PROPERTY RIGHTS, CORRUPTION AND THE ALLOCATION OF TALENT: A GENERAL EQUILIBRIUM APPROACH

Daron Acemoglu
MIT

and

Thierry Verdier
CERAS and DELTA

First Version: January 1994
Current Version: February 1998

JEL Classification: D23, H40
Keywords: Property Rights, Corruption, Allocation of Talent, Development.

Abstract

We consider an economy where contracts are necessary to encourage investments. Contract enforcement requires that a fraction of the agents work in the public sector and do not accept bribes. Corruption can be prevented by paying rents to these agents, which is costly as it induces a misallocation of talent. This trade-off determines the optimal degree of property right (contract) enforcement and corruption. We find that: (1) It may be optimal to allow some corruption and not enforce property rights fully. (2) Less developed economies may choose lower levels of property right enforcement and more corruption. (3) There may exist a "free-lunch" such that over a certain range it is possible to simultaneously reduce corruption, increase investment, and achieve a better allocation of talent.

We are grateful to two anonymous referees, and to Tim Besley, Olivier Blanchard, Abhijit Banerjee, Ricardo Caballero, Michael Kremer, Thomas Piketty, Jim Robinson, Christian Schulz and seminar participants at MIT, Northwestern, Paris, Brussels and NYU Political Economy Conference for useful comments.

1) Introduction

Bureaucratic corruption is widespread in many societies. Casual empiricism and case studies suggest that corruption distorts the allocation of resources, and discourages investment and the creation of new firms (e.g. Mydral, 1968, DeSoto, 1989). Cross-country studies also find that countries with high corruption or long bureaucratic delays suffer lower growth (e.g. Mauro, 1996; Sartre, 1997). It is therefore tempting to conclude that government policies and bureaucratic corruption are at least partly responsible for the lack of development or slow growth of many economies (e.g. Shleifer and Vishny, 1993).

Nevertheless, governments and bureaucracies do not exist only to seek rents. They perform a number of useful functions, including provision of public goods, correction of market failures, and redistribution. Without understanding why the state exists, it is difficult to assess why corruption arises, what its consequences are, and whether and how it should be prevented. In this paper, we analyze how the employees of the state (bureaucrats) can misuse their power to enforce property rights. The protection of property rights is commonly viewed as one of the most important roles of the state by political philosophers as diverse as David Hume, Karl Marx and Robert Nozick, while a number of social scientists including North and Thomas (1973) and Rosenberg and Bridzell (1989) emphasize the importance of secure property rights in the development of western societies.

For the state to have a role in enforcing property rights, some contractual problems must exist between private parties. In our economy, these contractual problems are between entrepreneurs. In particular, production requires two agents, and one of the entrepreneurs needs to undertake an investment, but the returns accrue to the other one. This can be thought as a partnership with the first agent as an upstream supplier providing an input of variable quality, and the second entrepreneur as a downstream producer. The effort of the first agent has to be rewarded, and this necessitates a contractual arrangement. However, contracts are incomplete without the help of the government: when there is no one to enforce the contract, the second entrepreneur's payment promise is not credible. Anticipating this outcome, the supplier chooses low investment and provides a low quality input. The role of the state and its employees is to enforce contracts so that the supplier's investment can rewarded. However, it is difficult for outsiders to judge what the exact terms of the contract are, and a public sector employee assigned to enforce a contract can also abuse his powers, siding unfairly with one of the entrepreneurs. If this type of corruption is widespread, contracts once again fail to accomplish their allocational role, and agents do not invest. Therefore, property rights (contract) enforcement, which is crucial for the creation of wealth, requires the prevention of corruption by these government employees.

As is usual in the literature on law enforcement (e.g. Becker, 1968; Becker and Stigler, 1974), we concentrate on the role of "efficiency wages" as the main method of preventing corruption. Government employees lose their relatively high wages if they are caught taking bribes.

While there are other methods of preventing corruption, the costs and benefits of efficiency wages are more transparent. The costs of paying high public sector wages include: (1) incentive costs of taxation; (2) misallocation of talent because rents in the public sector attracts agents with no comparative advantage for this sector. We focus on (2) as it is simpler to model.

Since preventing corruption and enforcing property rights is costly, the socially optimal resource allocation often involves less than full enforcement of property rights, and possibly some corruption. The optimal allocation also depends on a host of factors, including the productivity of entrepreneurial activities. As a result, it could be optimal for less developed economies, which may have less productive investment opportunities, to have a lower level of property right enforcement and more corruption. This implies that the possibility of reverse causality has to be borne in mind in interpreting cross-country correlations between growth and corruption.

More generally, our model offers a general equilibrium framework which may be useful for the analysis of a host of issues related to property rights enforcement, corruption, and investment. For example, our analysis shows that the presence of corruption, rents for public sector employees and misallocation of resources induced by the government sector do not necessarily imply that government intervention is counter-productive. In contrast, these features may be part of an optimal allocation in the presence of incomplete contracts and incentive problems (see also Acemoglu and Verdier, 1997). Our formulation where the role of government intervention is modeled is crucial in obtaining this result and suggests that a full assessment of optimal property right enforcement requires a general equilibrium approach. Another result which depends on the general equilibrium interactions is our *free-lunch* effect. We show that for certain parameter values, higher public sector wages can simultaneously increase entrepreneurial investment and improve the allocation of talent. This is because a marginal improvement in the enforcement of property rights secured by higher bureaucratic wages may make it worthwhile for entrepreneurs to invest, increasing the expected return to entrepreneurship. Higher entrepreneurial returns, in turn, induce more agents to choose this occupation rather than public employment.

Our paper relates to the growing literature on property rights and corruption. Rose-Ackerman (1975), Besley and McLaren (1993), Mookherjee and Png (1994), Carrillo (1996), Banerjee (1997) provide complementary models where corruption arises due to asymmetric information, and they discuss the costs and benefits of corruption, but do not feature the general equilibrium interactions which are important for our results.

The plan of the paper is as follows. Section 2 describes the basic environment. Section 3 characterizes the equilibrium for a given public sector wage. Section 4 characterizes the output maximizing level of public sector wage. Section 5 introduces heterogeneity among bureaucrats and shows that there can be equilibrium corruption in the output maximizing allocation. Section 6 discusses how public sector wages will be determined as a result of a political equilibrium process.

2) The Model

The economy consists of a continuum 1 of risk-neutral agents. Each agent can become an entrepreneur or work for the public sector. Agents are differentiated by their level of entrepreneurial talent (or comparative advantage), a, with the convention that $a=0$ represents the most talented agent. The level of talent is uniformly distributed over [0,1] and is private information.

An agent of talent a incurs a cost of human capital investment equal to a if he becomes an entrepreneur. There are two complementary entrepreneurial roles; supplier (S) and producer (P) --or upstream and downstream. Upon entering entrepreneurship, half of the agents discover that their skills are suited to production and the remaining half become suppliers. Each entrepreneur can produce net output worth V_0. Suppliers also provide inputs to producers. At cost e the supplier undertakes an investment which ensures that the input is high quality, and increases the value of the producer's output to V_1 with probability q, and leaves it unchanged with probability $1-q$. If the supplier does not make the investment, the input is low quality and does not contribute to producer's output. Whether the supplier has made the investment or not is not publicly observed. We assume that $q(V_1-V_0)>e$, which implies that investment is socially profitable.

The supplier's reward has to be conditioned on the realization of output in order to provide him with the right incentives. The menu of contracts available to the entrepreneurs is incomplete, so that even if the producer promises payment R conditional on high output, he can always claim that output is low. Therefore, it is necessary for a third-party to verify the realization of the producer's output. We assume, for simplicity, that in the pre-contracting stage, the supplier has all the bargaining power so that the producer is forced to promise $R=V_1-V_0$ conditional on high output. As a result, if the supplier believes that contracts will be enforced with a sufficiently high probability, he chooses to invest.

Agents can enter the public sector at no cost. Each public sector employee (bureaucrat for short) is matched with a pair of entrepreneurs and observes the realization of the return. Upon inspection, the bureaucrat finds out the return and can enforce the appropriate payments between the two entrepreneurs. More specifically, he reports a value $v \in \{V_0, V_1\}$, and conditional upon this report the producer pays R or nothing to the supplier.

Consider the situation in which $V=V_1$. If the bureaucrat reports $v=V_0$ instead of V_1, P would gain V_1-V_0, so he has an incentive to offer part of this return to the bureaucrat in order to induce him to misreport. In what follows, we assume, for simplicity, that the bureaucrat cannot report $v=V_1$ when in fact $V=V_0$, for example, because the producer does not have enough money to pay in this case. We also assume that whenever there is corruption (bribery) all the benefits accrue to the bureaucrat. As a result, if $V=V_1$ and he reports $v=V_0$, the bureaucrat receives a bribe equal to V_1-V_0.

A bureaucrat who accepts a bribe is caught with probability p and loses both his wage and the bribe. The probability p captures the degree of administrative control on bureaucratic corruption, and can be endogenized, without affecting our results, by having some bureaucrats monitor the others. Since each bureaucrat can extract the whole surplus, he will be corrupt if:

$$W - T < [W - T + (V_1 - V_0)](1 - p) \quad \textbf{(1)}$$

where W is the gross public sector wage rate, T is the lump-sum tax imposed on all agents and p is the probability of being caught when dishonest. Note also that the important variable for the bureaucrat is W-T, the gross wage rate minus the tax rate. If caught taking bribes, he loses the wage rate but also does not pay taxes since he has no money. Therefore, we define w=W-T, the net wage of bureaucrats and carry out our analysis in terms of this variable.[1] Equation (1) implies that when $w < T_0 \,/\, (V_1 - V_0)\,(1-p)/p$ bureaucrats accept bribes, and when $T_0 < w$, they are honest.

When the size of the bureaucracy, l_B, is greater than $1/3$, there are more bureaucrats than the number of entrepreneur pairs to be monitored, thus wages are paid to bureaucrats who do not perform a useful role. While this may be an important source of inefficiency in many real economies, here we abstract from this problem and assume that $l_B \# 1/3$ to focus on the trade-off between property rights enforcement and allocation of talent. As a result, for certain levels of the wage rate, w, there may be more applicants than available positions. Because talent is private information, a random selection of the applicants are accepted to the public sector, and the rest are turned down and become entrepreneurs. Misallocation of talent results because it is not necessarily those with a comparative advantage for the public sector who are selected.

Diagrammatically, the sequence of events is;

apply to bureaucracy	successful	U_B Prob Q
	non successful	U_E Prob 1-Q
apply to entrepreneurship		U_E

where U_B is the ex ante expected payoff to a bureaucrat, U_E is the expected payoff to an entrepreneur and Q is the probability of getting a public sector job. After the choice of career, we have:

Assign. of roles	P & S agree	S invests/returns	Match with burcrt.	Payoffs
1	2	3	4	5

In stage 1, entrepreneurs find out whether they are suited to production or supplier role. In stage 2,

[1] This emphasizes that we could have made the alternative assumption that only entrepreneurs pay taxes and bureaucrats are paid w and obtain exactly the same expressions and results. Another alternative which would not change our results, but complicate the expressions is for the government to pay only bureaucrats who have matched with entrepreneurs or to make wages contingent on reports.

each P entrepreneur finds a supplier (recall there are equal numbers). In stage 3, the supplier decides whether to invest and provides the input. In stage 4, returns are realized, and bureaucrats are randomly allocated to P-S pairs to inspect the outcome. Finally in stage 5, payments are made based on bureaucrats' reports. When bureaucracy is less than full size (i.e. less than *1/3)*, some ventures will not have a bureaucrat. In this case, the producer claims that the return was low and pays nothing to the entrepreneur.[2] Denoting the fraction of suppliers who invest by $\mathcal{J}$, and the probability that a random bureaucrat is hones by x, the expected return to entrepreneurship (before knowing which type of entrepreneur one will become) is:

$$u_E(a,\tau,l_B,x,T) = \frac{1}{2}\left[V_0 + \tau q(V_1 - V_0)(1 - \frac{2l_B}{1-l_B})\right] + \frac{1}{2}\left[V_0 + \max\left\{q(V_1 - V_0)\left(\frac{2l_B}{1-l_B}(x+(1-x)p)\right) - e;0\right\}\right] - a - T \quad \textbf{(2)}$$

Intuitively, an entrepreneur does not know ex ante what function he will be assigned to. Irrespective of his role, he will obtain V_0. Additionally with probability ½, he will become a producer, and if the corresponding supplier invests (probability $\mathcal{J}$) and the return is high (probability q), he may try to hide this. But this can only happen when there is no bureaucrat assigned to this project because otherwise, either the bureaucrat would be honest and the production entrepreneur would receive the additional returns, or the bureaucrat would be dishonest and appropriate all the returns. Therefore, this second term in the first bracket is multiplied by $1-(2l_B/(1-l_B))$ which is the probability of not meeting a bureaucrat. Conversely, with probability ½, the agent becomes a supplier and decides wether to invest and obtain the net return of investment as well as his regular V_0. If there is no bureaucrat assigned to the project, a supplier will never obtain the high return because the producer will always claim $V=V_0$. If the bureaucrat is dishonest, he will not receive the high return unless the bureaucrat is caught taking bribes. Therefore, for the supplier to receive the additional return, we require the venture to have matched with a bureaucrat (probability $2l_B/(1-l_B)$), and the bureaucrat needs to be honest (probability x), or to be dishonest but get caught (probability $(1-x)p$).

It follows from equation (2) that the decision to invest depends on the degree of property rights enforcement as summarized by $X= (2l_B/(1-l_B))[x+(1-x)p]$. Three elements affect this probability. First, the actual size l_B of the bureaucracy-- when there are more bureaucrats, property rights are more secure. Second, the degree of corruption x-- when more bureaucrats are corrupt, returns to investment are lower. Finally, the probability p of detecting corruption-- because when corruption is detected, returns from investment are reimbursed to the supplier. The investment rule of a typical supplier J=J(X) is:

---

[2] If he were forced to pay some constant amount r, incentives to invest would be unaffected.

$$\tau(X) = 0 \qquad if \quad q(V_1 - V_0)X < e$$
$$= 1 \qquad if \quad q(V_1 - V_0)X > e$$
$$\in [0,1] \qquad if \quad q(V_1 - V_0)X = e \qquad \textbf{(3)}$$

Substituting (3) in (2) gives the expected return to entrepreneurship as:
$U_E(a, X, l_B, T) = u_E(a, J(X), l_B, x, T)$.

To determine, bureaucrats' expected return, we distinguish two cases:

(a) $T_0 \# w$ *(honest bureaucracy)*

$$u_B(w,\tau) = w \qquad \textbf{(4)}$$

In this case, bureaucrats only receive their net wages (*W-T*) which are high enough to discourage bribes. Since *a* is the cost of entering entrepreneurship, it does not feature in (4).

(b) $w < T_0$ *(corrupt bureaucracy)*

$$u_B(w,\tau) = (1 - \tau q)w + \tau q(1-p)(w + V_1 - V_0)$$
$$= w + \tau qp(\omega_0 - w) \qquad \textbf{(5)}$$

where J is the probability that a random supplier has invested, and *q* is the probability that the investment leads to high return. With probability $1-Jq$, the bureaucrat does not meet a venture with a successful investment, and receives no bribes. With probability Jq, he meets a pair of entrepreneurs with a successful investment and demands bribes, with expected return $(1-p)(w + V_1 - V_0)$. Substituting the optimal investment decision rule in (4) and (5) gives the expected return to bureaucracy as $U_B(w,X) = u_B(w, J(X))$.

Finally, l_B bureaucrats receive a net wage *w*, as long as they do not get caught taking a bribe, and $1-l_B$ entrepreneurs pay taxes. Therefore, the government budget constraint is:

$$(1 - l_B)T = l_B(1 - \tau q(1-x)p)w \qquad \textbf{(6)}$$

An equilibrium can now be defined more formally. Given a net public wage *w*, an equilibrium is a tuple $\{a^e(w), l^e_B(w), x^e(w), X^e(w), J^e(w), T^e(w)\}$ 0 $[0,1]^6 \times R^+$ representing respectively an allocation of talent, $a^e(w)$; a public sector size, $l^e_B(w)$; a decision rule for bureaucrats determining whether they accept bribes or not, $x^e(w)$, and thus the degree of property right enforcement, $X^e(w)$; an investment decision for entrepreneurs, $J^e(w)$; and a tax level $T^e(w)$ such that:

(I) $U_B(w,X^e) = U_E(a^e,X^e,l^e_B,T^e)$.

(II) $l^e_B = min\ \{1-a^e, 1/3\}$.

(III) If $w < T_0$, then $x^e=0$, and if $w > T_0$, then $x^e=1$; and $X^e = (2\ l^e_B/(1-l^e_B)).[x^e+(1-x^e)p]$.

(IV) $J^e = J(X^e)$ as defined in (3).

(V) $T^e = w\ [l^e_B(1-J^e q(1-x^e)p]/(1-l^e_B)$.

Condition (I) defines the cut-off level of talent a^e such that agents above this level apply to the public sector. (II) determines the size of the bureaucracy as the minimum of *1/3* and the number of agents applying to public jobs, $1-a^e$. (III) defines the fraction of honest bureaucrats, $x^e(w)$, and the degree of property rights enforcement, X^e. (IV) incorporates the optimal investment decision for the supplier. Finally (V) restates the budget constraint of the government (6).

3) Equilibrium Property Rights, Allocations and Investment

Assumption A: $qp(V_1-V_0) < e$.

This assumption implies that investment is not profitable for the supplier as long as bureaucrats are corrupt. With a full size but corrupt bureaucracy, the expected return to investment, $qp(V_1-V_0)$, is less than e. Therefore, an honest bureaucracy (though not necessarily of full size) is essential for investment to be profitable. We now analyze cases (a) and (b) above separately:

(a) T_0 # w *(bureaucrats are honest).*

In this case, $x=1$. Thus $X = 2\, l_B/(1-l_B)$ and $T= w\, l_B/(1-l_B)$. Also the return to entrepreneurship depends on whether suppliers find it profitable to invest. For this purpose, we define:

$$l_B^+ \equiv \frac{e}{2q(V_1-V_0)+e} < \frac{1}{3} \tag{7}$$

The optimal investment decision rule (3) can then be stated directly as a function of l_B:

$$\begin{aligned}\tau(l_B) &= 0 && \text{if } l_B<l_B^+\\ &= 1 && \text{if } l_B>l_B^+\\ &\in [0,1] && \text{if } l_B=l_B^+\end{aligned} \tag{8}$$

Using (2) and (8), the *ex ante* return to entrepreneurship is:

$$U_E(a,l_B,T) = V_0+q\tau(l_B)\frac{V_1-V_0-e}{2}-a-T \tag{9}$$

Note that when there is investment ($J(l_B) = 1$), the size of the bureaucracy does not feature in the *ex ante* expected return, because when there is a bureaucrat, the supplier receives the rents, and when there is no bureaucrat, the production entrepreneur does, and since both outcomes are equally likely ex ante, the size of the bureaucracy is not important. Nevertheless, as equation (8) shows, the size of the bureaucracy determines whether investment is worthwhile from the viewpoint of the supplier.

The return to bureaucrats in this regime is given by (4) above-- they are all honest and only receive their wages $U_B(w,X) = w$. Substituting for T from (6) into (9), and using condition (I) of the definition of equilibrium, the cut-off level of talent in the case of an honest bureaucracy, $a^e= a^H(w)$, and the size of the public sector, $l_B(w)$, are:

$$\begin{aligned}a^H(w) &= \tau(l_B(w))\frac{q(V_1-V_0)-e}{2}+V_0-\frac{w}{1-l_B(w)}\\ l_B(w) &= \min\{1-a^H(w),1/3\}\end{aligned} \tag{10}$$

Figure 1 describes the determination of the equilibrium in this case. The first quadrant shows the condition $l_B= \min\{1/3,\ 1-a\}$ and the threshold level of the bureaucracy l_B^+ above which there is private investment. The second quadrant of Figure 1 represents the determination of the cut-off point $a^H(w)$ when l_B is less that 1/3. In this case, equation (10) implies that for $a^H(w)$ larger than $2/3$:

$$a^H(w) = \tau[1 - a^H(w)]\frac{q(V_1 - V_0) - e}{2} + V_0 - \frac{w}{a^H(w)} \tag{11}$$

In quadrant II, the right hand side of (11) is represented for a given wage w. It consists of three parts depending on the investment regime: curve (I-I) characterizes full investment ($J = 1,$). Part (N-N) is associated with no investment ($J = 0$). Finally, the vertical part at $a = 1\text{-}l_B^+$ corresponds to the mixed investment regime ($0 \# J \# 1$). At $l_B = l_B^+$, the curve (I-I) ceases to apply and (N-N) begins. The largest intersection of these curves with the 45^0 defines the relevant solutions: this is denoted by $a^I(w)$ in the full investment regime, and by $a^N(w)$ in the no investment regime.[3] Both functions, $a^N(w)$ and $a^I(w)$ are decreasing in the public sector wage rate, so the cut-off point $a^H(w)$ is the thick curve (1ABEF) in quadrant III. Between points A and B, there is less than full size bureaucracy and no investment (J=0), hence $a^H(w)$ coincides with $a^N(w)$ (curve 1ABCN). This case applies when the public sector wage is such that $a^N(w) > 2/3$ and $a^N(w) > 1\text{-}l_B^+$). Similarly, along EF, $a^H(w)$ coincides with $a^I(w)$ (curve 1AIEFJ), with less than full size bureaucracy and J=1. Finally, along the segment BE, suppliers play a mixed investment strategy ($J0$ [0,1]) and in this range, $a^H(w)$ is equal to $1\text{-}l_B^+$.

When l_B is equal to $1/3$ (i.e. $a^H(w) < 2/3$), T is equal to $w/2$ and the cut-off point , $a^H(w)$, is:

$$a^H(w) = q\frac{V_1 - V_0 - e}{2} + V_0 - \frac{3}{2}w \tag{12}$$

(instead of equation (11)). This is drawn in quadrant III of Figure 1 as the linear segment between points F and J. This regime occurs when w is larger than w_{FF} defined by $a^I(w_{FF}) = 2/3$. Namely, w_{FF} is the wage at which bureaucracy reaches full size (exactly 1/3 of the agents apply to bureaucracy) when entrepreneurs are playing J=1. Summarizing the determination of $a^H(w)$:

$$\begin{aligned}
\text{For} \quad w < w_{FF} \quad a^H(w) &= a^N(w) \quad \text{when} \quad a^N(w) > 1 - l_B^+ \\
&= a^I(w) \quad \text{when} \quad a^I(w) < 1 - l_B^+ \\
&= 1 - l_B^+ \quad \text{otherwise} \\
\text{For} \quad w \geq w_{FF} \quad a^H(w) &= V_0 + q\frac{V_1 - V_0 - e}{2} - \frac{3}{2}w
\end{aligned} \tag{13}$$

(b) $w < T_0$ *(corrupt bureaucracy)*

In this regime, $x=0$, $X = 2pl_B/(1-l_B)$. Assumption A implies that entrepreneurs do not invest ($J = 0$), and because bureaucrats have no bribe opportunities, this case is identical to case (a) with J=0. The cut-off point in this regime $a^e = a^C(w)$ is therefore equal to $a^N(w)$ when $a^N(w)$ \$ $2/3$ and $l_B = 1\text{-}a^N(w)$ # 1/3. Similarly when $l_B(w) = 1/3$, $a^C(w)$ is given by:

---

[3] When the public wage w is less than $V_0 - 1$, the intersection is larger than 1 and $a^H(w) = 1$.

$$a^C(w) = V_0 - \frac{3}{2}w \tag{14}$$

and is drawn as the line CN in quadrant III of Figure 1. This regime prevails when w is larger than w_F (point C), which is the wage rate defined by $a^N(w_F)=2/3$ when J=0, i.e. the wage at which bureaucracy is full size with no investment. Hence, under a corrupt bureaucracy, the talent cut-off point $a^C(w)$ is given by:

$$\begin{aligned} &For \quad w<w_F \quad a^C(w) = a^N(w) \\ &For \quad w \geq w_F \quad a^H(w) = V_0 - \frac{3}{2}w \end{aligned} \tag{15}$$

Summarizing the discussion in (a) and (b), the equilibrium cut-off point $a^e(w)$ is:

$$\begin{aligned} a^e(w) &= a^C(w) \quad for \quad w<\omega_0 \\ &= a^H(w) \quad for \quad w \geq \omega_0 \end{aligned} \tag{16}$$

A complete formal characterization of the equilibrium depends on how T_0 compares to the wage rates at which bureaucracy reaches full size in cases (a) and (b)-- i.e. w_F and w_{FF}. Rather than going through a lengthy taxonomy, we focus on the configuration of parameters illustrating the general equilibrium interactions between investment, property right protection and bureaucratic corruption most clearly. In particular, we consider the case $w_F \# T_0 \# w^* < w_{FF}$ where w^* is defined by $a^I(w^*) = 1-l_B^+$. In words, w^* is the public wage rate above which in the absence of corruption, bureaucracy reaches a sufficiently large size so that all suppliers are willing to invest, i.e. J=1, (see Figure 1).

Figure 2 describes the equilibrium (a formal characterization of the equilibrium for this configuration of parameters is provided in the Appendix). It is similar to Figure 1 with the additional quadrant IV drawing the equilibrium size of the public sector $l^e_B(w)$ as a function of the wage w. The thick curve in quadrant III traces the equilibrium cut-off point $a^e(w)$. This figure shows that an increase in the wage rate affects the equilibrium level of property rights through two channels: the size of the bureaucracy and its quality (or the level of corruption). First, in quadrant IV increasing the net wage rate w makes public jobs more attractive and the size of the bureaucracy, $l^e_B(w)$, increases The larger size bureaucracy improves the enforcement of property rights as long as $l^e_B(w)<1/3$. The usual efficiency wage effect on corruption is also present, and the quality of the bureaucracy improves with the public wage. Holding the size of the bureaucracy constant, this improved quality (honesty) increases expected returns to investment, which is responsible for the jumps in quadrants III and IV at T_0.

In Figure 2, the equilibrium size of the bureaucracy is *non-monotonic* in the wage rate because the quality of bureaucracy, rather than its size, is the important constraint on investment. When $w< T_0$, the bureaucracy is full size and dishonest, and as a result, there is no investment. When the wage level exceeds T_0, bureaucrats prefer not to accept bribes, and the improvement in property rights encourages suppliers to invest. This in turn makes the private sector more attractive because producers obtain higher returns due to suppliers' investment. As a result, a number of agents who would have otherwise applied for a public sector job now prefer to enter the private sector, and the size of the bureaucracy falls to l_B^+, the minimum size required to encourage investment. As the wage rate increases, the size of the public sector first stays at $l_B^+ < 1/3$, and the fraction of suppliers who invest, $\mathcal{J}$, rises towards 1. At w^*, there is full investment ($\mathcal{J}(w) = 1$) and $l^e_B(w)$ starts to increase again until it reaches full size at $1/3$. The *free-lunch* mentioned in the introduction is illustrated by the fact that higher wages in this range create three beneficial effects: (1) Less corruption and thus more investment. (2) A smaller bureaucracy, so a larger number of agents who can work in directly productive jobs. (3) No rationing in the public sector which ensures a better allocation of talent.

Finally observe that given the wage rate, the equilibrium in terms of the allocation of talent, investment and enforcement of property rights is uniquely determined, enabling us to conduct the welfare and political equilibrium analyses by looking at the public wage rate only.

4) Optimal Property Rights Enforcement

In this section, we characterize the optimal degree of property rights. The key to this exercise is a trade-off between the allocation of talent and corruption.

Recall that $1-a^e(w)$ is the number of individuals who apply to a public job at the wage w. Two cases have to be considered depending on whether there is rationing or not. With no rationing of public sector jobs, total surplus is given by:

$$\begin{aligned} Q_S(w) &= V^*(w)\frac{a^e(w)}{2} - \int_0^{a^e(w)} a\,da \\ &= V^*(w)\frac{a^e(w)}{2} - \frac{a^e(w)^2}{2} \end{aligned} \tag{17}$$

where

$$V^*(w) = 2V_0 + q\tau^e(w)[V_1 - V_0 - e] \tag{18}$$

is the expected total value of a pair of entrepreneurs (net of investment costs).

With rationing, total net expected surplus is given by:

$$\begin{aligned} Q_S(w) &= \frac{V^*(w)}{3} - \int_0^{a^e(w)} a\,da - \int_{a^e(w)}^{1} [1 - \frac{1}{3(1-a^e(w))}]\,a\,da \\ &= \frac{V^*(w)}{3} - \frac{1}{2} + \frac{1+a^e(w)}{6} \end{aligned} \tag{19}$$

Because there is full size bureaucracy, the number of ventures is also $1/3$ and total expected output is $V^*(w)/3$. The last term on the RHS of the first line reflects the distortion due to the fact that a random selection of those with talent $a \geq a^e(w)$ (rather than those with a comparative advantage) are accepted to bureaucracy. Also note that given Assumption A, corruption and investment never coincide. In what follows we think of total surplus as a measure of welfare that a utilitarian social planner would maximize. Alternatively, one can think of the allocation we characterize as simply output-maximizing.

First, consider two hypothetical cases: bureaucracy is always corrupt or always honest. We can then use (17) and (19) to plot social surplus under an "always" corrupt bureaucracy, and then an "always" honest bureaucracy. This is done for both regimes in Figure 3. The general shape of the social surplus function is independent of whether equation (17) --no rationing-- or (19) --rationing-- applies. $Q^N_S(w)$ (the curve OABCDN) is for corrupt bureaucracy (and no investment) while the curve $Q^H_S(w)$ (OABD'EFJ) corresponds to the case with an honest bureaucracy. $Q^H_s(w)$ is non-monotonic in the public sector wage, w, illustrating the trade-off between the allocation of talent and property rights protection. On the one hand, increasing the wage rate distorts the allocation of talent because the size of the bureaucracy increases and agents with a comparative advantage for the private sector also apply to bureaucracy. On the other hand, a high public wage improves the protection of property rights and encourages investment because it increases the number of bureaucrats and induces them to be honest. For low wages (OAB), the bureaucracy is too small to induce investment, so a higher wage rate has no other effect than distorting the allocation of talent further, and welfare is initially decreasing in the wage rate. But a sufficiently large increase in public wages discourages corruption and induces investment ($\mathcal{J}(w) > 0$). Until $w = w^*$, the number of applicants to bureaucracy $a^H(w)$ remains constant at $1-l_B^+$ and the allocation of talent is not distorted further. While investment increases from $\mathcal{J} = 0$ to 1, social surplus increases linearly until w^*, at which point all gains from investment are exhausted and surplus is once again decreasing in the wage rate.

The case of an "always" corrupt bureaucracy is more straightforward. Social surplus $Q^N_S(w)$ (OABCDN) is uniformly decreasing in w because in this case entrepreneurs never invest and a higher wage only attracts agents to unproductive activities. Observe also that in regions where there is rationing ($a^e(w) < 2/3$), the welfare function is linear, while it is decreases at a faster rate in the no rationing regime. The reason is that the distortion in the allocation of talent is less important with rationing of public jobs than without rationing because some of the individuals who apply for a public job come back to the private sector when they are turned down.

From the above discussion, social surplus is given as:

$$\begin{aligned} Q_S(w) &= Q^N{}_S(w) \quad \text{when} \quad w < \omega_0 \\ &= Q^H{}_S(w) \quad \text{when} \quad w \geq \omega_0 \end{aligned} \tag{20}$$

For the same configuration of parameters as in Figure 2, $Q_S(w)$ is represented by the thick curve in Figure 3. It joins the relevant parts of the curves that apply with always corrupt and always honest bureaucracy. At the threshold level $w= T_0$, welfare jumps up because bureaucrats stop taking bribes and investment becomes profitable. This is once again the *free lunch effect* whereby the increase in the wage rate prevents corruption and increases the return to entrepreneurship, reducing applications to the public sector.[4]

The optimal level of property rights enforcement can be determined diagrammatically. Point O in Figure 3 is associated with no bureaucracy, no property rights and no investment. Point E at $\min\{w^*, T_0\}$ is a local maximum (with w^* such that $a^e(w^*)= 1-l_B^+$ and $J^e(w^*)=1$). When E is lower than point O, it is never optimal to have property rights protection. This occurs when (V_1-V_0) is small enough (see the Appendix), because with weak enough investment opportunities, it is not worth paying for an honest bureaucracy. Conversely, when investment opportunities are sufficiently high, point E is above O, and there exists a threshold $w_c > w^*$ such that $Q_S(w_c) = Q_S(0)$ (see Figure 3). The optimal degree of property rights protection is characterized by:

Proposition 1*: There exists w_c such that:*

I) When $T_0 > w_c$, then the optimal public wage is equal to 0 and no property rights are enforced.

II) When $T_0 \leq w_c$, then it is socially optimal to have an honest bureaucracy and a positive public wage rate equal to $Max\{w^*, T_0\}$.

Three features are worth noting. First, since enforcement is costly, it is not optimal to enforce all property rights. In fact, it can be shown that the only situation in which full property rights are optimal is when $T_0 \geq w_{FF}$ which is the case where full property rights are necessary for investment.

Second, Proposition 1 reveals that the optimal organization of the society involves rents to public sector employees and misallocation of talent. And yet, these observations are not proof of government failure (see also Acemoglu and Verdier, 1997). The reason is intuitive; property right/contract enforcement is necessary for the redistribution of ex post rents according to ex ante agreements. However, this implies that there will be ex post incentives to violate these property rights, and the rents for the government employees are necessary in order to prevent such violations (corruption). The presence of rents in one sector in turn distorts the allocation of talent and make the enforcement of property rights more costly, creating the trade-off between property right enforcement and the allocation of talent.

Third, note that the condition $T_0 \leq w_c$ is necessary for the protection of property rights to be socially optimal. Since $T_0 = (1-p)/p\ (V_1-V_0)$, better administrative controls as captured by p make it more likely that property right enforcement is optimal. In contrast, a higher level of V_1-V_0 creates

[4] Note that in general the Social Planner can have an additional instrument; to choose the size of the bureaucracy independent of the public sector wage. If this were allowed, the Social Planner would choose a lower size of bureaucracy, but our qualitative results would not be affected.

two opposing effects: returns to property rights protection increase, but the efficiency wage, T_0, that bureaucrats need to be paid also rises. Nevertheless, it can be shown that the first --direct-- effect dominates, and as a result, economies with higher corporate investment opportunities should indeed choose a higher degree of property rights protection. It is often stated that economies with high levels of corruption (e.g. Klitgaard, 1988; Murphy, Shleifer and Vishny, 1991) or those with weak property rights (e.g. North, 1981; Rosenberg and Bridzell, 1986) grow less because they do not invest enough in their corporate sectors. Such a correlation appears to be in the data (e.g. Mauro, 1996; Svensson, 1994). Underlying these statements is a view in which the level of corruption and property rights are exogenous. Our model endogenizes the level of property rights as a function of a measure of corporate investment opportunities, $q(V_1-V_0)-e$, and suggests that differences in the productivity of investments across countries due to autonomous factors will influence both the optimal and the equilibrium level of property rights. Therefore, in interpreting cross-country evidence, it has to be borne in mind that both the degree of corruption and the investment levels are endogenous.

It is also worthwhile to remark that this general equilibrium relationship between property rights and corporate activities may also help us explain Huntington (1968)'s observation that political modernization is often associated with an increase in corruption. This may be partly because in autocratic societies corporate opportunities are limited, therefore, although public sector employees may be willing to accept bribes, there are no bribes to be received. Modernization may encourage investment, and in effect increase *the observed incidence of corruption* (see also next section).

5) Partially Corrupt Bureaucracy and Investment

In the previous section, Assumption A ensured that investment was profitable only when bureaucrats were honest. As a result, bribes were never observed in equilibrium. In this section, we consider the case where investment can be profitable under partial corruption.

We first introduce ex post heterogeneity among bureaucrats. We assume that corrupt bureaucrats incur a dishonesty cost equal to ' (this is sometimes referred to as "moral cost", e.g. Klitgaard, 1988). The exact magnitude of this cost is discovered only after being in the bureaucracy,[5] and is 0 for a proportion ″ of bureaucrats and (for a proportion $1-$ ″. Inspection shows that there exists an additional wage rate level T_1 /$(V_1-V_0)(1-p)/p$ - (/p such that when $w<$ T_1, all bureaucrats are ready to be corrupt, and when $T_1<w<T_0$, only the fraction ″ of bureaucrats with no dishonesty cost will accept bribes, and finally when $T_0<w$, all bureaucrats are honest. The fraction of honest

---

[5] If the dishonesty cost were known before application, there would be an adverse selection problem, which complicates the analysis without changing our main results. See Besley and McLaren (1993) for an analysis of this adverse selection problem.

bureaucrats, x, can now take three values 0, $1- ''$, and 1 and the definition of the equilibrium has to be modified accordingly.

We also replace Assumption A with:

Assumption B: $q.p.(V_1-V_0) < e < q.[(1-'') + ''p].(V_1-V_0)$.

which implies that investment may be profitable even if some of the bureaucrats are corrupt.

Our analysis follows closely that of Section 3. ω_0 and ω_1 are the wage levels at which the two types of bureaucrats are indifferent between honesty and corruption. There is now an additional intermediate regime, which applies when $\omega_1<w<\omega_0$,. Recalling the construction of $a^N(w)$ and $a^H(w)$ in Section 3, the equilibrium cut-off level of talent $a^e(w)$ above which agents apply to bureaucracy can be determined as:

$$\begin{aligned} a^e(w) &= a^N(w) \quad \text{if} \quad w<\omega_1 \\ &= a^P(w) \quad \text{if} \quad \omega_1 \leq w<\omega_0 \\ &= a^H(w) \quad \text{if} \quad \omega_0 \leq w \end{aligned} \tag{21}$$

where $a^P(w)$ is the cut-off level of talent which applies when there is partial corruption among bureaucrats (and is given by equations (A3) and (A4) in the Appendix).

Denoting the wage rate at which bureaucracy reaches full size with partial corruption by w_P, we can see that a complete characterization of equilibrium once again depends on the relative positions of the wage rates w_F, w_{FF}, w_P and ω_0 and ω_1. Since we only want to highlight the additional features due to partial corruption, we focus on the case where $w_F < \omega_1 < w_P < w_{FF} < \omega_0$. At w_F, bureaucracy is full size, but until ω_1 all bureaucrats are corrupt and there is no investment. After this wage rate, bureaucrats with positive dishonesty costs no longer accept bribes, so return to entrepreneurship increases, and fewer agents, l_B^{++} of them, apply to bureaucracy. Then, as the wage rate increases further, first the fraction of entrepreneurs who invest, and then the number of agents applying to bureaucracy increase, until at w_P bureaucracy reaches full size and J=1. At this point, we still only have partial honesty. From that point on, bureaucracy remains at full size until we reach the no corruption regime. Moreover, since w_{FF} is less than ω_0, the no corruption regime, starting at ω_0, is characterized by full size bureaucracy. The new feature compared to the previous sections is the fact that between ω_P and ω_0 investment and bribes coexist.

The welfare analysis is also similar to before. In particular, since agents with a positive cost of dishonesty never receive bribes, (17) and (19) still apply exactly, and inspection of these expressions establishes (proof available upon request):

Proposition 2: *Let w_P^* be the wage rate where investment is fully profitable with partially corrupt bureaucracy ($a^P(w_P^*) = 1-l_B^{++}$). Then as long as $w_P^* < \omega_0$, the output maximizing allocation never has fully honest bureaucracy.*

Proposition 2 demonstrates that the optimal organization of the society may include corruption as well as rents and misallocation of talent. However, this is not because corruption is a more efficient allocation system (e.g. Leff, 1964), but because of precisely the opposite reason: the Planner is trying to implement an allocation which involves transfers from production entrepreneurs to suppliers, and these transfers create room for corruption. Too much corruption would destroy property rights and investment incentives, but preventing all corruption may be excessively costly.

6) Political Equilibrium

In this section, we investigate the degree of property right enforcement which emerges as the political equilibrium based on egalitarian voting. Although there are good arguments for why egalitarian voting is not the appropriate way in which specific economic decisions are taken, we use this as an example to illustrate how the heterogeneous preferences of the individuals may influence these decisions. In this section, the main heterogeneity is between agents who want to become bureaucrats and those who want to become entrepreneurs. To facilitate the treatment we deal with the case where Assumption A holds. The political equilibrium corresponds to a wage rate, w^{pe}, and while choosing this wage rate, agents anticipate the resulting (unique) equilibrium $a^e(w^{pe}), l_B^e(w^{pe}), \tau^e(w^{pe}), X^e(w^{pe})$ characterized Section 3.

We assume that voting takes place before career choices but also suppose that the wage rate that can be chosen is bounded above by w^{sup} such that at all wage rates $w \# w^{sup}$, the number of applicants to the public sector $1-a(w)$ is less than ½.This implies that, given the restriction on the voting alternatives, at least half of the agents in the economy have exactly the same preferences over wages. Therefore, they will all vote for the same wage rate.

The utility of a representative majority voter (gross of cost of entry) is:

$$U_E(w) = V_0 + \tau^e(w)\frac{\left(1-\frac{2l_B^e(w)(1-x^e(w))(1-p)}{1-l_B^e(w)}\right)q(V_1-V_0)-e}{2} - \frac{l_B^e(w)w}{1-l_B^e(w)}.$$

where the superscript e denotes the equilibrium characterized in Section 3. Recall that when $x^e(w)<1$, there is no investment, and this has already been incorporated into the expression.[6]

The entrepreneur always receives V_0 and pays taxes equal to $l_B^e(w)w/(1-l_B^e(w))$ where $l_B^e(w)$ is the equilibrium size of bureaucracy at wage rate w. Additionally, if property rights are enforced, each entrepreneur, when selected for a supplier role (probability ½), prefers to invest and incurs the cost e. When there is investment ($\tau^e>0$), an entrepreneur therefore anticipates to receive V_1-V_0 in three different scenarios; when he is the production entrepreneur and there is no bureaucrat; when he is the supplier and there is an honest bureaucrat; and finally when he is the supplier, and there

[6] The full expression for taxes is: $w[1-\tau^e(w)pq(1-x^e(w)]l^e_B(w)/(1-l^e_B(w))$. We have already incorporated the fact that for $x^e(w) < 1$, $\tau^e(w)=0$, so taxes are equal to $wl^e_B(w)/(1-l^e_B(w))$.

is a dishonest bureaucrat who is detected. The sum of these terms give the additional expected return.

Substituting the equilibrium public sector size $l^e_B(w)$ and the cut-off talent level point $a^e(w)$ and simplifying, we obtain an expression for the expected return of a typical entrepreneur:

$$
\begin{aligned}
U_E(w) &= U_E(0) && \text{when} \quad w \leq V_0 - 1 \\
&= w + a^N(w) && \text{when} \quad V_0 - 1 < w < \omega_0 \\
&= w + a^H(w) && \text{when} \quad w \geq \omega_0
\end{aligned}
$$

As was the case with the output maximizing allocation, the expected return to an entrepreneur, U_E, has a local maximum at E = min $\{w^*, T_0\}$, so the median voter (entrepreneur) would like to choose the minimum level of bureaucracy sufficient to encourage investment. For this local maximum to entail higher output than the allocation without property rights, investment opportunities $(V_1 - V_0)$ need to be sufficiently large. Equivalently, let w_c' be such that $w_c' > w^*$ and $U_E(w_c') = U_E(0)$. Then the optimal degree of property rights protection in the political equilibrium is characterized by

***Proposition 3**: (a) When $T_0 > w_c'$, the political equilibrium public wage is equal to 0 and no property rights are enforced.*

(b) When T_0 # w_c', the political equilibrium wage rate max$\{w^*, T_0\}$ and property rights are enforced.

(c) In the political equilibrium, there is never more property rights than the output maximizing allocation.

The proof mirrors that of Proposition 1 and is omitted. Although the political equilibrium also involves a choice between points O and E in Figure 3, the exact conditions for this choice are different than in Proposition 1 (i.e. the two threshold wages w_c and w_c' are different). The conditions for the property rights enforcement to be privately preferred are more stringent. As a result, the political equilibrium may lead to less property rights than the output maximizing allocation. What is the intuition? There are two differences between Propositions 2 and 3: first, the median voter ignores the rents received by the bureaucrats, and second, he ignores the misallocation of talent induced by these rents since he is not the marginal agent. The first --direct-- effect always dominates the indirect effect, and causes wages and the enforcement of property rights to be too low.[7]

6) Concluding Comments

---

7 When there is heterogeneity among entrepreneurs, there can be "too much" property rights enforcement in the political equilibrium. For example, agents who are more likely to be suppliers prefer more secure property rights, and may be the majority. The reason for too much enforcement in this case is that property rights do not only encourage investment, but also redistribute rents.

In the absence of a state to enforce agreements, contracts are incomplete, and investments that need contractual guarantees will be curtailed. Therefore, there is a need for some of the agents to be employed to uphold property rights and enforce contracts, and it has to be ensured that these agents are not corrupt. Because preventing corruption is costly, an intermediate level of property right enforcement may be optimal, and it may be too costly to prevent all corruption. We also show that despite the trade-off between investment and the allocation of talent, there can be a range where the society has a free-lunch: increasing public sector pay may simultaneously increase investment and improve the allocation of talent. This is because better property rights induced by higher public sector pay make the private sector more profitable, reducing applications to the public sector.

We used a simple model to highlight the trade-off between property right enforcement and allocation of talent. A number of extensions and important issues are left for future work.

1) It is possible to endogenize the amount of bureaucratic control within the government (i.e. endogenize p). This can be done by introducing a hierarchy of agents monitoring each other (e.g. Rose-Ackerman, 1974; Carrillo. 1996), or by allowing the public sector itself choose the rules by which it functions (which appears to be the de-facto situation in many countries). In either case, the result is likely to be an intermediate value of p. It would be too costly for the society to create a large enough bureaucracy so that each public sector employee is perfectly monitored. It would also be self-detrimental for the bureaucracy to choose a very low value of p because this would make the public sector of little use and induce the society to dismantle the bureaucratic machinery.

2) A dynamic extension of such a model would also be useful. An interesting result that arises from such an extension is that past levels of property rights determine the willingness of agents to pay for future property rights. For example, if weak property rights induce the current generation to choose low levels of human capital, they will have less to benefit from future improvements in property rights, and will not be willing to vote for them. This type of persistence in the organization of society may condemn some countries to a low property right-low investment trap (see for example, Acemoglu, 1995; Tirole, 1996; for models with this flavor).

3) A dynamic model would also be useful in providing predictions on the likely path of property rights enforcement over the course of development. Our comparative static results suggest that less developed economies may prefer lower levels of property right enforcement and may be more tolerant towards corruption. However, it is not clear how such results can be obtained in a fully dynamic model, and whether the forces highlighted here can explain the emergence of centralized governments as in seventeenth century, and then the gradual increase in the role of the government.

4) Finally, the results presented here invite further empirical work. Can we identify anything like the free-lunch effect? Is there any evidence that less developed economies are more tolerant towards corruption (rather than corruption condemning them to underdevelopment)? Does corruption harm growth through its impact on investment? How can we quantify costs and benefits of corruption and

property right enforcement?

Appendix:

In the text, we analyzed equilibria for $w_F < T_0 \# w^* < w_{FF}$ diagrammatically. Here, we characterize the equilibrium more formally.

Proposition A1*: Suppose Assumption A holds and $w_F < T_0 \# w^* < w_{FF}$, the equilibrium tuple $(l^e_B(w), a^e(w), J(w))$ is given by: [I] (0,1,0) if $w< V_0 -1$; [II] $(1-a^N(w),a^N(w),0)$ if $V_0-1 \# w \# w_F$; [III] $(1/3, V_0/2 - 3w/2, 0)$ if $w_F \# w \# T_0$; [IV] $(l_B^+, 1-l_B^+, J(w) O (0,1))$ if $T_0 < w \# w^*$; [V] $(1-a^I(w), a^I(w), 1)$ if $w^* \# w < w_{FF}$; [VI] $(1/3, [V_1-V_0-e]/2 + V_0 - 3w/2, 1)$ if $w_{FF} \# w$.*

The proof is straightforward by working through the cases. When $w< V_0 -1$, the wage rate is too low to attract agents to the public sector and $a^e(w)=1$. $V_0-1 \# w \# w_F$, bureaucracy is less than full size and corrupt, so there is no investment. At w_F, the bureaucracy reaches full size, but still with no investment. Once the wage reaches T_0, bureaucrats stop taking bribes, and investment is profitable. At this point, applications to bureaucracy fall to l_B (if there were less than l_B^+ bureaucrats, investment would not be profitable). As the wage increases, first there is no more application to bureaucracy, but a larger fraction of suppliers invest, increasing the return to entrepreneurship and keeping the agent with $a=1-l_B^+$ indifferent between entrepreneurship and bureaucracy, despite the larger wage. At w^*, the number of applications to the public sector start increasing again, and at w_{FF}, bureaucracy reaches full size, all bureaucrats are honest, and all suppliers invest ($J=1$).

Characterization of the Social Surplus Curve and Proof of Proposition 1:

Suppose Assumption A holds and $w_F < T_0 \# w^* < w_{FF}$, then total surplus is given by:

$$
\begin{aligned}
Q_S(w) &= Q_S^N(w) = V_0 -1/2 && \text{if } w \# V_0 -1 \\
&= Q_S^N(w) = a^e(w)(V_0-a^e(w))/2 && \text{if } V_0-1 \# w \# w_F \\
&= Q_S^N(w) = 2V_0/3 - 1/3 + a^e(w)/6 && \text{if } w_F \# w < T_0 \\
&= Q_S^H(w) = (1-l_B^+)[V_0 + J(w)[q(V_1-V_0)-e]/2-(1-l_B^+))/2] && \text{if } T_0 \# w < w^* \\
&= Q_S^N(w) = a^H(w)[V_0 + q[(V_1-V_0)-e]/2-a^H(w)/2] && \text{if } w^* \# w < w_{FF} \\
&= Q_S^H(w) = [2V_0 + q(V_1-V_0) - e]/3 - 1/3 + a^H(w)/6 && \text{if } w_{FF} \# w
\end{aligned}
$$

Again the proof is straightforward by simply working through the different cases. It is also clear from the expression that the local maximum of $Q_S^H(w)$ is at w^*, and is greater than $Q_S^N(0)$ if $q(V_1-V_0)-e$ is sufficiently large. More precisely, $Q_S^H(4)<Q_S^N(0)$ and $Q_S^H(w^*)>Q_S^N(0)$, and $Q_S^N(w)$ is monotonically decreasing after w^*. Therefore, there exists a unique w_c such that $Q_S^H(w_c)=Q_S^N(0)$. If $T_0 > w_c$, point E can never be reached, i.e. $Q_S(w_c)=Q_S^N(w_c)$, so no property right enforcement is optimal. If $T_0 < w_c$, then $Q_S(w_c)=Q_S^H(w_c)$, so E is above O, and the output maximizing public sector wage rate is w^*.

Characterization of the cut-off point $a^P(w)$ under partial corruption :

In the partial corruption regime, the ex ante return of bureaucracy is:

$$U_B(w,\tau) = (1-\tau q\alpha)w + \tau q\alpha(w+V_1-V_0)(1-p)$$
$$= w + \tau q\alpha p(\omega_0 - w)$$

which is similar to (5) in the text, except that the ex ante probability for a bureaucrat to be corrupt is Jq ″ because only bureaucrats with no dishonesty cost accept bribes.

The expected return to an entrepreneur is again given by (2) with $x = 1-$ ″, which implies that the threshold size of bureaucracy for investment to be profitable is:

$$l_B^{++} = \frac{e}{e+2q(V_1-V_0)[1-(1-p)\alpha]} > l_B^{+} \tag{A1}$$

For example, if $l_B > l_B^{++}$, then J=1. Using equations (A1) and (2) in the main text, the expected return to entrepreneurship is:

$$U_E(a,l_B,T) = V_0 + \tau(l_B)\frac{q(V_1-V_0)[1-(1-p)\alpha\frac{2l_B}{1-l_B}] - e}{2} - a - T \tag{A2}$$

Using the budget constraint (6) with $x=1-$ ″, the cut-off point $a^P(w)$ above which individuals apply to a public job (as long as bureaucracy is less than full size and partially corrupt) is characterized by:

$$\begin{aligned} w + \tau(l_B)\, q\,\alpha\, p(\omega_0 - w) &= V_0 + \tau(l_B))\frac{q(V_1-V_0)[1-(1-p)\alpha\frac{2l_B}{1-l_B}] - e}{2} \\ &\quad - a^P(w) - \frac{l_B}{1-l_B}[1-\tau(l_B)\,\alpha\, qp]w \\ and \quad l_B &= 1 - a^P(w) \end{aligned} \tag{A3}$$

Simplifying terms and using the definition of T_0, when $l_B = 1/3$, $a^P(w)$ is:

$$a^P(w) = V_0 - \frac{3}{2}w - \frac{3}{2}\alpha p q(\omega_0 - w) \tag{A4}$$

References

Acemoglu, Daron (1995);"Reward Structures and the Allocation of Talent" forthcoming *European Economic Review*. January 1995, pp 17-33.

--------------------- and Thierry Verdier -(1997) “The Choice Between Market Failures and Corruption” MIT Working Paper.

Banerjee, Abhijit (1997);"A Theory of Misgovernance" MIT mimeo.

Becker, Gary. S. (1968);"Crime and Punishment: An Economic Approach" *Journal of Political Economy* pp 167-217

-------------- and George J. Stigler (1974);"Law Enforcement, Malfeasance and the Compensation of Enforcers" *Journal of Legal Studies* Vol 3, pp 1-19.

Besley, Timothy and John McLaren (1993);"Taxes and Bribery: The Role of Wage Incentives" *Economic Journal* Vol 103, pp 119-141.

Carrillo, Juan D. (1996);"Corruption in Hierarchies" University of Toulouse Mimeo.

DeSoto, H. (1989); *The Other Path: The Invisible Revolution in the Third World* New York, Harper.

Donahue, John D. (1989); *The Privatization Decision* New York: Basic Books.

Huntington, Samuel P. (1968); *Political Order in Changing Societies* Yale University Press

Klitgaard, Robert (1988); *Controlling Corruption*, University of California Press

----------------------- (1989);"Incentive Myopia" *World Development* Vol 17, 447-459.

Leff, Natheniel (1964);"Economic Development Through Bureaucratic Corruption" *American Behavioral Scientist*, pp 8-14.

Mauro, Paolo (1995); “Corruption, Country Risk and Growth” *Quarterly Journal of Economic,* Vol 110, pp 681-712.

Mookherjee, Dilip and I. L. Png (1994); “ Corruptible Law Enforcers: How Should They be Compensated?” *Economic Journal* Vol 105, pp 145-159.

Murphy, Kevin, Andrei Shleifer and Robert W. Vishny (1991);"The Allocation of Talent: The Implications For Growth" *Quarterly Journal of Economics* Vol 106, pp 503-530.

Mydral, Gunner (1968); *The Asian Drama: An Inquiry into the Poverty of Nations* New York the 20th Century Fund.

North, Douglas, C. (1981); *Structure and Change in Economic History* New York, Norton

--------------------- (1990); "Institutions and Transaction-Cost Theory of Exchange" in James Alt and Kenneth Shepsle (editors) *Perspectives on Positive Political Economy* Cambridge University Press.

---------------------- and R. P. Thomas (1973); *The Rise of the Western World: A New Economic History* Cambridge University Press.

Rose-Ackerman, Susan (1975);"The Economics of Corruption" *Journal of Public Economics* Vol 4, pp 187-203.

Rosenberg, Nathan and L. E. Bridzell Jr. (1985); *How the West Grew Rich?* New York basic Books.

Sartre Pierre-Daniel (1997);"Informality and the Nature of Bureaucracies in a Model of Long-Run Growth" Federal Reserve Bank of Richmond Mimeo.

Shleifer, Andrei and Robert W. Vishny (1993);"Corruption" *Quarterly Journal of Economics* Vol 108, pp 599-618.

Svensson, Jakob (1994);"Investment, Property Rights and Political Instability: Theory and Evidence" Stockholm, mimeo

Tirole, Jean (1996); "A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality" *Review of Economic Studies* Vol 63, pp 1-22.