Public Expenditure, Corruption, and Economic Growth:
The case of Italy

Alfredo Del Monte* and Erasmo Papagni

Dipartimento di Teoria e Storia dell'Economia Pubblica,
Università di Napoli "Federico II"

Abstract

Public services and goods can provide relevant inputs to private productive activities. Modern States organize the production of these inputs on the basis of taxes collected from the community. When this process is affected by bureaucrats' corruption the efficiency of public expenditure decreases. In this paper we deal with the long-run consequences of this form of corruption. A model of economic growth with public inputs to private production is put forward. The production of public goods needs inputs from the private sector that bureaucrats buy with some degree of discretion. The aim of an illegal agreement between the exchanging parties is to profit from the lack of information. Governments fight corruption through costly public purchases monitoring. The extent of corruption is a decision variable in the maximization of expected revenue. This model finds support in the econometric analysis of the Italian case. A dynamic panel data approach to economic growth based on data of 20 regions allows us to estimate the effect of corruption on the productivity of expenditure on public investment. This effect is significant and distinct from a direct negative one of corruption on the growth rate.

(JEL O10, H50; key words: government efficiency, dynamic panel data, Italian economy)

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* Correspondence: Alfredo Del Monte, Dipartimento di Teoria e Storia dell'Economia Pubblica, Università di Napoli "Federico II", Via Cintia (Monte S. Angelo) 80126 Napoli, Italy. E-mail, delmonte@cds.unina.it

We are grateful to Antonio Acconcia, Costas Azariadis, Isaac Ehrlich, Massimo Marrelli, Riccardo Martina, and Pietro Reichlin for helpful comments and suggestions. Usual caveats apply. A version of this paper has been presented at the annual meetings of the Society for Economic Dynamics, Oxford, 7-10 July, 1997. Thanks to Massimo Guagnini (NOMISMA) and Alberto Marradi for providing us data.

1. Introduction

In recent years a large number of papers on the causes and consequences of corruption have been published. Most of these papers are theoretical or qualitative analyses[1]. The first comprehensive econometric research to assess the impact of corruption on economic growth is contained in Mauro, (1995). On the basis of cross-country data Paolo Mauro finds a significant negative relation between a corruption index, built using information assembled from the correspondents of Business International in 70 countries in the early 1980s, and the rate of growth. According to the findings of Mauro, policies to fight corruption could be very beneficial to growth:

"…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." (Mauro, 1998).

There are different ways corruption could reduce economic growth. Corruption could act as a tax and could lower incentive to invest. Corruption could increase the ability of agents to get resources from central and local governments. Therefore, public resources reward the more "able" people, not the best entrepreneurs. Corruption could distort the composition of government expenditure as corrupt politicians may be expected to invest in large, non-productive projects from which it is easier than in productive activities to exact large bribes.

Most of the existing literature on the long-run economic consequences of corruption (Shleifer e Vishny, 1993; Ehrlich, 1999) focuses on rent seeking in the provision of public

[1] There are several papers that analyze the impact of corruption on welfare (Lui, 1985; 1986; Rose-Ackerman, 1978; Shleifer and Vishny, 1993), but these papers have seldom examined the dynamic impact of corruption on the economy (Andvig and Moene, 1990; Rinaldi et al., 1993; Feichtinger and Wirl, 1993).

services. A government official controls the offer of a service against private demand. He has some discretionary power on the offer and can restrict it in several ways (e.g. denying permission or delaying its release). Bribes are the extra-price charged by bureaucrats to private customers, and arise like rents. The economic consequences of this phenomenon concern distortions in resources allocation mainly in terms of less private investment, and a reduced rate of human capital formation. In Ehrlich (1999) corruption is an economic activity that requires some political capital. Effort devoted to the accumulation of this kind of knowledge has an alternative use in human capital production. Corruption reduces economic growth through a negative influence on investments in human capital.

Our paper maintains that corruption has strong negative effects on economic growth also because it lowers the amount and quality of public infrastructure and services supplied to the private sector. Corruption arises when bureaucrats manage public resources to produce public goods and services. Asymmetric information between government and its agents is the basic assumption that we make in a model of economic growth. The State cannot fully ascertain what (its quality or efficiency) bureaucrats buy and the actual price they charge. Illegal behaviour results from providing the government with low quality goods at the same price as private markets, acquiring the same goods at a higher price, or both cases. Bureaucrats and private agents agree to profit from a lack of information, even if their behaviour is harmful for the community welfare.

This case of corruption appears relevant in undeveloped countries (Bardhan, 1997) where the organization of the State is especially inefficient, democratic control of the civil community over government actions is absent, and bureaucrats have wide discretionary power (Azariadis and Lahiri, 1997).

In order to evaluate the effect of corruption on the efficiency of public expenditure, particularly investment in infrastructures, we perform an econometric analysis with reference to the Italian economy. One problem that arises in the interpretation of regression based on cross-country data is the following: countries differ greatly, not only in levels of corruption, but also in the extent of administrative controls on different aspects of economic life, the importance of government-subsidies and transfers, the incidence of government-operated enterprises etc.. It could be very difficult in regressions based on cross-country data to control for such differences. A study that is based on regional data within a country could more easily control for such differences.

We have used data on time series of 20 Italian regions to verify whether corruption –measured by the official number of crimes against the public administration- is one of the possible causes of the limited success of the policy addressed to the development of Southern Italy. Our results show that the efficiency of public expenditure is lower in regions where corruption is higher, and that corruption has a negative effect on economic growth of Italian regions[2].

In the following section 2 a model of growth is put forward. Then, in section 3 the econometric model is described and results are discussed. Conclusions follow in section 4.

2. A model of growth and corruption in government purchases from the private sector.

Our theoretical framework rests on a model of growth where corruption arises from market relations between government and private agents. In a very simple setting, the government collects taxes from the community and provides it with public goods the production of which require inputs purchased from the private sector.

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[2] Putnam, (1993) studies the performance of Italian regional governments as political institutions. His analysis takes the point of view of political sciences and does not contain a quantitative assessment of the economic impact of the quality of regional institutions.

The economy is made up of a large number of equal agents that produce and consume a single good with two types of inputs: private capital and public goods. Each agent in turn spends some time (fixed) working as a community agent. He plays that part by collecting taxes and buying commodities from private producers for the production of public goods. This market is regulated by the government and subject to asymmetric information. The community can easily ascertain prices but will have some difficulty in ascertaining the effective amount of goods acquired by government agents. Bureaucrats and entrepreneurs can find an agreement and make a profit from corruption. Each agent in turn plays both parts in this illegal exchange, and we assumed they are all equal, so that a representative agent takes all the profit earned from corruption, and we can put aside any analysis of profit share.

Ex-post monitoring over government purchases makes revenues from corruption uncertain. Discovery and punishment occurs with probability *P*. Monitoring has a cost that causes a certain amount of resources to be wasted to fight corruption. Agents decide the extent of their involvement in this illegal activity maximizing expected revenues.

Economic growth with public spending is modelled as in Robert Barro (1990). Per-capita output y can be used as consumption c, as investment $\dot{k}$, and as a rival, excludable good provided by the government g. In fact, we assume a one to one technology for public goods production with respect to private inputs. Taxes ty provide the government with resources. When corruption affects public expenditure, the private sector can count only on a share $(1-\theta)$ of public goods production, while corrupt agents take the rest θ. Let us define g as the amount of public goods production without any corruption, then the following identity results:

$$ty \equiv g \equiv \theta g + (1-\theta)g \qquad (1)$$

In this economic environment production technology can be described as:

$$y = Af\left[k, (1-\theta)g\right] \qquad (2)$$

where A is the level of technology, and returns to scale are constant. In the following, a Cobb-Douglas production function replaces eq. (2).

Our formalization of corruption as an economic activity follows the one of microeconomic models of crime such as Becker (1968) and Ehrlich (1973). Agents are assumed to be risk neutral and to choose θ, the quantity of public resources they steal, maximizing the illegal expected net income. Entrepreneurs are engaged in two different activities: goods production and corruption. We assume the two are fully separate. In fact, each agent has little significance with respect to the aggregate, and he chooses k assuming no effect of his decisions on the level of income and public expenditure (see Barro, 1990, p. S108). This hypothesis also means that variations in capital stock do not change the revenue from corruption.

The outcome of corruption is uncertain because of the repressive action of the State. When successful (with probability $1-P$), entrepreneurs profits are: θty; Ex-post monitoring of the transactions in the public sector occurs with frequency P, and a cost per unit value of public expenditure $S(P)$ that increases with P

$$S_p \equiv \frac{\partial S}{\partial P} > 0; \qquad S_{pp} > 0.$$

In cases of unsuccessful attempts at corruption, guilty agents take θty but are charged with a monetary penalty Mty, that can be thought of as a direct consequence of punishment (as a fine), or indirect as income losses deriving from both imprisonment and the monetary value of losses in social status. $M(\theta)$ is a positive increasing function of θ, that approximate crime seriousness, with:

[illegible]; $M(0)=0; \quad M_{\theta} > 0; M_{\theta\theta} \geq 0$.

The expected profit of corruption is:

$$E(\pi_c) = (1-P)\theta ty + P\theta ty - PM(\theta)ty = \theta ty - PM(\theta)ty \qquad (3)$$

A representative agent maximizes eq. (3) with respect to θ. The first order condition is:

$$\frac{\partial E(\pi_c)}{\partial \theta} = 1 - PM_{\theta} = 0 \qquad (4)$$

From equation (4), the optimal value of effort $\theta *$ is an inverse function of the probability P:

$$M_{\theta} = \frac{1}{P}; \qquad \text{and} \qquad (5)$$

$$\theta * = \theta\left(\frac{1}{P}\right) \qquad (6)$$

with $\theta(1) = 0$.

Of course, according to eq. (3) it is always possible to set such a high fine that it discourages any illegal activity, or to check any transaction ($P=1$). But, in order to describe real economies we rule out these opportunities. Legal systems today, even in undeveloped countries, do not allow the setting of very high penalties for crimes against the administration. We assume that there are costs in collecting penalties from guilty agents. They collaborate with the State, and pay the penalty if they feel that the amount is fair relative to the seriousness of the crime, hence collection costs are low. These costs increase if agents consider that the fine is disproportionate with respect to the crime and fight against such an unfair penalty. The government can choose for each value of θ the penalty $M(\theta)$ that maximizes the revenue from fines net of costs[3].

Given $M(\theta)$, the government fights against corruption monitoring bureaucrats' purchases, and wasting an amount of resources $PSty$. It is reasonable to assume that monitoring is paid out of fines collected from guilty agents[4]:

$$PSty = PMty.$$

In this case the frequency of monitoring P is such that $M(\theta^*) = S(P)$, or

$$M[\theta(P)] = S(P) \qquad (7)$$

On the left side of eq. (7) there is a decreasing function of P, while the function on the right side is increasing. Nothing prevents us from assuming that the functions involved in eq. (7) are shaped so that an equilibrium value for P exists and is always lower than one (figure 1).

The negative effect of corruption stands clear in the budget constraint of the government:

$$ty+PMty= \theta ty+(1- \theta)ty + PSty, \qquad (8)$$

From the viewpoint of private agents, corruption allows a reduction in the amount of taxes transferred to the government because of an expected net revenue $\theta ty - PMty$. This illegal revenue has a negative counterpart in terms of public goods and services offered to the private sector.

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[3] The following example gives an increasing convex function $M(\theta)$. The government maximizes the objective function with respect to M:

$$M - C[M/\theta] = M - b[M/\theta]^2,$$

where $C[M/\theta]$ is a cost function for collecting fines. From f. o. c., a function can be derived:

$$M = \frac{\theta^2}{2b}$$

that gives the optimal penalty for each crime of corruption θ.

[4] Other policies against corruption could be specified –e. g. maximizing the rate of growth, or intertemporal utility – but our qualitative results remain the same.

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:

$$U = \frac{c^{1-\sigma} - 1}{1-\sigma}. \tag{9}$$

Each entrepreneur derives income from his legal and illegal activities, and maximizes utility over infinite time subject to a balance constraint. This problem is formalized as

$$\begin{aligned} &\underset{c}{Max} \int_0^{\infty} e^{-\rho\tau} U(c) d\tau \\ &s.t. \\ &\dot{k} = (1 - t + \theta t - PMt) y - c \end{aligned} \tag{10}$$

The Hamiltonian function is:

$$H = e^{-\rho\tau} \frac{c^{1-\sigma} - 1}{1-\sigma} + \lambda \left\{ (1 - t + \theta t - PMt) k^{1-\alpha} (1-\theta)^{\alpha} g^{\alpha} - c \right\}, \tag{11}$$

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

$$e^{-\rho\tau} c^{-\sigma} - \lambda = 0 \tag{12a}$$

$$\dot{\lambda} = -\lambda (1 - t + \theta t - PMt)(1-\alpha) k^{-\alpha} (1-\theta)^{\alpha} g^{\alpha} \tag{12b}$$

Combining eq. (12a) and eq. (12b), we get the growth rate of consumption:

$$\gamma_c = \frac{1}{\sigma}\left[(1-t+\theta t - PMt)(1-\alpha)k^{-\alpha}(1-\theta)^{\alpha} g^{\alpha} - \rho\right]. \tag{13}$$

Another expression for γ derives from considering that *(1-θ)g=(1-θ)ty*, and

$$\frac{(1-\theta)g}{k} = (1-\theta)^{\frac{1}{1-\alpha}} t^{\frac{1}{1-\alpha}}. \tag{14}$$

In fact, substituting eq. (14) into the growth rate equation (13) we obtain:

$$\gamma_c = \frac{1}{\sigma}\left[(1-t+\theta t - PMt)(1-\alpha)(1-\theta)^{\frac{\alpha}{1-\alpha}} t^{\frac{\alpha}{1-\alpha}} - \rho\right]. \tag{15}$$

This growth rate is common to the variables g and $\dot{k}$, and the economy evolves along a balanced growth path without passing through any transitional dynamics.

Eq. (15) shows two opposite effects of corruption on the rate of growth. One effect is positive due to the reduction of taxes caused by illegal profits *(θty-PMty)*. The second is negative as a consequence of fewer public services to productive activities. In appendix A we show that, if γ° is the growth rate when corruption is nil, then

$$\gamma = \gamma^\circ \psi + \frac{\rho}{\sigma}(\psi - 1) < \gamma^\circ \quad \text{if } \psi<1, \tag{16}$$

where $\psi = (1-\theta)^{\frac{\alpha}{1-\alpha}}\left[1 + \frac{t}{1-t}(\theta - PM)\right]$

The negative effect of corruption on the growth rate could prevail when productivity of g is high (α is high), and the tax rate t is low. These conditions seem to apply to undeveloped economies where infrastructure scarcity makes their productivity high, and a large irregular productive sector provides the government with poor resources. Higher efficiency of public monitoring, (lower costs *S(P)),* may cause an increase in the probability P of corruption discovery, that reduces θ and has a positive impact on the growth rate. In the same way, an improvement in public purchase regulation could reduce the economic incentive for corruption. In fact, in this case too, corruption discovery becomes less expensive.

3. An econometric analysis of economic growth, public infrastructure and corruption in Italy, (1963-1991).

3.1 The econometric model and data.

In this section we perform an econometric analysis of economic growth in Italy that highlights the negative effects of corruption. The theory of the previous section maintains a significant role of corruption in the management of public resources on economic growth through reduced efficiency of public expenditure. The case of Italy provides us with an important opportunity for an empirical test of that proposition. In fact, within this country regional inequalities and structural public policies have characterized economic growth since the years after World War II. In this period, governments have tried to reduce the distance between Northern and Southern regions in terms of per capita income through programs of public spending (investment and consumption). A similar policy has been directed towards some regions in the North (Valle d'Aosta, Trentino-Alto Adige, Friuli). Even though poor regions have grown substantially, today their distance from the rich is still wide. We maintain corruption is one of the main reason for the smaller amount of infrastructures available to the private sector in several Italian regions, notwithstanding the huge program of public expenditure that has been carried out during the last forty years.

The empirical literature on productivity and rate of return on public infrastructure has produced a variety of estimates and approaches to the question. In several studies, data concern both particular items within the category of infrastructure, and aggregate public investment. Some models[5] refer to the tradition of factor productivity estimation, performed either on the basis of production functions parameters (Aschauer, 1989), or applying the theory of duality between technology and costs (Morrison and Schwartz, 1996). A different econometric framework has been specified in studies of cross-countries economic growth. These focus on the determinants of the rate of growth, among which some proxies for public infrastructures and public expenditure have been included. The endogenous growth theory provides theoretical support to that relation, but there are still problems in the econometric test of that class of models[6].

In order to distinguish corruption among the causes of bureaucrats and public spending inefficiencies, the careful specification of an econometric model is needed. Our attempt consists in estimating a model of the growth rate of per-employee GDP in which public investment has a positive effect that declines with corruption. This amounts to the introduction of a non-linearity in the econometric model. Data used in estimates are time series (1963-1991) for 20 Italian regions. Dynamic panel data econometric methods have been implemented.

A single equation ADL model provides the basis for our econometric analysis:

$$\Delta y_{jt} = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta y_{jt-i} + \sum_{i=0}^{m} \mathbf{d}_i \mathbf{x}_{jt-i} + f_j + u_{jt}\,; \qquad (17)$$

where j= 1 .....20 regions, t='65 . . '91, and fixed effects f_j are included conditioned to the Hausman test. Equation (17) accounts for the dynamics of the growth rate (first-difference in the log. of GDP per employee, Δy) as a function of a vector of exogenous variables $\mathbf{x}$. The specification of eq. (17) focuses on public investment, our proxy for infrastructure growth. This variable G refers to the share of the real public investment in the real GDP.

[5] A review of the literature can be found in Acconcia and Del Monte, (1998).

Corruption (table 1) is represented by *Cor,* the number of crimes against the public administration per million employees[7]. Corruption enters our model in two ways: As an isolated regressor, *Cor,* and as denominator in the variable *GC=G/Cor*[8]. A property of this functional form is the derivative of the rate of growth with respect to public investment that is a positive decreasing function of corruption with a lower limit at infinity. A more complete account of economic growth in Italy is pursued entering the model with variables for private investment *I*, human capital *HC*, and government consumption *Cc*. Data on *I* refer to the share of real private investment on real GDP. Human capital is approximated by the ratio of high school enrolment on the labour force. Time series on *Cc* are shares of government consumption in the GDP. Human capital and government consumption time series show evidence of being non-stationary, but we avoid any question of spurious regression taking first difference *ΔHC, ΔCc*. The relation between stocks of capital (private and public) and production is assumed delayed by one period.

3.2 Econometric results: Growth and corruption.

The first approaches to the econometric estimation of eq. (17) have led us to the choice of a maximum lag of one year, and to the adoption of ordinary least squares with dummy variables (LSDV). The basic equation is:

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[6] Jones, (Jones, 1995) highlights likely inconsistencies between the time series features of growth rates (often stationary) and those of its determinant variables (non-stationary). Kocherlakota and Yi (1997) maintain that introducing government policy variables in time series growth equations is the right way to testing endogenous growth theory. See also ch. 12 in Aghion and Howitt, 1998.

[7] It is a matter of fact that everybody dealing with data concerning illegal activities does not know the true number of crimes. However, there is no evidence of differences across Italian regions in reporting crimes of corruption to the police, and these crimes usually do not involve strong violence that could justify fear. The Association of Young Entrepreneurs has produced a survey on corruption in Italy (see Giovani Imprenditori Confindustria, 1994). Unfortunately, those interesting data are affected by self-selection and are not representative at a regional level, so they cannot be used in the kind of econometric analysis that we performed.

[8] A more general specification $GCor^{-\eta}$ has been tested, with the estimate of η very close to one.

$$\Delta y_{jt} = \beta_0 + \beta_1 \Delta y_{jt-1} + \beta_I I_{jt-1} + \beta_G G_{jt-1} + \beta_{GC} GC_{jt-1} + \\ + \beta_{Cc} \Delta Cc_{jt} + \beta_{Cc1} \Delta Cc_{jt-1} + \beta_{HC} \Delta HC_{jt-1} + f_j + u_{jt} \tag{18}$$

Support to this specification has been provided by autocorrelation diagnostic, Hausman test of the null hypothesis of random against fixed effects, and a Ramsey's Reset test. Instrumental variable estimation has been performed to deal with possible endogeneity of private investment. When in a model of simultaneous equations there is correlation between all the exogenous variables and the individual effects, Cornwell, Schmidt and Wyhowski (1993) demonstrated that a consistent estimator is 2SLS after a within data transformation. Endogeneity has been ruled out in the case of human capital because there is evidence of declining relative wages of skilled workers in the period[9]. An opposite trend in prices should be observed in the case of a reverse effect of growth on the demand for skilled labour[10].

Table 2 presents the whole set of parameter estimates concerning regression equations of the rate of growth of per capita GDP. The basic equation does not include corruption *Cor* among the explanatory variables, and provides us with a reference. Other specification follow when we add further variables to the basic equation. A general evaluation of the estimated basic equation gives a positive impression due to specification tests that show goodness of fit, the lack of residuals autocorrelation, and support the choice of LSDV. Significant parameters have been estimated with reference to important variables such as education, government consumption and private and public investment. Instrumental variables estimation provides scarce evidence of endogeneity of private investment.

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[9] Data from the Bank of Italy survey on households show that skilled workers - high school graduates and university degree holders - in 1971 had wages ratios above the average: 1.34 and 1.93; the same ratios became in 1993: 1.06 and 1.19.

[10] De Long and Summers (1991) discuss the case of investment endogeneity according this view.

In order to evaluate the influence of corruption on economic growth, the variable *Cor* has been added to the set of regressors. *Cor* has a significant negative parameter when lagged two periods. It could summarize several negative effects of corruption and efficiency of public institutions on economic growth. An appreciable effect of augmenting the basic equation (18) seems to be that on private investment (tab. 2). As well known in the literature, an important effect of corruption is lower private investment. This is also an important result in Mauro (1995). The relation between investment and corruption is shown in table 3 that reports the estimates of an ADL model for *I* on the lagged values of itself, Δy and *Cor*. Our results confirm the general opinion about the negative consequences of corruption on entrepreneurs' decisions.

3.3 Econometric results: Corruption and public investment.

The aim of this paper is to provide a theoretical explanation and econometric support to the hypothesis that corruption, among several negative effects on the economy, has an important adverse influence on the efficiency of the State organization. Testing for this distinct effect of corruption on economic growth requires the introduction of this variable in a non-linear fashion in regression equations. We have performed these enlarged regressions, and the ratio *G/Cor* has parameters estimates (table 2) strongly significant, with the expected positive sign. The estimated value of an F-test – F(56,457)=1.25) - does not support the hypothesis of different parameters of *G, Cor* and *G/Cor* among regions. According to our estimates, the same increase in public investment has a positive impact on the rate of growth of per capita GDP that varies inversely with the amount of corruption.

To figure out this effect of corruption among Italian regions, we compute the elasticity of the rate of growth Δy to public investment *G*:

$$\varepsilon_j \equiv \frac{\partial \Delta y}{\partial G}\frac{G}{\Delta y} = \beta_G \left(\frac{G}{\Delta y}\right)_N + \frac{\beta_{GC}}{Cor_j}\left(\frac{G}{\Delta y}\right)_N ; \quad j = 1.....20$$

where $\left(G/\Delta y\right)_N$ is the ratio of national averages of *G* and *Δy* taken over the period '64 - '91, while Cor_j is the average over the same period relative to *Cor* of region *j*. In table 4 it can be appreciated how much each region pays for corruption. Interestingly enough, our estimates highlight inefficiencies of public spending even in non-Southern regions where it is easy to recognise a special presence of the State.

It is also interesting to verify if our results concerning the negative effects of corruption on economic growth hold even if we control for other indicators of the quality of public institutions. In fact, recent studies (Putnam, 1993) argue that the economy of a some Italian regions (Emilia Romagna, Toscana, Lombardia) has been positively affected by efficient political institutions that have been built up civic traditions.

The variable approximating corruption in our estimates could also summarize other effects of bad public institutions. A good indicator of the efficiency of regional governments is the share of expenditure arrears on the annual budget. In fact, it represents the inability of the administration in pursuing its goals through expenditure. We have collected data on this variable over the period 1981-1985 and computed the average ratio -$Budget_j$ for each region. The last two columns in tab. 2 present the estimates of equations of the rate of growth *Δy* with regressors that include this new variable. Random effects estimation has been chosen because $Budget_j$. does not varies over time, hence it approximates for fixed effects[11]. $Budget_j$ has a negative estimated parameter, as expected, and contributes to the explanation of the rate of growth Δy of the Italian regions. Moreover, the specification of

[11] See the Hausman test

the model with respect to public investment and corruption remains robust even after the inclusion of $Budget_j$.

4. Conclusions.

In this paper we dealt with the phenomenon of corruption that arises from purchases made by government officials. We maintain that this kind of corruption has a direct negative effect on the long-run opportunities of economic growth because governments can offer less inputs to private economic activities. A simple model of economic growth has been built that allows for corruption as an economic activity that individuals can choose under uncertainty. The State devises monitoring on transactions that involve its officials, and punishes guilty agents with a monetary penalty. With a positive amount of corrupt transactions, some economic resources are wasted and fewer infrastructures or public services are disposable for private production. A more complete account of the organization of the State, and its influence on economic growth should be pursued with the integration in growth models of the principal-agent approach to bureaucrats' effort and corruption.

The model that we have presented provided us with a framework for the econometric analysis of the Italian case. Our econometric results show two distinct negative effects of corruption on economic growth. One effect seems to be that on private investment; the other is on the efficiency of expenditures on public investment. From these results important suggestions for political economy derive. In fact, policies to deter corruption and to increase the efficiency of local public institutions could give very positive impulses to economic growth. As far as the debate on Southern Italy's development is concerned, our analysis carries support to policies aimed at the fight against crime and corruption.

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Appendix A

In this appendix we derive eq. (16) that compares the growth rates with and without the effects of corruption: γ, and $\gamma°$. The latter is defined as:

A1 $$\gamma° = \frac{1}{\sigma}(1-t)(1-\alpha)t^{\frac{\alpha}{1-\alpha}} - \frac{\rho}{\sigma}.$$

A1 becomes: $\gamma° + \frac{\rho}{\sigma} = \frac{1}{\sigma}(1-t)(1-\alpha)t^{\frac{\alpha}{1-\alpha}}$ that can be substituted in eq. (15) to provide:

A2 $$\gamma = \left(\gamma° + \frac{\rho}{\sigma}\right)(1-\theta)^{\frac{\alpha}{1-\alpha}} - \frac{\rho}{\sigma} + \left(\gamma° + \frac{\rho}{\sigma}\right)\frac{t}{1-t}(\theta - PM)(1-\theta)^{\frac{\alpha}{1-\alpha}};$$

Eq. A2 can be rearranged as:

A3 $$\gamma = \gamma°\left[(1-\theta)^{\frac{\alpha}{1-\alpha}} + (1-\theta)^{\frac{\alpha}{1-\alpha}}\frac{t}{1-t}(\theta - PM)\right] + \frac{\rho}{\sigma}\left[(1-\theta)^{\frac{\alpha}{1-\alpha}} + (1-\theta)^{\frac{\alpha}{1-\alpha}}\frac{t}{1-t}(\theta - PM) - 1\right]$$

If we define $\psi = (1-\theta)^{\frac{\alpha}{1-\alpha}} + (1-\theta)^{\frac{\alpha}{1-\alpha}}\frac{t}{1-t}(\theta - PM)$ then A3 becomes:

$$\gamma = \gamma°\psi + \frac{\rho}{\sigma}(\psi - 1)$$

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Table 1. Crimes against the public administration per employee (million). Average 1963-1991.

Piemonte	29.47
Valle D'Aosta	56.08
Lombardia	19.84
Trentino	21.74
Veneto	31.44
Friuli V. G.	25.33
Liguria	38.72
Emilia Romagna	16.83
Toscana	20.83
Umbria	27.98
Marche	25.29
Lazio	31.46
Abruzzo	34.06
Molise	48.88
Campania	30.38
Puglia	32.01
Basilicata	38.27
Calabria	51.55
Sicilia	44.08
Sardegna	45.72

Source: ISTAT.

Table 3. Private investment and corruption.

Dependent variable I	LSDV	t
I_{-1}	0.927	(21.91)
I_{-2}	-0.107	(-2.55)
Δy_{-1}	0.125	(4.07)
Δy_{-2}	0.045	(1.47)
Cor	-0.098	(-2.17)
R^2	0.77	
ϕ	-0.030 (-0.67)	
Hausman. $\chi^2(5)$ (p-val)	25.99 (0.0001)	
obs.	520	

Table 4. Elasticity of growth rate of GDP per employee to public investment expenditure. Percentage values.

	$\frac{\beta_{GC}}{Cor}\left(G/\Delta y\right)_N$	ε	*
Italy	**5.16**	**20.86**	
Piemonte	4,83	20,53	-0,328
Valle D'Aosta	2,50	18,20	-2,664
Lombardia	7,13	22,83	1,972
Trentino	6,51	22,21	1,352
Veneto	4,41	20,11	-0,755
Friuli V. G.	5,55	21,25	0,387
Liguria	3,65	19,35	-1,507
Emilia Romagna	8,32	24,02	3,161
Toscana	6,81	22,51	1,648
Umbria	4,99	20,69	-0,167
Marche	5,55	21,25	0,387
Lazio	4,41	20,11	-0,755
Abruzzo	4,16	19,86	-0,999
Molise	2,88	18,58	-2,280
Campania	4,54	20,24	-0,621
Puglia	4,41	20,11	-0,755
Basilicata	3,65	19,35	-1,507
Calabria	2,72	18,42	-2,437
Sicilia	3,19	18,89	-1,973
Sardegna	3,06	18,76	-2,103

* Difference with respect to the national average.

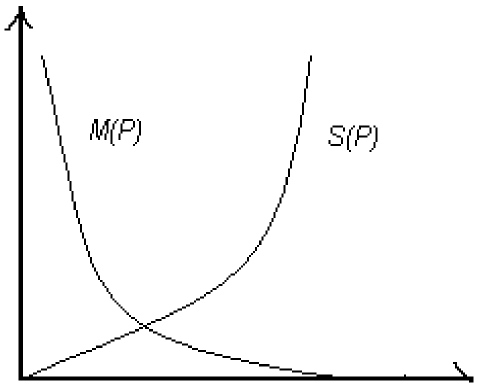

Figure 1. Public purchases monitoring *P* is determined equating expenditures to income from fines.

Table 2. The effects of public investment and corruption on the rate of growth of Italian regions.

Dependent variable Δy	LSDV	*a)* 2SLS	LSDV	*b)* 2SLS	LSDV	c) 2SLS	d) Random Effects	e) Random Effects
Δy_{-1}	0.009	0.006	0.001	0.0005	0.007	0.007	0.043	0.023
	(0.295)	(0.205)	(0.05)	(0.015)	(0.24)	(0.226)	(1.421)	(0.77)
I_{-1}	0.045	0.057	0.027	0.032	0.019	0.022	0.012	0.0005
	(2.157)	(2.355)	(1.254)	(1.287)	(0.924)	(0.870)	(0.07)	(0.025)
G_{-1}	0.401	0.401	0.387	0.387	0.283	0.283	0.071	0.156
	(4.830)	(4.825)	(4.691)	(4.693)	(3.361)	(3.363)	(1.146)	(2.328)
Cor_{-2}			-0.146	-0.143	-0.113	-0.111		-0.138
			(-3.330)	(-3.188)	(-2.546)	(-2.495)		(-3.333)
$(G/Cor)_{-1}$					0.003	0.003	0.003	0.0027
					(4.521)	(4.508)	(5.216)	(4.485)
ΔCc	-3.205	-3.194	-3.202	-3.197	-3.218	-3.216	-3.247	-3.228
	(-22.609)	(-22.457)	(-22.794)	(-22.690)	(-23.314)	(-23.23)	(-23.09)	(-23.63)
ΔHC_{-1}	0.0018	0.0018	0.0016	0.0016	0.0014	0.0015	0.0015	0.0014
	(5.345)	(5.291)	(4.768)	(4.759)	(4.292)	(4.289)	(4.56)	(4.238)
Budget							-0.026	-0.023
							(-1.965)	(-1.441)
R^2	0.55		0.56		0.57		0.56	0.57
ϕ (t statistic)	-0.470 (-0.11)	0.004 (0.08)	0.003 (0.06)	0.004 (0.1)	0.012 ((0.27)	0.012 (0.28)		
Hausman. χ^2 (p. val)	24.58 (0.0002)		18.92 (0.004)		19.16 (0.008)		20.33 (0.002)	6.99 (0.43)
Reset2 (p. value)	0.07 (0.79)		0.244 (0.62)		0.468 (0.49)			
obs.	540	540	540	540	540		540	540

Notes: ϕ refers to the estimate of the first order parameter in a residual AR(1) model $e_{jt} = \phi e_{jt-1} + \varepsilon_{jt}$. Student's *t* in brackets.

a) Instruments: exogenous variables and I_{-2}, G_{-2}, Cor_{-1}, $(G/Cor)_{-1}$.
b) Instruments: exogenous variables and I_{-2}, G_{-2}, $(G/Cor)_{-1}$.
c) Instruments: exogenous variables and I_{-2}, G_{-2}, .
d) Estimates include a constant: 0.02 (4.86).
e) Estimates include a constant: 0.02 (4.99).