time with probability π; then, in this case, there is a true probability q' of being detected but, with a probability $(1-\pi)$, the reform will not last in time (this brings back to the initial probability q) and in this case the actual increase of q will be lower. The probability expected by the operators is q" with $q" < q'$ and equal to $q" = q'\pi + q(1-\pi)$. In this case, even if the State intended to increase monitoring to lead the economy to equilibrium A, in truth the operators are confronting a lower value q". If this value is such that

$$\frac{(a_M - a_T) - 2s}{(c+m)} \leq q" \leq \frac{(a_M - a_T)}{(c+m)}$$

the economy ends up at equilibrium B, representing a worse condition, from the viewpoint of economic growth, of the desired outcome of the reform, i.e. equilibrium A, as well as of the baseline equilibrium C.

4 An empirical check for Italy

4.1 Introduction

In the light of a widespread theoretic literature on corruption and on the relation between this and the economic performance, the papers that tried to estimate the impact of corruption on economic activity levels using data are recent and scarce. Such empirical literature generally highlights a negative impact of corruption on economic growth: for example, the works by Mauro (1995), Knack and Keefer (1995), Kaufmann and Wei (1999) and Li, Xu and Zou (2000), carried out on different samples, point out to a negative, statistically significant relation between corruption and economic growth. A number of sensitivity and robustness analyses, described in the cited works, support this conclusion. Del Monte and Papagni (2001) highlight a negative impact of corruption on economic growth, and stress that such relation changes according to the corruption level[14].

The empirical check described in this section does not test, at least directly, the relation between corruption and economic growth. Instead, the purpose of this part of the paper is to empirically review a number of implications that can be tested and that are directly derived from the theoretical model described in the previous section[15]. A prediction of the presented model is that a *non-linear* relation exists between the monitoring performed by the State on bureaucrats to prevent the spreading of corruption and economic growth. In fact, the dynamic model developed in the previous section points out to a non-linear relation between the monitoring level performed by the State, corruption, and economic growth. At low monitoring levels implemented by the public bodies in charge, entrepreneurs and bureaucrats agree to implement projects in innovative sectors, characterized by high growth potentials; however, the reallocation of resources (using bribes) from the entrepreneurs to the bureaucrats that are not involved in the manufacturing process reduces the growth potential generated by the investments of the entrepreneurial class. At higher monitoring levels – say intermediate – the entrepreneurs draw no benefit from implementing projects in the innovative sector, because of the costs of corruption, and this results into lower growth rates for the economy. Finally, even higher monitoring levels – say high – discourage both the entrepreneurs and the bureaucrats from performing corrupted transactions, and this ensures investments by the entrepreneurs in the innovative sector, while stimulating the accumulation process and, ultimately, generating even stronger growth.

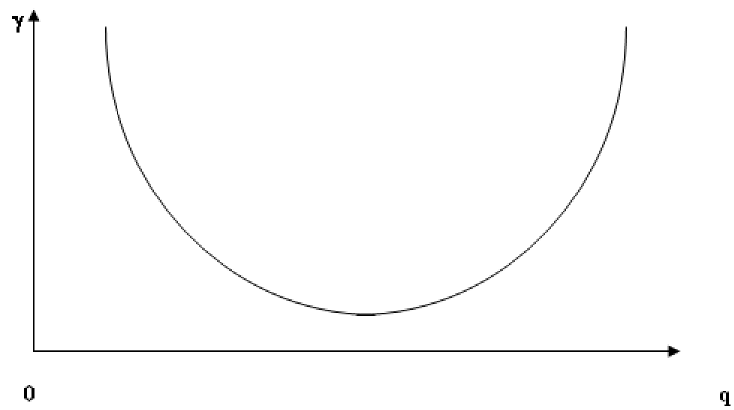
The empirical analysis of the paper aims at checking whether this model prediction is confirmed, using the Italian data. Our analysis refers to data for the Italian regions and for the 1971-1996 period.

The non-linear character of the relation between the corruption monitor-

[14]Production in their model requires capital and, in particular, a public asset, the public infrastructures. By worsening the quality of public infrastructures, corruption indirectly hampers economic growth. Thus the relation that the authors submit to this empirical check assumes that public infrastructures have a positive impact on economic growth which, however, declines as corruption increases.

[15]Actually, as already mentioned in the previous section, this relation between the monitoring aimed at limiting corruption and growth also reflects a relation between corruption levels and economic growth levels. In fact, each of the monitoring value ranges corresponds to a equilibrium that the economy may achieve, which is characterized by both a given economic growth rate and a corruption level.

Figure 4: Growth rate and monitoring.



ing level and the growth rate is formalized by using an empirical specification reflecting a parabolic relation between the two variables, with the concavity upwards. To this end, the functional form of a second-grade polynomial was selected for the empirical equation, as shown in Figure 4.

4.2 The data used

As stated above, an empirical analysis is performed on the Italian regional data referred to the 1971-1996 period. Table 3 in Appendix B contains the variables used for the estimate and the sources of the data used.

For the monitoring-level variable, a figure supplied by Istat was used[16] specifying the number of reported corruption and misappropriation crimes (in Appendix B). The drawback of this figure is that it can be interpreted in different ways. The number of reported corruption crimes is a function of the corruption level, as well as of the level of prevention in place to reduce the phenomenon. The following relation may be assumed:

No. of detected corruption crimes = f(Monitoring; corruption)

[16] The same choice was made by Del Monte (1996). In his work, the determinants of corruption in the Italian regions are analyzed, and the same Istat figure that we used was taken as an indicator for corruption.

The number of crimes may then rise both because corruption has increased in the system at the same monitoring level and because, with the same corruption level in the system, the monitoring level by the legal and police authority has increased. However the number of reported crimes is not a satisfactory choice as a proxy of the monitoring level, because its trend, with the same corruption level, may reflect different degrees of monitoring. In the light of the above, the level of public investments was considered as a proxy for corruption[17]. From the theoretical and empirical literature reviewed in the previous work it emerged, in fact, that corruption has a strong correlation with the weight of the State on the economy and, thus, on the public expenditure. Current expenditure (employee salaries, etc.) however may be considered as being less influenced by corruption. The variable considered as a proxy for the monitoring level[18] is then constructed as follows:

$$\text{Monitor}=\frac{\text{No of corruption crimes}}{\text{Public investments}}$$

Prior to the empirical analysis, it was deemed appropriate to provide a few simple descriptive statistics (Table 4), summarized in the appendix C for the main variables considered, along with a table (Table 5) with mean monitoring level values and a mean income growth rate for the 1970-1996 period.

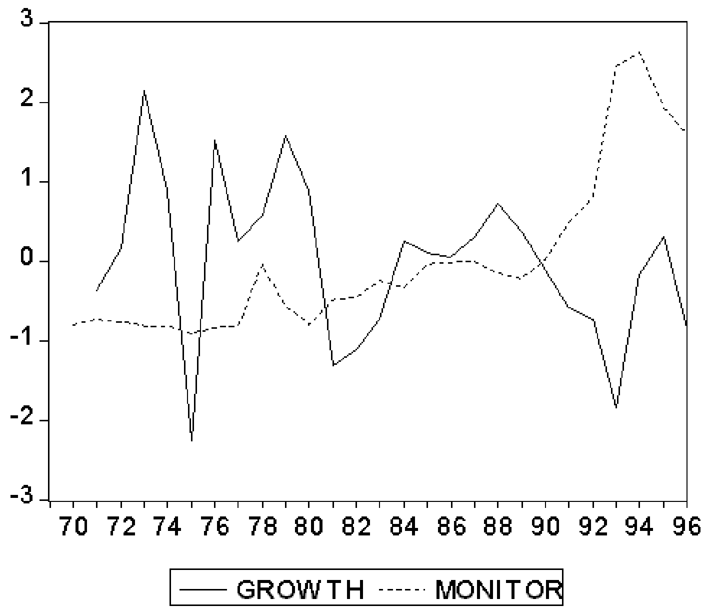
Figure 5 shows the dynamics of monitoring and of the mean GDP growth rate. This chart shows an upward trend of the "monitor" variable, with two relative peaks: one in 1978 and a sharper one in 1992. The "growth" variable shows negative peaks in 1974 and in 1993. The monitoring value has a peak in 1993. This evidence appears in line with the widespread perception that the struggle against corruption (following the better known "Clean Hands" scandal) became harsher in those very years, with higher monitoring levels.

[17]This intuition is supported by Rose - Ackerman (1999), who states that higher corruption levels are associated with a higher share of public investments over the GDP. An alternative and satisfactory way to find an index of regional corruption was adopted by Golden and Picci (2001), suggesting a new measure of corruption for the Italian regions:

"We propose a novel alternative measure based on objective data, namely, the difference between a measure of the physical quantities of public infrastructure and a measure of the value of public capital stocks. Where the difference between the value of existing infrastructure and the actual physical infrastructure is larger, more money is being siphoned off in mismanagement, fraud, bribes, kickbacks, and embezzlement; that is, corruption is greater". pp 1

[18]To make both related values more similar in their order of magnitude, the numerator (number of crimes) was multiplied by 1000.

Figure 5: Monitoring (mean) and income growth rate. Years 1970-1996.



This would then lead to consider the mode by which the monitoring variable was approximated as satisfactory, given the necessary caution.

4.3 The empirical specification

In this section, the Italian data is checked for the above-described predictions of the theoretical model. The specification of the basic estimated equation does not correspond to a structural form for a given model. On the contrary, the basic equation is a reduced form specified in such a way as to allow a check on whether a number of implications of the theoretic model are supported by data.

The tested equation is expressed as follows:

$$growth_{it} = \beta_1 growth_{it-1} + \beta_2 monitor_{it-1} + \beta_3 (monitor_{it-1})^2 +$$

$$+\beta_4 growthinv_{it} + \beta_5 conpa_{it} + e_{it}$$

where $growth_{it}$ is the growth rate of the per-capita income at 1990 constant prices, $growth_{it-1}$ is the growth rate of the per-capita income delayed by one period, $monitor_{it-1}$is the monitoring level delayed by one period, $growthinv_{it}$ is the investment growth rate at 1990 constant prices, and $conpa_{it}$is public consumption over the GDP. The growth rate of the delayed income is included to express persistent dynamics in the manufacturing activity. The investment growth rate and the level of public consumption over the GDP are important control variables in the regression and are both often included in regressions that try to explain the trend of the income growth rate (see, for example, Levine and Renelt, 1992). The term e_{it}represents the stochastic noise, which is assumed to be IID. The index i refers to the regions and the index t refers to time. The crucial explanatory variable is, obviously, the monitoring level. According to the above statements, the variable "monitor" is included in the equation in a non-linear form. A quadratic term is, in fact, included for the variable.

There is a dual reason why the "monitor" variable is included in the equation with a delay of one period: first, because changes in the monitoring level are very likely to require some time before they influence the operators' decisions. Second, any distortions due to simultaneousness, resulting from the possible endogeneity of the "monitor" variable, need to be mitigated.

Based on the predictions of the suggested theoretical model, a positive (and statistically significant) sign is expected for β_3, pointing out to the existence of a non-linear relation between income growth rate and monitoring level. The expected sign for β_1 is positive, pointing out to a positive correlation between the delayed growth rate and the income growth rate at time t; finally, for the expected theoretic sign of the public expenditure/ratio (β_5), different works in literature do not come to the same conclusion[19].

The estimate of equation was performed with reference to the 20 Italian regions in the 1971-1996 period using an appropriate method for dynamic panels. The first step was to ensure, using appropriate tests, that the model was either specified with fixed effects or with random effects, i.e. individual effects that may not be observed, which are not constant variables but, rather random variables.

The model with random effects is seen as an appropriate specification if the N individuals making up the panel are taken at random from a large

[19]In fact, as stressed by Levine and Renelt (1992):

"One the most important and frequently studies issues in economics is the role of fiscal policy in economic development.(.......) it is worth mentioning some problems with these fiscal policy measures. Government may provide growth – promoting public goods and design taxes to close gap between private and social costs. On the other hand, governments may waste funds, funnel resources to endeavours that do not encourage growth, and impose taxes and regulations that distort private decisions." pp . 949-951

population.

In our case, the regions are not taken at random from a population, and the model with fixed effects should then be deemed to better describe the analyzed relations. This assumption, however, is supported by the value taken by the Hausman test, used to establish whether the model should be estimated with fixed effects or with random effects. The test indicates that the fixed-effects model is more desirable (28.37, p-value of 0.00).

The studied economic relation is dynamic as such, thus the advantage of having panel data available allows to better understand the underlying dynamics in the relation concerned, and the delayed dependent variable is then considered among the regressors. A problem arises, however, because the delayed value of the dependent variable is correlated with the fixed effects.

In fact, when dynamic relations between regressors are studied, including the delayed dependent variable:

$$y_{it} = \delta y_{i,t-1} + u_{it}$$

with

$$u_{it} = \mu_i + \nu_{it}$$

then the OLS estimates are distorted and inconsistent, even if the ν_{it} noises are not serially correlated. In fact, $y_{it}$is a function of μ_i, $y_{i,t-1}$, which is a regressor, and is therefore correlated with the error term. In the case of our model, having considered a fixed-effects model, if an OLS estimator is used with fixed effects, for the above reason, distorted and inconsistent estimates would be obtained, because the delayed dependent variable would be correlated with the fixed effects. In order to take into account the endogeneity of regressors, the Generalized Moments Method (GMM) developed by Arellano and Bond (1991) is used to estimate panel data. This method turned out effective among the methods of estimation with instrumental variables. Arellano and Bond (1991) demonstrate that appropriate instruments in a dynamic model with panel data derive from the conditions of orthogonality which exist between the appropriately delayed values of the dependent variable ($t-3, t-4$ and even earlier) and noises ν_{it}.

In particular, to obtain consistent estimates of the parameter δ, the above equation is differentiated:

$$y_{it} - y_{i,t-1} = \delta(y_{i,t-1} - y_{i,t-2}) + (\nu_{it} - \nu_{i,t-1})$$

For the period t=3 the following relation is observed:

$$y_{i3} - y_{i2} = \delta(y_{i2} - y_{i1}) + (\nu_{i3} - \nu_{i2})$$

In this case y_{i1} is a valuable instrument, because it is correlated with $(y_{i2}-y_{i1})$ but not with $(\nu_{i3}-\nu_{i2})$, in that errors ν_{it} are not serially correlated. If the process is repeated for $t = 4. \ldots T$, valuable instruments are obtained, which allow to obtain effective and consistent estimators.

The results of the estimates are summarized in the next section.

4.4 Results

As already noted, in order to obtain undistorted estimates, the generalized moments method (GMM) discussed in the previous section was used, as described by Arellano and Bond (1991). Table 2 contains the resulting evidence.

The results of the estimate, summarized in column a) of Table 2, further empirically support the existence of a non-linear relation, which appears statistically significant, between the income growth rate and the monitoring level: the squared coefficient of the monitoring variable is positive (+0,013) and significant (the t statistic is 9.54). This would confirm the existence of a parabola-shaped relation with the concavity upwards.

Positive and statistically significant coefficients are also associated to the investment growth rate (t in absolute value equal to 10) and to the difference before the ratio of public consumption[20] to incomes (t in absolute value equal to 33.35).

For both specifications estimated with the GMM method, whose results are summarized in Table 2, diagnostic tests were also performed. In particular, in order to assess the goodness of the specification, the Sargan test and the m2 test were calculated on the existence of a self-correlation of second-order errors. The Sargan test values (19.05 with p-value 0.94 in specification a) and 19.28 with p-value 0.93 in specification b)) show that the selected instruments are appropriate, because the correlation between residuals and instruments seems to be moderate (the asymptotic distribution of the test is chi-square with 30 degrees of freedom). The test on second-order serial correlation also shows that, with a 5-percent significance level, the errors are not self-correlated (the test's asymptotic distribution is the usual standard).

[20]Similarly to the work of Del Monte and Papagni (2001), the difference before the ratio of public consumption to GDP was considered. The reason is a possible non-steadiness of this variable, as results from the empirical analysis carried out by the two authors on Italian data.

Table 2: GMM estimate of dynamic growth on panel data.

Dependent variable: growth		
Variables	a)	b)
growth (-1)	$-0,069$	$-0,046$
	$(-3,13)**$	$(-2,76)**$
monitor(-1)	$-0,012$	$-0,012$
	$(-3,49)*$	$(-4,02)**$
monitor^2(-1)	$0,013$	$0,013$
	$(9,54)**$	$(11,47)**$
dconpa	$0,003$	$0,003$
	$(33,35)**$	$(48,20)**$
growthinv	$0,049$	$0,042$
	$(10,00)**$	$(10,48)**$
growthinv (-1)	$0,014$	
	$(3,61)**$	
Constant	$-0,002$	$-0,002$
	$(-23,08)**$	$(-23,95)**$
Sargan test : χ^2 (30)	19,05	19,28
Prob> χ^2	0.939	0,934
Test on serial z	1,74	1,89
2^{nd}-order correlation Prob>z	(0,082)	(0,06)
Observations	458	438
Number of regions	20	20
Absolute value of t in brackets:	* 5% significant;	** 1% significant

5 Conclusions

The negative consequences of corruption on growth in the literature (see Shleifer and Vishny, 1993, Campos, Lien and Pradhan, 1999, and Wei, 1997) are also related to the degree of uncertainty[21] with respect to corruption practices. But when no reforms are in place, if corruption is predictable, i.e. if mechanisms are in place by which corrupted bureaucrats and entrepreneurs may often meet, "stable" relations may be established with the information flows that help develop a reputation for the bureaucrats. In this case, bribery occurs on an ongoing basis and the structure of relations is quite stable in time: thus behavioural rules emerge and are consolidated between the different actors, as true informal norms that allow to reproduce a highly corrupted system. Such stable "rules of the game" reduce the uncertainty associated to the corrupted transaction, thus promoting investments. The announcement of a reform aimed at curbing corruption "breaks" the stability of these relations and may, if the economic agents do not fully trust that such reform will be implemented, alter the economic benefit for the entrepreneurs investing in the modern sector, and thus result into reduced economic growth. Thus the introduction of a reform to weed out corruption, if not fully trusted by the economic agents, reduces corruption as well as economic growth.

The theoretical model developed highlighted a non-linear relation between corruption and economic growth and between the monitoring level implemented by the police authority and economic growth. Based on such result, a reform aimed at weeding out corruption, if not fully trusted by the economic agents, was demonstrated to lead the economy to equilibrium with less corruption compared to the one preceding the reform's introduction, but also with less economic growth. Thus a State wishing to implement a reform to reduce or weed out corruption and improve economic growth should consider this non-linear character of the corruption-economic growth relation: in fact, in order for the economy to achieve a equilibrium with less corruption and more economic growth, the reform should be "relevant".

The empirical check performed for the Italian case seems to support a number of predictions of the theoretic model described above.

"Clean hands" therefore will have proven to ensure healthy growth in the Italian case only when citizens, enterprises, and bureaucrats will have sensed a permanent shift in the political willingness to fight corruption. In the

[21] In fact, as argued by Campos, Lien and Pradhan (1999):
"it is not only the level of corruption that affects investment but also the nature of corruption. Corruption regimes that are more predictable – in the sense that those seeking favours from the government do obtain those favours – have less negative impact on investments than those that are less predictable". pp. 1059

absence of such clear commitments, fighting corruption may have devastating effects on economic performance.

A Appendix: Solution to the static game

The static game is solved with the backward induction method, which allows to identify the equilibria. Starting from stage 3, the entrepreneur needs to decide whether to negotiate with the bureaucrat. Both payoffs are then compared, because the bureaucrat asked for a bribe. The entrepreneur will decide to negotiate if

$$(a_T k - sk) < \frac{(a_M + a_T)k}{2} - skT - (c+m)\frac{kq}{2}$$

Thus if:

$$\frac{kq(c+m)}{2} < \frac{a_M k - a_T k}{2}$$

or if

$$q < \frac{(a_M - a_T)}{(c+m)}$$

the entrepreneur will decide to negotiate **(CASE I)**

but if

$$q \geq \frac{(a_M - a_T)}{(c+m)} = q_1$$

the entrepreneur will decide not to negotiate **(CASE II)**

According to the value of the parameters, then, the outcome of the game will be different. The two cases are analyzed individually to identify the equilibria.

CASE I: $q < \frac{(a_M - a_T)}{(c+m)} = q_2$

Notice that $q_2 \in [0,1]$ is a probability if :

$$(a_M - a_T) \leq c + m \tag{3}$$

it means that the difference in the returns between the two sectors must not be greater then the cost to be corrupt; consequently the presence of the probability q determines the entrepreneur choice to enter in the transaction.

Going up the decision-making tree, the bureaucrat needs to decide whether to ask $b^d > 0$ or not ask $b^d = 0$ for a bribe.

Should he decide not to ask for a bribe, his payoff will be W, whereas should he decide to ask for a bribe, he knows that the entrepreneur will deem it convenient to start a negotiation, whose outcome is bribe b^{NB}, and therefore his payoff will be

$$W + \frac{(a_M - a_T)k}{2} - \frac{(c+m)qk}{2}$$

.

Thus, since due to the parameter condition, the result is always:

$$W + \frac{(a_M - a_T)k}{2} - \frac{(c+m)qk}{2} > W$$

the bureaucrat will always find it convenient to ask for a bribe other than zero ($b^d > 0$). In particular, he will ask for a bribe $b^d = \infty$. Such bribe will be rejected by the entrepreneur, who will start a negotiation with outcome b^{NB}.

Proof. If both inequalities $q < \frac{(a_M - a_T)}{(c+m)}$ and $(a_M - a_T) \leq c + m$ are verified (the first is necessary to be in case I while the second is such that q_2 is admissible), then the following implications are verified

$$q < \frac{(a_M - a_T)}{(c+m)} \leq 1 \Rightarrow (c+m)q < (a_M - a_T) \leq (c+m) \Rightarrow$$

$$-(c+m)q > -(a_M - a_T) \geq -(c+m) \Rightarrow$$

$$(a_M - a_T) - (c+m)q > (a_M - a_T) - (a_M - a_T) \geq (a_M - a_T) - (c+m) \Rightarrow$$

$$(a_M - a_T) - (c+m)q > 0$$

it means that the inequality holds for each parameter value belongs to the parameter space defined above.

At stage one of the game, the entrepreneur should now decide whether to submit his project to the Public Administration, being aware of the outcome of the negotiation.

Should he decide not to submit the project, his payoff will be $a_T k$, whereas should he decide to submit the project and to pay bribe b^{NB} to the bureaucrat, his payoff will be

$$\frac{(a_M - a_T)k}{2} - sk - \frac{(c+m)kq}{2}$$

Thus if

$$\frac{(a_M - a_T)k}{2} - sk - \frac{(c+m)kq}{2} \geq a_T k$$

or if

$q \leq \frac{(a_M - a_T) - 2s}{c+m} = q_1$ the entrepreneur will decide to submit the project to the Public Administration and the bureaucrat will ask him for an infinite bribe, to which the entrepreneur will respond by offering bribe b^{NB}.

Notice that $q_1 \in [0,1]$ is a probability if :

$$0 \leq \frac{(a_M - a_T) - 2s}{c+m} \leq 1 \Rightarrow c + m \geq a_M - a_T - 2s \geq 0 \tag{4}$$

Proof. Let $(a_M - a_T) \leq c + m$ for the (3), then $c + m - 2s < c + m$ implies

$c + m - 2s \geq a_M - a_T - 2s$ so that

$$c + m > c + m - 2s \geq a_M - a_T - 2s$$

and consequently condition (4) holds if and only if

$$a_M - a_T - 2s \geq 0 \Rightarrow \frac{a_m - a_T}{2} \geq s$$

Notice that such a condition implies that the half of the surplus (as the difference between the returns of the two productivity sectors) must be greater then the project cost.

If the previous hypothesis are verified, we also have to check if $q_1 < q_2$. in order to have a positive probability the entrepreneur will not submit the project.

Proof.

$$q_2 = \frac{a_M - a_T - 2s}{c+m} = \frac{a_M - a_T}{c+m} - \frac{2s}{c+m} < \frac{a_M - a_T}{c+m} = q_1$$

The game ends at a equilibrium called **C** with the following payoffs:

Bureaucrat $W + \frac{(a_M - a_T)k}{2} - \frac{(c+m)qk}{2}$

Entrepreneur $\frac{(a_M + a_T)k}{2} - sk - \frac{(c+m)qk}{2}$

But if

$$\frac{(a_M + a_T)k}{2} - sk - \frac{(c+m)qk}{2} < a_T k$$

or if

$$q > \frac{(a_M - a_T) - 2s}{c+m}$$

the entrepreneur will decide not to submit the project to the Public Administration and the game will end at a equilibrium called **B** with the following payoffs:

Bureaucrat W

Entrepreneur $a_T k$

It will now be assumed that the parameters have such a value that:

CASE II:

$$q \geq \frac{(a_M - a_T)}{c+m}$$

At stage two, the bureaucrat should decide whether to ask $b^d > 0$ or not to ask $b^d = 0$ for a bribe.

Should he decide not to ask for a bribe, his payoff will be W, whereas should he decide to ask for a bribe, he knows there is no room for negotiation, and therefore he will refuse to grant the licence to the entrepreneur, who will have to invest in the traditional sector. In this case the bureaucrat's payoff will be W.

Thus the bureaucrat's payoff is the same as if he decides to ask for a bribe equal to zero. As noted, in this case of equal payoff, the bureaucrat may be assumed to prefer to be "honest", and therefore not to ask for a bribe.

At stage one the entrepreneur should now decide whether to submit his project to the Public Administration. Should he decide not to submit the project, his payoff will be equal to $a_T k$, whereas should he decide to submit his project, his payoff will be equal to $a_M k - sk$. Since by assumption $a_M k - sk > a_T k$, in this case the entrepreneur will submit the project and things will end up at a equilibrium called **A** with the following payoffs:

Bureaucrat

$$W$$

Entrepreneur

$$a_M k - sk$$

Proposition 1. Let $0 \leq q_2 \leq q_1 \leq 1$ as in (3) and (4). Thus the following 3 parameter conditions may occur:

$q \geq \frac{(a_M - a_T)}{(c+m)}$ In this case equilibrium **A** is achieved

$$q < \frac{(a_M - a_T)}{(c+m)}$$

and In this case equilibrium **B** is achieved

$$q > \frac{(a_M - a_T) - 2s}{(c+m)}$$

$q \leq \frac{(a_M - a_T) - 2s}{(c+m)}$ In this case equilibrium **C** is achieved.

B Appendix: The data and the relevant sources

The legal statistics of Istat represent one of the main sources for region-based corruption analysis. Corruption crimes fall within two classes of crimes considered by Istat. The first class includes crimes by public officials considered by the criminal code (arts. 314 and 322) and referred to as embezzlement of public funds or misappropriation (art. 324); the second class concerns private interests in official deeds. The considered figure refers to the total number of crimes that Istat classifies with serial numbers from 286 to 294, namely:

286 Embezzlement of public funds
287 Embezzlement by drawing profit from another's error
288 Misappropriation to the damage of private individuals

Table 3: The variables used and the relevant sources

GDP at 1990 prices	1970-1979: Svimez[22] (1993); 1980-1996: Istat, "Conti Economici Regionali", various years
Gross fixed **i**nvestments **at 1990 prices**	1970-1979: unpublished ISTAT data, CRENoS[23] processing of Svimez estimates (1993); 1980-1996: Istat, "Conti Economici Regionali", various years
Corruption level	1970-1996: Istat, "Annuario Statistico e Giudiziario", various years
Population	1970-1996: Istat, Annuario Statistico Italiano, various years
Public investments **at 1990 prices**	1970-1996: Bonaglia -Picci (2000)
Public consumptions **at 1990 prices**	1970-79, unpublished ISTAT data, CRENoS processing of Svimez estimates (1993); ISTAT,"Conti Economici Regionali", 1997; 1980-95, ISTAT, "Conti Economici Regionali", 1998.

289 Extortion
290 Corruption for official deeds
291 Corruption for deeds contrary to official duties
292 Corruption of a party in charge of a public service
293 Corruptor's liability
294 Incitement to corruption.

While data is available since 1961, it is not homogeneous as of 1968, because data for the 1961-1968 period refers to the crimes reported to the legal authority and therefore has a wider scope than the data concerning the years after 1968, for which only the crimes reported to the authority are considered against which the legal authority has brought a criminal action.

A processing of the data on corruption for the years before 1961 can be found in Cazzola (1987), but it only concerns Italy at a national level.

C Appendix: Descriptive data statistics

Table 4: Descriptive statistics.

Variable	**N Obs.**	**Mean**	**Median**	**Min**	**Max**	**Std.Dev.**
GDP (growth rate)	540	$0,0246$	$0,021$	$-0,06$	$0,514$	$0,036$
Investment (growth rate)	540	$0,0146$	$0,016$	$-0,375$	$0,41$	$0,091$
Monitor	539	$0,1963$	$0,104$	0	$2,377$	$0,257$
Public Investment	540	$294024,8$	$297079,6$	$27535,2$	$555253,9$	86250
Public Consumption	540	$9662,3$	7249	347	33595	$7403,1$

Legend: For public consumption and investment, the measurement unit is billions of ITL at 1990 constant prices. The GDP and investment growth rates are not expressed in percent numbers.

Table 5: Monitoring (mean) and income growth rate (mean) in 1970-1996.

Year	**Monitoring**	**Growth**
1970	0.088	
1971	0.096	0.017
1972	0.091	0.026
1973	0.092	0.628
1974	0.096	0.040
1975	0.074	-0.019
1976	0.078	0.051
1977	0.086	0.028
1978	0.178	0.032
1979	0.122	0.054
1980	0.896	0.037
1981	0.139	-0.004
1982	0.148	0.001
1983	0.176	0.012
1984	0.163	0.026
1985	0.192	0.023
1986	0.192	0.021
1987	0.188	0.029
1988	0.185	0.035
1989	0.171	0.028
1990	0.210	0.019
1991	0.250	0.013
1992	0.303	0.007
1993	0.556	-0.013
1994	0.520	0.018
1995	0.447	0.262
1996	0.391	0.005

Legend: the GDP growth rate is not expressed in percent numbers.

References

[1] Acemoglu, D. and T. Verdier (2000) "The Choice Between Market Failures and Corruption", *American Economic Review.*

[2] Acemoglu, D. and T. Verdier (1998) "Property Rights, Corruption and the Allocation of Talent: A General Equilibrium Approach", *The Economic Journal*, pp. 1381-1403.

[3] Arellano, M. and S. Bond (1991) "Some Test of Specification for Panel Data: Monte Carlo Evidence and Application to Employment Equations", *The Review of Economic Studies*, pp. 277-297.

[4] Baltagi, B.H. (1995) "Econometric Analysis of Panel Data", New York: John Wiley & Sons

[5] Barreto, R. (2000) "Endogenous Corruption in a Neoclassical Growth Model", *European Economic Review*, pp. 35-60.

[6] Barro, R.J. (1991) "Economic Growth in a Cross Section of Countries", *Quarterly Journal of Economics*, 106 pp. 407-444.

[7] Bertola, G. and A. Ichino (1998) "In mezzo al Guado: Congiuntura e Struttura nel Problema Occupazionale italiano", Liberalizzazione dei Mercati e Privatizzazione, Il Mulino .

[8] Binmore K., - Rubinstein A., - Wolinsky A., (1986) "The Nash Bargaining Solution in Economic Modelling" *Rand Journal of Economics*, 176-189

[9] Bonaglia, F and L. Picci (2000) "Lo Stock di Capitale nelle Regioni Italiane", Quaderni del Dipartimento di Scienze Economiche N ° 374, University of Bologna

[10] Cazzola, F. (1988) "*Della corruzione*", Bologna, Il Mulino.

[11] Campos, J.E., D. Lien and Pradhan S. (1999) "The Impact of Corruption on Investment: Predictability Matters", *World Development*, Vol. 27, No. 6, pp. 1059-1067.

[12] Del Monte, A. (1996) "I Fattori Determinanti la Corruzione nelle Regioni Italiane", In L. Costabile (a cura di) *Istituzioni e Sviluppo Economico nel Mezzogiorno*, Il Mulino, Bologna.

[13] Del Monte, A. and E. Papagni (2001) " Public Expenditure, Corruption and Economic Growth", *European Journal of Political Economy.*

[14] Elliott, K. (1999) "Corruption and the Global Economy", Institute for International Economics.

[15] Golden M. and L. Picci (2001) "A Proposal for a Measure of Corruption, and a Test Using Italian Data", Manuscript

[16] ISTAT, "Annuario Statistico e Giudiziario", various years

[17] ISTAT, "Conti Economici Nazionali", various years

[18] ISTAT, "Conti Economici Regionali", various years

[19] ISTAT, "Opere Pubbliche", various years

[20] Jain, A. (2000) " Corruption: a Review", *Journal of Economic Surveys"*, 1, pp. 71-121.

[21] Knack, S. and P. Keefer (1995) "Institutions and Economic Performance: Cross – Country Test Using Alternative Institutional Measures", *Economics and Politics*, pp. 207-227.

[22] Levine, R. and D. Renelt (1992) " A Sensitive Analysis of Cross – Country Growth Regression", *American Economic Review.*

[23] Li, H., C.L. Xu and H. Zou (2000) "Corruption, Income Distribution and Growth", *Economics and Politics*, pp. 155-182.

[24] Mauro, P. (1995) "Corruption and Growth", *Quarterly Journal of Economics*, pp. 681-712.

[25] Mauro, P. (1998) "Corruption and the Composition of Government Expenditure", *Journal of Public Economics*, pp. 263-279.

[26] Rose - Ackerman, S. (1975) "The Economics of Corruption", *Journal of Public Economics*, pp. 187-203.

[27] Rose - Ackerman, S. (1978) *Corruption, A Study in Political Economy,* Academic Press.

[28] Rose - Ackerman, S. (1999) "*Corruption and Government*", Cambridge University Press.

[29] Rodrik, D (1991) "Policy Uncertainty and Private Investment in Developing Countries", *Journal of Development Economics*, pp. 229-242.

[30] Shleifer, A. and R. Vishny (1993) "Corruption", *The Quarterly Journal of Economics*, pp. 599-617.

[31] Svimez (1993) "I conti del centro nord e del mezzogiorno nel ventennio 1970-1989", Il Mulino

[32] Transparency International (2001a). *Global Corruption Report 2001.*

[33] Transparency International (2001b). *"Background Information to the CPI".*

[34] http://www.transparency.org/documents/cpi/2001/.

[35] Wei, S. (1997) "Why is Corruption So Much More Taxing Than Tax? Arbitrariness Kills", *NBER Working Paper 6255*.