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

Daron Acemoglu
Thierry Verdier

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massachusetts institute of technology

50 memorial drive
cambridge, mass. 02139

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Daron Acemoglu
MIT

and

Thierry Verdier
CERAS and DELTA

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Abstract

We consider an economy where property rights are necessary to ensure sufficient rewards to ex ante investments. Because enforcement of property rights influences the ex post distribution of rents, there is room for corruption. We characterize the optimal organization of the society and optimal degree of property right enforcement subject to incentive constraints of the agents. We find that three frequently mentioned government failures arise quite naturally as part of the optimal mechanism; (i) rents for government employees, (ii) corruption, and (iii) misallocation of talent. Therefore, these observations are not in themselves proof of government failure. We also discover that the general equilibrium aspect of our model leads to a number of new results: there may exist a "free-lunch" such that over a certain range it is possible to simultaneously reduce corruption, misallocation of talent and increase investments; and it will often be the case that bureaucracies will impose a certain amount of self-discipline.

"What distinguishes property from mere momentary possession is that property is a claim that will be enforced by society or the state, by custom or convention or law." C. B. Macpherson [1978]

"A coercive third-party is essential to constrain the parties to exchange when the contracts essential to realizing the productive potential of modern technology extend across time and space and involve impersonal exchange with other." D. North [1991, p.194].

"The society... buys the amount of enforcement which it deems appropriate to the statute or rule: more will be bought if the statute serves a more valuable goal... and if a given increase in enforcement is less expensive." G. Becker and G. Stigler [1974, p.3].

I. Introduction

Despite prevalent market failures, many economists and social scientists are wary of government intervention (e.g. Mills [1986], Shleifer and Vishny [1994]). Three concerns, often suggested as arguments in support of limited government, are:

1) Governments pay excessive salaries (rents) to their employees. This claim receives support from studies using U.S. data (e.g. Katz and Kruger [1991], Poterba and Ruben [1994]) as well as casual empiricism from developing countries.

2) Government intervention brings corruption. Case studies of bureaucratic corruption and casual empiricism (e.g. Mydral [1986], Carino [1986], DeSoto [1989]) support this argument.

3) Government intervention distorts the allocation of resources, in particular the allocation of talent (e.g. Lal [1985], Donahue [1989]). There are many stories of talented young men and women, especially in developing countries, entering the civil service only to sit at unproductive desk jobs.

Are these concerns justified? In this paper we argue that these three 'failures' of the state need not be real failures at all: even in its most basic role as the protector of property rights, the implementation of the government's duties will lead to the presence of rents for many bureaucrats, to corruption, and to misallocation of resources. However, these are not proof of government failure but signs of the tight incentive constraints that even the simplest form of government intervention has to live with.

Although our model can be extended to other (useful) roles of the government, the protection of property rights is the least controversial role of the state accepted by political philosophers as diverse as David Hume, Karl Marx and Robert Nozick. Moreover, it is because economic agents trust that the state will enforce their claims that they undertake long-term investments and accumulate wealth. The importance of secure property rights in the development process has also been repeatedly emphasized (e.g. Mydral [1986], North and Thomas [1973]). For instance, Braudel [1977] argues that the lack of transfer of wealth between generations, which is a limitation on property rights as we understand them today, was one of the key reasons for the lack of accumulation incentives in Eastern societies.

An understanding of the role and duties of the government requires an analysis of (1) the cost of government action as emphasized by Becker and Stigler [1974], and the incentives of government employees as emphasized by the literature on corruption (e.g. Rose-Ackerman [1975]). These considerations take us to an economy in which some agents choose to work in the public sector to enforce property rights. More specifically, public sector employees ("bureaucrats")[1] inspect bilateral business partnerships and make reports upon which the compensation of the parties in this business venture will be based. The importance of this report is that ex ante anticipation of an appropriate report, thus of an appropriate reward scheme, will encourage entrepreneurs to undertake productive investments. The key problem however is that since the report of the bureaucrat will influence the ex post distribution of income and rents, there will be influence activities that entrepreneurs would like to engage in. In other words, there will be room for corruption.

How can the honesty of bureaucrats be ensured? Although there are a number of methods in practice, many of these involve increasing the attractiveness of the job while imposing punishments for taking bribes (e.g. Rose-Ackerman [1975], Besley and McLaren [1993]). We model this in a simple way as an *"efficiency wage"* for the bureaucrats. However, this immediately introduces an important cost; since there is a "rent" in one of the sectors of this economy, the allocation of talent does not take place according to the *comparative advantage* principle, thus the efficiency wage induces a *misallocation of talent*. Moreover, given that the prevention of corruption is costly (in terms of leading to a misallocation of resources), it will often not be optimal to prevent corruption completely. Thus, our first and key result is that the *optimal organization* of the economy will involve a government sector whose role is to protect property rights and to set the ground rules for private exchange. But more importantly, in this optimal organization of the society, there will be *corruption*, *rents* for government employees and *misallocation of talent*. At this point, it is useful to contrast our key result to an intuition dating at least back to Leff [1964] which claims that corruption is not a proof of market failure, but instead a sign of markets circumventing the artificial barriers erected by governments. Our conclusion could not be more different than Leff's: in our economy corruption is an evil that the society has to put up with in order to benefit from necessary government intervention in the most economical way. This conclusion is also in line with some of the historical accounts of government intervention. For instance Wade [1990] documents the problems of government intervention but also stresses the importance of such intervention for East Asian Development.

In addition to this main conclusion, we draw a number of further insights from our analysis: 1) An important issue occupying the minds of, among others, Locke, Hume and Rousseau is the

[1] Throughout the paper we will use public sector employee interchangeably with bureaucrat. This is not because we believe that enforcing property rights is bureaucrats main role. Rather, this terminology facilitates the exposition and also stresses that other roles of bureaucrats in practice often involve ex post redistribution and thus similar issues arise.

degree of just or optimal property rights. Our analysis, following Becker and Stigler, takes an economist's approach by emphasizing the costs and benefits of property rights enforcement. On the cost side, government interventions have to ensure the honesty of the agents responsible for enforcing these property rights. On the benefit side, property rights provide incentives for a better allocation of resources. In contrast to Becker and Stigler, however, we show that general equilibrium interactions are important in this process, and also that because property rights not only provide incentives but also distribute rents, the degree of property rights enforcement that arises as the result of political equilibrium may differ from the optimal amount.

2) We also discover that the size of corporate relative to non-corporate sector is a key determinant of the degree of optimal and equilibrium enforcement. This is an important observation because a correlation between the development level of an economy and the degree of property rights is often noted, both in the cross-section and time-series. For instance, in Mauro's [1995] empirical work an index of corruption is found to be negatively correlated with investment and growth, Svensson [1994] shows that an index of property rights enforcement is positively correlated with investment and growth and negatively correlated with political instability. Further, Alesina et al [1992] document the negative correlation between political instability and growth, and many scholars of development blame underdevelopment partly on weak property rights and corruption (e.g. North and Thomas [1973], Mydral [1968]). Do these correlations arise because societies that do not enforce property rights cannot develop? Our analysis suggests that the reverse causality is a factor to be taken into account[2]; economies with less productive investment opportunities will tend to choose a lower level of property rights enforcement (which then of course reduces investment incentives further).

3) An obstacle to efficient government is that in contrast to our simple story where the optimal organization of the society is somehow implemented, government officials in general will have the power to look after their own interest (e.g. Shleifer and Vishny [1993]; also see Wilson [1989] on the influence of bureaucracies on the set of the rules they face). This could be one of the major arguments in favor of limiting the size of government. However, a simple extension of our model demonstrates that even when bureaucrats have the power to look after their own interest, they will naturally impose some degree of discipline on themselves. Further, this observation suggests an explanation for why bureaucracies, for instance the French [Crozier, 1956] or many Latin American organizations [Sloan, 1989], have rigid structures and a variety of codes that reduce discretion of

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[2] It is natural to ask then whether this reverse causality means that the often made assertions that corruption (e.g. Klitgaard [1988] or Mydral [1968]) or low levels of property rights (Rosenberg and Bridzell [1968]) may jeopardize the development of an economy are incorrect. The answer is no. An earlier version of our paper showed how a dynamic equivalent of our economy may get stuck in a high corruption and low property rights equilibria. The intuition of this result is similar to Acemoglu [1995]; anticipating low property rights, agents invest less and thus support low property rights in the future which in turn contaminates future investment and political decisions. Details available from the authors upon request.

individual bureaucrats.

Finally, although the basic intuition underlying our argument is simple, we use a general equilibrium model to formalize our claims. However, this analysis is also not without its rewards. First, this places us among the papers that emphasize the determination of organizational relations in a general equilibrium context (to name a few, Banerjee and Newman [1993], Legros and Newman [1995], Acemoglu and Zilibotti [1995]), but with a very different scope. Second, our analysis enables us to distinguish clearly between two distinct constraints on the enforcement of property rights: (i) the number of bureaucrats; (ii) their honesty; and which one of these constraints is more severe has interesting implications. Third, we discover a general equilibrium *free-lunch* effect; we show that an increase in the public sector wage rate not only reduces corruption but also improves the allocation of talent. This happens because an increase in the public sector wage prevents corruption and makes investment more profitable for the entrepreneurs, thus the private sector may become sufficiently attractive relative to the public sector. This is an important observation since the emphasis on the costs of government intervention and the increasingly severe fiscal constraints, may have led an *over-reaction* by many developing countries in cutting public sector salaries. In particular, in a recent paper, Klitgaard [1993] argues that there is "incentive myopia" in government sectors of many countries because bureaucrats are badly selected and paid too little to do their jobs properly. Our free-lunch effect suggests that increasing the pay of bureaucrats may be less costly than it first appears.

There is only limited work on the determination of property rights, corruption and allocation of talent in an equilibrium framework. In this respect our paper is definitely related to the principal-agent approach to law enforcement pioneered by Becker [1968] and Stigler [1970], for recent contributions, see Besley and McLaren [1993] and Carrillo [1995]. However, in contrast to the partial equilibrium nature of these papers which take the costs and benefits as exogenously given, in our model these are derived endogenously. Banerjee's [1994] model of bribes, though again partial equilibrium, is also related; bureaucrats accept bribes because they have a different utility function than that of the government which is trying to implement an allocation that does not maximize revenues. In Banerjee's model, as in ours, corruption may be an unavoidable price to pay for the implementation of certain allocations.

Finally, our paper is also linked to the rapidly growing literature on rent-seeking. Contrasting our result with this literature is a good way of emphasizing some of our key intuitions. The rent-seeking literature stresses the conflicts between different groups in society in dividing the rents (see Tornell [1993], Acemoglu [1995], Hirshleifer [1995] for recent contributions). In many instances, a group - like bureaucracy or elites - is argued to be in dire conflict with the rest of the population (see Mills [1986] or Olson [1991] for statements along these lines, or Grossman [1991] and Ades and Verdier [1994] for economic models). In our economy too, a group of agents, the bureaucrats,

become the ex post "rent-seekers". However, our paper differs from this literature in that we investigate the microfoundations, and the general equilibrium interactions and a number of very different insights arise. First, as noted above, although bureaucrats act as rent-seekers and are often corrupt, their existence is necessary to solve more important market failures. Second, although there is conflict between the bureaucrats and the entrepreneurs in the distribution of rents, there are also important conflicts among entrepreneurs themselves, and despite all these conflicts the general equilibrium interactions imply that interests of different groups can be aligned in certain situations, i.e. our free lunch effect. And finally, our result in section VII shows that the bureaucrats, as a group, will often prefer to impose discipline on themselves, thus reducing the amount of social conflict.

The plan of the paper is as follows. Section II outlines the basic framework. Section III derives the equilibrium allocations, corruption and investment levels for given public sector wage rate. Sector IV derives the optimal degree of property rights and the optimal organization of the economy subject to the incentive constraints. This section demonstrates that rents for public sector employees and misallocation of talent will be part of the optimal organization. However, under the parameter configurations of section IV, corruption never arises as part of the optimal mechanism. Section V shows that in a different region of the parameter space, the optimal organization will exhibit corruption as well as rents and misallocation of talent. Section VI turns to political equilibrium. Section VII suggests how bureaucratic self-control can be endogenized. Finally, section VIII concludes while an appendix contains all the proofs.

II. The Model

Our economy consists of a continuum of risk-neutral agents, with measure normalized to 1. Each agent can enter one of the two occupations in this economy; entrepreneurship or the public sector. Production takes place in the private sector of this economy but the public sector will be necessary to enforce property rights. Agents in this economy 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 assumed to be the private information of each agent.

The entrepreneurial sector

To enter entrepreneurship, each agent has to incur the cost of human capital investment, $C(a)$. For simplicity we will consider the linear case $C(a) = a$. Production in this economy takes place in pairs of entrepreneurs randomly matched. There are two complementary functions in a project: Production, P, and Marketing, M. After a pair is formed, these two functions are also randomly allocated between the entrepreneurs. After this assignment, the production entrepreneur

has an additional investment decision which costs e. The project is run and its realized value is denoted by V. This value depends on whether the production entrepreneur, P, has invested or not. If he has not invested, V takes the value V_0 while if he has made the investment, with probability $(1-q)$, $V=V_0$ and with probability q, $V=V_1$. We assume that $q(V_1-V_0) > e$, so the ex ante investment is (socially) profitable.

Whether the production entrepreneur invests or not will depend on the returns he expects. An optimal contract would pay a fixed return to the marketing entrepreneur and make P the residual claimant thus inducing the right investment incentives. Thus M would receive R $(< V_0)$ while P gets the rest[3], $V-R$. However, there is one problem with this contract; in our economy, V accrues to and is only observed by the marketing entrepreneur, M, and he will therefore have an incentive to claim that $V=V_0$ and keep the difference when the project has a higher return. As a result, the production entrepreneur will never invest and socially beneficial investment opportunities will remain unexploited. But the introduction of a public sector helps by ensuring that M reports truthfully and thus enforcing *property rights*[4].

The public sector

Agents can enter the public sector at no cost [a normalization] and they will be employed to enforce property rights. More specifically, each bureaucrat is matched with a pair of entrepreneurs and observes the realization of the return. He can consequently enforce the appropriate payments between the two entrepreneurs. He would report a value of $V \in \{V_0, V_1\}$ and conditional upon this report the marketing entrepreneur, M, has to pay $V-R$ to the production entrepreneurs, P. Now consider the situation in which $V=V_1$; if the bureaucrat reports V_0 instead of V_1, M would gain V_1-V_0, thus will have an incentive to offer part of this return to the bureaucrat and induce him to misreport. In what follows we will assume for simplicity that whenever there is corruption (bribery) all the benefits accrue to the bureaucrat, thus the bribe will be equal to V_1-V_0[5].

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[3] We assume that such a contract can be written and committed to. For instance, this contract can be written at the point when the entrepreneurs meet but before the assignment is made. Alternatively, such a contract may be specified by law. Parenthetically, there is an interesting effect that we are ignoring; the agents may choose a contract that reduces the bribes that the bureaucrat can receive.

[4] It is worth emphasizing that since the outcome of the project is not observed by the production entrepreneur, without the bureaucrats, there is no contract that can induce investment. Thus we are not artificially restricting the contract space of the private agents. It could also be argued that the role we assign to the public sector can be played by a collection of private agents. Given the set-up of our model this is certainly possible. In this however the equilibrium would depend on the market structure and entry conditions for this sector, and in general the constrained optimum will not be reached.

[5] We assume that only M offers bribes and thus V will only be under-reported; P never offers bribes to make the bureaucrat over-report. This is natural because P does not observe the actual realization, and under our assumption that the bureaucrat has all the bargaining power in the bribe game, P will prefer not to offer bribes and hope for an honest bureaucrat and $V=V_1$. Further, given our assumptions, at the time of the bribe, the entrepreneur will have no funds and the bribe will have to be paid ex post which will introduce reverse hold up problems. In any case, allowing for this would not change our

However, two forces mitigate the problem of corruption. First, each bureaucrat has a probability p of getting caught in which case he loses all his wage and bribe money. This probability of getting caught, p, is first taken as an exogenous parameter capturing the degree of severity of administrative control on bureaucratic corruption. We will endogenize this probability in section VII as a self-discipline mechanism of the bureaucracy. Second, corrupt bureaucrats incur a dishonesty cost equal to Γ (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[6] and is supposed to take two possible values: *0* for a proportion α of bureaucrats, and γ for a proportion *1-*α. In particular, since each bureaucrat is assumed to extract the whole surplus, when he meets a pair of entrepreneurs with a successful investment, he will accept bribes provided that:

$$W-T < [W-T+(V_1-V_0)](1-p) - \Gamma \qquad (1)$$

where W is the gross public sector's wage rate, T is the lump-sum tax imposed on all agents, Γ is the dishonesty cost and p is the probability of being caught when dishonest. It is important that Γ is non-observable and it is therefore not possible to pay differential wages conditional on Γ. 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. Given this form, we can define w=W-T, the net wage of bureaucrats and carry out our analysis with this variable[7].

Let us now define

$\omega_1 = (V_1-V_0)\ (1-p)/p - \gamma/p$ and $\omega_0 = (V_1-V_0)\ (1-p)/p$.

According to equation (1), when $w < \omega_1$, all bureaucrats are ready to be corrupt; when $\omega_1 \leq w < \omega_0$, only the fraction α of bureaucrats with no dishonesty cost will accept bribes; finally when $\omega_0 \leq w$, all bureaucrats will be honest.

Allocation of Talent:

Let l_B be the size of the bureaucracy. Since one bureaucrat per project is sufficient to enforce property rights and two entrepreneurs are necessary to run a project, it is clear that a size of the bureaucracy $l_B > 1/3$ means more bureaucrats than the number of projects to be monitored, thus

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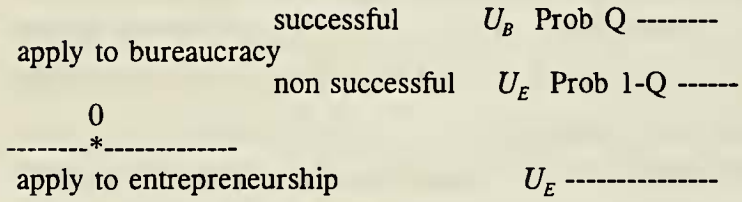
results. Also note that the assumption that the bureaucrat receives all the surplus as the bribe just simplifies the notation but does not affect our results.

[6] This assumption enables us to ignore the adverse selection problem. Without this assumption, dishonest people would be more willing to apply to public sector jobs (e.g. Besley and McLaren [1993]). However, if we were to allow for this effect, it would also be necessary to introduce the possibility that some honest agents would be keen to become a bureaucrat because of non-pecuniary reasons.

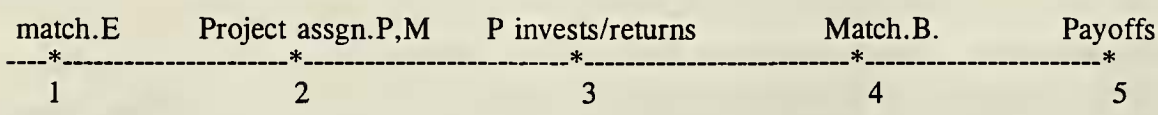
[7] This emphasizes that we could have made the alternative assumption that only entrepreneurs pay taxes and bureaucrats are paid w and obtain exactly the same expressions and results. Another alternative which would not change our results but complicate our expressions is for the government to only pay bureaucrats who have matched with a pair of entrepreneurs or to make the bureaucrats salary conditional on his report.

wages are paid to socially useless bureaucrats. While this may be an important source of inefficiency in many real economies [e.g. Shleifer and Vishny, 1994], here we abstract from this problem and assume that $l_B \leq 1/3$. This will help us concentrate on the determinants of the trade-off between property rights enforcement and the allocation of talent. As a result of this restriction on the size of the bureaucracy, too many people may apply to the public sector for certain levels of the public sector wage rate, w. Here our assumption that talent is not publicly observed becomes important. The government cannot condition its hiring decisions on the talent of the applicants [and since agents have no additional wealth in this economy, screening mechanisms in which the government charges an application fee, i.e. sells the jobs, but still later pays an efficiency wage are not implementable]. As a result, the government is forced to use uniform rationing among the pool of applicants and individuals who do not receive a job in the bureaucracy have no alternative but to enter the only other occupation, the private sector. Misallocation arises because government's rationing does not necessarily select the agents with a comparative advantage for the public sector. This will be an important source of inefficiency in the model: when the government tries to reduce corruption, it will often deteriorate the allocation of the key resource of this economy; talent.

Diagrammatically, the sequence of decisions takes the following form;



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, the timing of these events is as follows.



In stage 1 entrepreneurs match randomly. In stage 2 production and marketing functions are allocated in each venture. In stage 3 the production entrepreneur, P, decides whether to invest or not and after this investment decision, the return of the project is realized. In stage 4, ventures are matched randomly with bureaucrats who can verify the realized value of the project. At this stage bureaucrats can be bribed. Finally in stage 5, payoffs are paid to entrepreneurs according to the value announced by bureaucrats. It should be noted that when bureaucracy is less than full size (less than *1/3)*, some ventures will not have a bureaucrat; then, the M entrepreneur observes the realized value of the project and reports it and since there is no way to falsify it, payments are based on his report.

Obviously, in this case the marketer will always claim $V=V_0$ and the production entrepreneur will be paid[8] V_0-R. We can now write the expected return of an entrepreneur before the project assignment stage as;

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

Let us now explain this expression. When an agent decides to become an entrepreneur, he does not know what function he will be assigned to. With probability *1/2*, he will become the marketer and receive R. However, he may also get some additional returns; if the corresponding production entrepreneur invests (probability τ), the return will be high (with probability q) and he may try to hide this. Yet, this can only happen when there is no bureaucrat assigned to this project. Why? Because if there is a bureaucrat, either he will be honest in which case the production entrepreneur will get the additional returns or he will be dishonest and appropriate all the returns. Thus this second term is multiplied by $1-2l_B/(1-l_B)$ which is the probability of <u>not</u> meeting a bureaucrat. Conversely, with probability *1/2*, the agent becomes the production entrepreneur; in this case, he gets V_0-R for sure but also may choose to invest and obtain the net return of investment. Whether he finds it profitable to invest will depend on the probability of receiving the returns; if there is no bureaucrat assigned to the project, he will never get the high return, as M will always claim $V=V_0$, and if the bureaucrat is dishonest, he will not receive the high return unless the bureaucrat is caught while taking bribes. Thus for the additional return to the production entrepreneur we require the venture to have matched with a bureaucrat (probability $2l_B(1-l_B)$), and the bureaucrat 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 reflected by $X= 2[x+(1-x)p]l_B/(1-l_B)$. Three elements affect this probability. *First,* the actual size l_B of the bureaucracy. *Second*, the quality of the bureaucracy (the degree of corruption) as captured by x: the more corrupt the bureaucracy, the lower are the returns to investment and the weaker are the incentives to invest. *Finally,* the probability p of detecting corruption; if corruption is detected, returns from investment are reimbursed to the production entrepreneur.

There are three possible cases for the expected return to bureaucracy (expected at the point

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[8] Obviously since no one else other than the market entrepreneur observes the realized value of the project, it is impossible to make the payment to the production entrepreneur depend on the actual return. Then setting the payment to the production entrepreneur equal to R is without loss of any generality. A contract that specifies that in the absence of a bureaucrat, the production entrepreneur receives $R^* \leq V_0$ would give exactly the same results.

of allocation of talent thus before honesty costs are known):

i) $\omega_0 \leq w$ *(Non corrupt bureaucracy)*

$$U_B(w) = w \tag{3}$$

In this case, bureaucrats of both types only receive their wages which are high enough to discourage bribes. Recall that w is the net public sector wage, W-T. Also note that since a is defined as the cost of entering entrepreneurship, the return to bureaucracy is independent of this.

ii) $\omega_1 \leq w < \omega_0$ *(Partially corrupt bureaucracy)*

$$\begin{aligned} U_B(w) &= (1-\tau q\alpha)w + \tau q\alpha(w+V_1-V_0)(1-p) \\ &= w + \tau q\alpha p(\omega_0 - w) \end{aligned} \tag{4}$$

where τq is the probability that a bureaucrat meets a venture with successful investment [recall that τ is the probability that the production entrepreneur invests]. With probability $\tau q\alpha$ a bureaucrat is dishonest and meets a venture with successful investment [only with no dishonesty cost is a bureaucrat corrupt and this occurs with probability α]. In this case, the expected payoff is $(w + V_1\text{-}V_0)(1\text{-}p)$. With the complementary probability $1\text{-}\tau q\alpha$, a bureaucrat receives no bribes. This is because either he is honest and/or he meets a venture without a successful investment.

iii) $w < \omega_1$ *(Totally corrupt bureaucracy)*

$$\begin{aligned} U_B(w) &= (1-\tau q)w + \tau q[(w+V_1-V_0)(1-p)-(1-\alpha)\gamma] \\ &= w + \tau qp[\alpha(\omega_0 - w)+(1-\alpha)(\omega_1 - w)] \end{aligned} \tag{5}$$

In this case all bureaucrats are corrupt. Hence with probability $(1\text{-}\tau q)$, they do not meet a venture with a successful investment and simply receive their wage w. On the other hand, with probability τq they match with a venture with successful investment and receive the bribe $V_1\text{-}V_0$. The expected payoff is $(w+ V_1\text{-}V_0)(1\text{-}p)$ minus the expected cost of dishonesty; $(1\text{-}\alpha)\gamma$.

Given the net public sector wage rate, w, and the tax T, an individual with talent a will apply for a public office if and only if $U_B(w) \geq U_E(a,T)$. This condition defines the cut-off level of talent a^e such that agents above this level apply to the public sector. This also gives us the size of the bureaucracy as $l_B = Min\ (1\text{-}a^e,\ 1/3)$. For a given wage w, from (1) we can compute the fraction of honest bureaucrats, $x(w)$, and derive the probability $X = [x(w) + (1\text{-}x(w)p].\ 2l_B/(1\text{-}l_B)$ for a venture to meet an honest bureaucrat which is a measure of property rights enforcement in our model. Finally the investment decision in (2) gives us the probability that a bureaucrat will meet a venture with a successful investment, $\tau(X)q$. Thus, for a given value of w the equilibrium is defined as an allocation of talent represented as $a^e(w)$, a decision rule for bureaucrats which determines whether they accept bribes or not, $x(w)$ [and thus $X^e(w)$], and an investment decision for entrepreneurs, $\tau^e(w)$. These can be summarized in the form of a vector $(a^e,\ l_B^e,\ X^e,\ \tau^e)$ such that:

$$
\begin{aligned}
a^e(w) &= 1 - l(w, x(w), \tau^e) \\
l_B^e(w) &= Min[l(w, x(w), \tau^e), \frac{1}{3}] \\
X^e(w) &= [x(w) + (1 - x(w)p] . \frac{2l_B^e}{1 - l_B^e} \\
\tau^e(w) &= \tau(X^e)
\end{aligned}
\tag{6}
$$

III. Equilibrium Property Rights, Allocations and Investment

To simplify the exposition we will first consider a configuration of parameters such that

Assumption A: $q[(1-\alpha) + \alpha p].(V_1 - V_0) < e$.

This condition ensures that ex ante investment is not profitable if the bureaucracy is only partially honest: with a full size bureaucracy and a fraction of dishonest bureaucrats α (those with a dishonesty cost of 0), the expected return of the investment, $q[(1-\alpha) + \alpha p].(V_1 - V_0)$, is less than e. We thus need a fully honest bureaucracy (though not necessarily of full size) for investment to be profitable. In section V, we will return to the case with $e \leq q[(1-\alpha) + \alpha p].(V_1 - V_0)$ where ex-ante investment by entrepreneurs may also be profitable under a partially honest bureaucracy.

i) $\omega_0 \leq w$ *(all bureaucrats are honest).*

In this case, the return to entrepreneurship will depend on whether the production entrepreneurs find it profitable to invest; this will be the case iff $\frac{2l_B}{1-l_B} q(V_1 - V_0) > e$. Expressed alternatively, there will investment ($\tau = 1$) as long as $l_B > l_B^* \equiv \frac{e}{2q(V_1 - V_0) + e}$. Then the return to entrepreneurship is:

$$
U_E(a,T) = \begin{cases} q\frac{V_1 - V_0 - e}{2} + \frac{V_0}{2} - a - T & \text{if } l_B > l_B^* \\ \frac{V_0}{2} - a - T & \text{if } l_B < l_B^* \end{cases}
\tag{7}
$$

Note that when there is investment by production entrepreneurs, the size of the bureaucracy does not matter for the expected return because when there is a bureaucrat, the production entrepreneur receives the rents, and when there is no bureaucrat, the marketing entrepreneur does, and since both outcomes are equally likely ex ante, the size of the bureaucracy does not matter [this would not be true if $x(w)$ were not equal to 1, see below]. Nevertheless, the size of the bureaucracy crucially features in determining whether investment is worthwhile from the viewpoint of the production entrepreneur.

The return to bureaucrats in this regime is simply given by (3) above; they are all honest and

only receive their wages. Now we can determine the equilibrium cut-off level for applying to a public sector job, $a^e(w,T)$ such that all types $a \geq a^e(w,T)$ apply to bureaucracy. First assume that $l_B > l_B^+$, then production entrepreneurs are expected to invest ($\tau=1$) and we get that $a^e(w,T)=a^{**}(w,T)$ where

$$a^{**}(w,T) = \frac{q(V_1-V_0)-e}{2} + \frac{V_0}{2} - T - w \tag{8}$$

Clearly, for $l_B > l_B^+$, it is necessary that $1-a^{**}(w,T) > l_B^+$.

Alternatively, if this condition is not satisfied, then $\tau=0$ (no investment) and because the return to entrepreneurship is lower, the cut-off level of talent is given by $a^e(w,T)=a^*(w,T)$ where

$$a^*(w,T) = \frac{V_0}{2} - w - T \tag{9}$$

Both of these expressions depend on T as well as w. Imposing the government budget constraint, we can write

$$T = \frac{l_B^e(w)(1-\tau q(1-x)p)}{1-l_B^e(w)} w \tag{10}$$

and where $l_B^e(w)=Min\ \{1/3,\ 1-a^e(w,T)\}$. (10) can be explained as follows; there is a total of l_B bureaucrats receiving a net wage w and this net wage is paid by the entrepreneurs and there are $1-l_B$ of them. However, when there are some ventures with high returns, not all of the bureaucrats are paid their wages. There is a probability τq that a bureaucrat meets a venture with high return, and a proportion $1-x$ of these bureaucrats will be corrupt and take bribes and a proportion p of those will get caught; hence we subtract this proportion form the total wage bill.

Now substituting for T from (10) into (8) and (9), we obtain the cut-off level of talent, $a^e(w)=a^{**}(w)$ or $a^e(w)=a^*(w)$, as functions of the net public sector wage rate only. The next lemma establishes that both functions, $a^*(w)$ and $a^{**}(w)$ are decreasing in the public sector wage rate.

Lemma 1: *$a^*(w)$ and $a^{**}(w)$ are continuously decreasing in w.*

Given the monotonicity of these functions, two other critical wage levels w_F and w_{FF} can be defined such that

$$a^*(w_F)=1/3 \text{ and } a^{**}(w_{FF})=1/3$$

and naturally $w_{FF} > w_F$. These wages are the levels at which the public sector reaches the full size, $l_B=1/3$ and therefore, if $w > w_F$ and there is no investment in the private sector, or if $w > w_{FF}$, there will be an excess number of applicants to bureaucracy and some of these jobs will have to be randomly rationed. Figure 1 shows the determination of w_F and w_{FF} diagrammatically.

ii) $\omega_1 \leq w < \omega_0$ *(Partially corrupt bureaucracy)*

A fraction α of bureaucrats are corrupt. Due to assumption A entrepreneurs do not invest, therefore the probability that a bureaucrat meets a venture with a successful investment is 0. Recalling (2) and (4), this gives;

$$U_E(a,T) = \frac{V_0}{2} - a - T$$
$$U_B(w) = w \qquad (11)$$

These expressions are the same as (7) and (3) in the case where the size of the bureaucracy was less than l_B^+. Therefore, as found above, all individuals with talent a larger than $a^*(w)$ will apply to the public sector.

iii) $w < \omega_1$ *(Totally corrupt bureaucracy)*

Entrepreneurs will not invest and bureaucrats have no bribe opportunities which makes this case exactly the same as (ii). It follows by inspection of Figure 1 that the whole characterization of the equilibrium depends on the relative positions of ω_0, w_F, w_{FF}.

Proposition 1: *a) If* $w_{FF} \leq \omega_0$, *then the equilibrium size* $l_B(w)$ *is given by:*

$$\begin{aligned} l_B(w) &= 0 && \text{if } w \leq V_0/2 - 1 \\ &= 1 - a^*(w) && \text{if } V_0/2 - 1 \leq w \leq w_F \\ &= 1/3 && \text{if } w_F \leq w \end{aligned}$$

b) If $w_F \leq \omega_0 \leq w_{FF}$, *then the equilibrium size* $l_B(w)$ *is given by:*

$$\begin{aligned} l_B(w) &= 0 && \text{if } w \leq V_0/2 - 1 \\ &= 1 - a^*(w) && \text{if } V_0/2 - 1 \leq w \leq w_F \\ &= 1/3 && \text{if } w_F \leq w \leq \omega_0 \\ &= 1 - a^{**}(w) && \text{if } \omega_0 < w \leq w_{FF} \\ &= 1/3 && \text{if } w_{FF} \leq w \end{aligned}$$

c) If $\omega_0 \leq w_F$, *then* $\exists\, w^{**} \in [\omega_0, w_F]$, *such that the equilibrium size* $l_B(w)$ *is given by:*

$$\begin{aligned} l_B(w) &= 0 && \text{if } w \leq V_0/2 - 1 \\ &= 1 - a^*(w) && \text{if } V_0/2 - 1 \leq w \leq w^{**} \\ &= 1 - a^{**}(w) && \text{if } w^{**} \leq w \leq w_{FF} \\ &= 1/3 && \text{if } w_{FF} \leq w. \end{aligned}$$

Figure 2 describes case (a). Figure 3 illustrates case (b) while figure 4 shows case (c). In all diagrams the size and the quality of the bureaucracy are shown as a function of the public wage w. When the wage is below $V_0/2 - 1$, even individuals with a strong comparative advantage for public jobs do not want to apply to these jobs, and the equilibrium size, l_B, is equal to zero. 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)*. On the one hand, increasing the net wage rate w makes public jobs more attractive and distorts the allocation of talent towards the public sector. This in turn improves the enforcement of property rights for a less than full size bureaucracy, and consequently investment becomes more attractive. On the other hand, the usual efficiency wage effect on corruption is also present (e.g. Rose-Ackerman [1975]) and the quality of the bureaucracy

improves, which, holding the size of the bureaucracy constant, increases expected returns on investment. Which channel matters more for the protection of property rights depends on the parameters of the model.

Case (a) illustrates the situation where it is easier to get a full size bureaucracy than a fully honest one. In this case, the major constraint on protection of property rights is the honesty of the public sector. The equilibrium size of the bureaucracy is a non-decreasing function of the public sector wage w. When w_{FF} is smaller than ω_0, full size bureaucracy (*1/3*) is reached before full honesty (Figure 2). In this case, investment by the private sector begins only when society has a fully honest and full size bureaucracy and thus only when property rights are totally protected ($w \geq \omega_0$).

Case (b) describes a situation where the equilibrium size of the bureaucracy is not monotonic in the wage rate (Figure 3). This non-monotonocity comes from a general equilibrium effect on the allocation of talent. When the *wage level exceeds* the threshold level ω_0, the bureaucracy becomes fully honest and it is profitable for entrepreneurs to invest in production skills. This in turn makes the private sector more attractive. Consequently some agents who would otherwise apply for a public sector job now prefer to enter the private sector. When $\omega_0 < w \leq w_{FF}$, this shift of talent to the private economy is strong enough so that only less than a third of the people now apply to public offices. As a consequence there is less than full size bureaucracy and no more rationing. This illustrates the *free-lunch* mentioned in the introduction: by increasing the wage rate at this point, three beneficial effects are being created at no cost: (i) Less corruption and thus more investment. (ii) A smaller bureaucracy, therefore a larger number of agents who can work in directly productive jobs. (iii) No rationing, hence a better allocation of talent.

Case (c) and Figure 4 illustrate the situation polar to (a). It is now easier to get a fully honest bureaucracy than to attract enough people to enforce property rights. For $\omega_0 \leq w < w^{**}$, although all bureaucrats are honest, the size of the public sector is too small to have property rights well protected from the opportunistic behavior of marketing entrepreneurs and hence ex-ante investment is not profitable. When $w^{**} \leq w \leq w_{FF}$, we still have less than full bureaucracy but the probability $2l_B/(1-l_B)$ for a venture to meet a bureaucrat (who is in this case necessarily honest) is high enough to make investment profitable. After w_{FF}, the bureaucracy has full size, 1/3. Finally note also that in all cases, given the wage rate and the equilibrium in terms of the actions, investment and enforcement of property rights is uniquely determined. This feature will enable us to conduct the welfare analysis, and later the political equilibrium by looking at the public wage rate only.

IV. Optimal Property Rights and the Organization of the Society

In this section, we characterize the optimal degree of property rights given the non-verifiability constraint on the investment returns and the potentially opportunistic behavior of the bureaucrats. The key to this exercise will be a trade-off between the allocation of talent and

efficiency wage considerations in the public sector to reduce corruption.

Let us first define *1-a(w)* as the number of individuals who apply to a public job with salary *w*. Two cases have to be considered depending on whether there is rationing or not. With no rationing of pubic sector jobs, total surplus is given by:

$$Q_S(w) = V^* \frac{a(w)}{2} - \int_0^{a(w)} a\,da = V^* \frac{a(w)}{2} - \frac{a(w)^2}{2} \tag{12}$$

where V^* is the expected value of a pair of entrepreneurs (net of investment costs). With a size of the bureaucracy given by *1-a(w)*, only *a(w)/2* ventures exist. Therefore total expected output is V^* *a(w)/2* and total fixed costs of entry into entrepreneurship are given by the integral of entry costs over the agents in private sector. Hence equation (12) for net expected surplus.

With rationing, total net expected surplus is given by:

$$Q_S(w) = \frac{V^*}{3} - \int_0^{a(w)} a\,da - \int_{a(w)}^{1} [1 - \frac{1}{3(1-a(w))}]a\,da = \frac{V^*}{3} - \frac{1}{2} + \frac{1+a(w)}{6} \tag{13}$$

Because there is full size bureaucracy, the number of ventures is also *1/3* and total expected output is $V^*/3$. The two last terms on the RHS of the first line of equation (13) reflect total costs of entry into the entrepreneurial sector given that there is uniform rationing for the people who apply to a public job (i.e. those with talent $a \geq a(w)$). Also note that given assumption A, corruption and investment never coincide, hence the moral cost of honesty is never incurred and does not feature in social surplus calculations. In what follows we will think of total surplus as a measure of welfare that a utilitarian social planner would maximize.

Proposition 2: *a) If $w_{FF} \leq \omega_0$, then expected social welfare is given by:*

$Q_S(w) = V_0/2 - 1/2$ *if* $w \leq V_0/2 - 1$

$= a^*(w)(V_0 - a^*(w))/2$ *if* $V_0/2 - 1 \leq w \leq w_F$

$= V_0/3 - 1/3 + a^*(w)/6$ *if* $w_F \leq w < \omega_0$

$= [V_0 + q(V_1 - V_0) - e]/3 - 1/3 + a^{**}(w)/6$ *if* $\omega_0 \leq w$

b) If $w_F \leq \omega_0 \leq w_{FF}$, then total surplus is given by:

$Q_S(w) = V_0/2 - 1/2$ *if* $w \leq V_0/2 - 1$

$= a^*(w)(V_0 - a^*(w))/2$ *if* $V_0/2 - 1 \leq w \leq w_F$

$= V_0/3 - 1/3 + a_*(w)/6$ *if* $w_F \leq < w < \omega_0$

$= a^{**}(w)(V_0 + q(V_1 - V_0) - e - a^{**}(w))/2$ *if* $\omega_0 \leq w < w_{FF}$

$= [V_0 + q(V_1 - V_0) - e]/3 - 1/3 + a^{**}(w)/6$ *if* $w_{FF} \leq w$

c) If $\omega_0 \leq w_F$, then total surplus is given by:

$Q_S(w) = V_0/2 - 1/2$ *if* $w \leq V_0/2 - 1$

$= a^*(w)(V_0 - a^*(w))/2$ *if* $V_0/2 - 1 \leq w < w^{**}$

$= a^{**}(w)[V_0 + q(V_1 - V_0) - e - a^{**}(w))]/2$ *if* $w^{**} \leq w < w_{FF}$

$= [V_0 + q(V_1 - V_0) - e]/3 - 1/3 + a^{**}(w)/6$ *if* $w_{FF} \leq w$

where $w^{**} \in [\omega_0, w_F]$ is defined in Proposition (1c).

Figures 5, 6 and 7 plot the shape of social surplus function, $Q_S(w)$, in the three cases. As we can see in all of these, the curve is non-monotonic in the public sector wage, w. This illustrates the trade-off between allocation of talent and property rights protection. On the one hand, increasing the wage rate distorts the allocation of talent towards the public sector: first, the size of the bureaucracy increases; second, as public sector jobs offer rents, agents with a comparative advantage for the private sector also apply to bureaucracy. On the other hand, a high public wage improves -- by a size as well as a quality effect on bureaucracy -- the protection of property rights, and investment becomes more attractive. For low wages, welfare is initially decreasing in the wage rate because the bureaucracy is small and/or corrupt and increasing the wage has no effect other than distorting the allocation of talent further toward unproductive bureaucrats. Yet a further increase in public wages may improve the quality of the bureaucracy and make private investment attractive. At that threshold level, welfare jumps up. In cases (a) and (b), the jump occurs at $w=\omega_0$. In (a), investment starts when the bureaucracy is fully honest and has already reached full size. The binding constraint for welfare and investment is therefore not the size, but the quality of the public sector. In the second case (b), investment is undertaken under honest and full size bureaucracy which becomes less than full size after the jump (*the free-lunch*). Finally, the increase in welfare in case (c) occurs at the wage w^{**} with a less than full size bureaucracy that has already reached full honesty. In that situation, the binding constraint for investment is not the quality but the size of the bureaucracy. After the jump, due to our dichotomous specification for investment, there is no further gain from having a higher wage. Welfare declines again with wages since high wages only cause distortion in the allocation of talent. Note that in regions where there is no rationing, the shape of the welfare function is declining at a faster rate than otherwise. The intuition is quite simple. The distortion on 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 nevertheless come back to the private sector when they are rationed. Hence welfare only decreases now because, as more people apply, it is not always those with the comparative advantage for public jobs who are admitted, but a random selection of the applicants: the higher is the wage, the more agents want to get a job in bureaucracy thus the more severe is the misallocation of talent[9].

Now the socially optimal level of property rights enforcement can be determined diagrammatically. We can see that the social planner will only locate at one of the points A or B, thus we only need to compare the heights of these points in Figures 5, 6 and 7. At point A we have the welfare level associated with no bureaucracy and therefore no property rights and no investment.

---

[9] 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, in (a) and (b) above, the Social Planner would choose a lower size of bureaucracy. Yet, the costs of enforcing property rights in terms of misallocation of talent would still remain and all our general results would continue to apply.

Point B corresponds to the welfare level with a fully honest bureaucracy and private investment. However, note that in cases (b) and (c), there is still less than full protection of property rights at point B because the bureaucracy is less than full size and some ventures will not be matched with bureaucrats. Thus, since enforcement is an economically costly activity it will not in general be optimal for societies to try to enforce all the property rights. In our model, the only situation in which full property rights are optimal is when $\omega_0 \geq w_{FF}$ which is the case where full property rights are necessary for investment. From Proposition 2, we also get:

Proposition 3: *a) When $w_{FF} \leq \omega_0$, the socially optimal public wage is ω_0 and there is full size honest bureaucracy if and only if: $V_0/2 - 1 \leq [V_0 + q(V_1-V_0) - e]/3 - 1/3 + a^{**}(\omega_0)/6$.*
Otherwise the optimal public wage is equal to 0 and there is no bureaucracy.
b) When $w_F < \omega_0 \leq w_{FF}$, the socially optimal public wage is ω_0 and there is less than full size honest bureaucracy if and only if: $V_0/2 - 1/2 \leq a^{**}(\omega_0)[V_0 + q(V_1-V_0) - e - a^{**}(\omega_0)]/2$
Otherwise the optimal public wage is equal to 0 and no property rights are enforced.
c) When $\omega_0 \leq w_F$, the socially optimal public wage is w^{**} as defined in Proposition 1c and there is less than full size honest bureaucracy if and only if: $V_0/2 - 1/2 \leq a^{**}(w^{**})[V_0 + q(V_1-V_0) - e - a^{**}(w^{**})]/2$.
Otherwise the optimal public wage is equal to 0 and there is no property right enforcement.

This proposition constitutes the first part of our key result. The optimal organization of the society will involve rents to public sector employees and misallocation of talent. And yet, these observations are not proof of government failure. The reason is intuitive; property rights are necessary for the redistribution of ex post rents according to ex ante agreements. This however implies that there will be ex post incentives to violate these property rights, and the rents for the government employees arise in order to prevent such violations (corruption). As soon economic rents exist in one sector, some misallocation of resources is unavoidable, and here the key resource is talent, thus the allocation of talent gets distorted. An important point to note, however, is that the optimal organization of society here does not involve actual corruption, for which we need to relax assumption A in the next section.

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 [1993], Svensson [1994]). Underlying these statements is a view in which the level of corruption and the degree to which property rights are enforced are *exogenous*. Since our paper suggests a way of endogenizing the level of property rights, it is informative to investigate how corporate investment opportunities influence the equilibrium property rights. To do this we interpret the profitability of investment V_1-V_0 as a measure of corporate investment opportunities. However, inspection of Proposition 3 will reveal that increasing V_1-V_0 creates two opposing effects; the social benefit to higher enforcement increases, but since the efficiency wage that bureaucrats need to be paid is also increasing in this variable, the cost of higher property rights in terms of misallocation of talent also rise. However, as should be

expected, the first, direct, effect dominates the second, and as a result, economies with higher corporate investment opportunities should indeed choose a higher degree of property rights protection.

This statement can be illustrated in Figure 8 which is drawn in the space of (ω_0, π), i.e. the necessary efficiency wage, ω_0, and expected returns from investment, which we denote by π. The relevant region is divided into three areas. Below curve DD it is not profitable to protect property rights at all. Above DD, because investment is sufficiently profitable, it is socially optimal to have some level of property rights enforcement. An increase in corporate investment opportunities, V_1-V_0, is a move along the line VV in this diagram and this takes us from the no property rights region to full or partial property rights enforcement. Thus overall, differences in the productivity of investments across countries or time that are driven by 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 due to the fact that in autocratic societies, corporate opportunities are low, therefore, although public sector employees may be willing to accept bribes, there are no bribes to be received. Modernization may thus enable corporate investment opportunities to be exploited which could in turn increase *the observed incidence of corruption* (see next section).

V. Partially Corrupt Bureaucracy and Investment

So far we have assumed that investment could be profitable only if all bureaucrats were honest (assumption A). By implication, for a given wage rate w, actual bribes will never be observed in equilibrium. In this section we consider the case where it could be profitable to invest although the bureaucracy is not totally honest, by replacing assumption A with;

Assumption B: $q.p.(V_1\text{-}V_0) < e < q.[(1\text{-}\alpha) + \alpha p].(V_1\text{-}V_0)$.

Our analysis in this case will follow that of section III. Again ω_0 and ω_1 are defined as the wage levels at which the two types of bureaucrats will be indifferent between honesty and corruption. Since we have now relaxed assumption A, we will need to define three wage levels for the bureaucracy to reach full size; one with full corruption, w_F; one with partial corruption, w_P; and one with no corruption, w_{FF}. The wages w_F and w_{FF} are exactly as defined in Section III. To determine w_P we need to write the return of an entrepreneur when there is partial corruption and investment (if investment were not profitable then a^* would apply and the relevant cut-off level would be w_F). This return to entrepreneurship is equal to

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

and the return to entering bureaucracy is given by (4) above. By substituting for the tax rate from the government budget constraint, we again obtain the cut-off level of talent, this time denoted by $a^P(w)$;

$$a^P(w)=\frac{V_0}{2}+\frac{1}{2}[q(V_1-V_0)-e]\ -\frac{1}{1-l_B}\alpha pq\,(\omega_0-w)$$

Next similar to our previous analysis, let us define $a^P(w^P) = 2/3$ where now w_P is the wage at which bureaucracy becomes full size with partial corruption. The characterization of equilibrium will now depend on the relative positions of the wage rates w_F, w_{FF}, w_P and ω_0 and ω_1. More precisely, it is easy to show that:

Lemma 2: - *If* $w_0 < w_{FF}$, *then* $w_F < w_{FF} < w_P$.
- *If* $w_{FF} < w_0 < w_F+[q(V_1-V_0)-e]/(3\alpha pq)$ *then* $w_F < w_P < w_{FF}$.
- *If* $w_F+[q(V_1-V_0)-e]/(3\alpha pq) < w_0$ *then* $w_P < w_F < w_{FF}$.

This Lemma would be useful in fully characterizing the equilibrium of this case, however, here we want to highlight the features that were missing from the analysis of Section III. For this purpose we only consider the case where $w_F < \omega_1 < w_P < w_{FF} < \omega_0$. The size of the bureaucracy as a function of the public sector wage rate is shown in Figure 9. At w_F, full size bureaucracy is reached, 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, therefore entrepreneurs are therefore willing to invest. But once this wage rate is exceeded, the private sector becomes relatively attractive, and the number of applicants to the public sector suddenly drops. Nevertheless, bureaucracy still needs to be of a sufficient size to induce entrepreneurs to invest, and this critical size is given by $l_B^{**}=\frac{e}{e+(1-\alpha)q(V_1-V_0)}$. Thus the number of applicants cannot fall below l_B^{**}. As the wage rate increases, the size of bureaucracy goes up and at w_P, it reaches full size, but we still only have partial honesty. From that point on, it is immediate that bureaucracy remains at full size until we reach the no corruption regime. Further, as w_{FF} is smaller 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_1 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, (12) and (13) still apply exactly. By inspecting (12) and (13), we can establish the following result;

Proposition 4: *Let* w^* *be the wage rate where investment becomes profitable with partially corrupt bureaucracy and* w^{**} *the wage rate where investment becomes profitable with fully honest bureaucracy. As long as* $a^{**}(w^{**}) < a^P(w^*)$, *the Social Optimum never has fully honest bureaucracy.*

This proposition completes our key result. The optimal organization of the society not only can include rents and misallocation of talent, but also actual corruption. Yet, as emphasized in the introduction, this is not because corruption is a more efficient allocation system, but because of precisely the opposite reason; the Social Planner is trying to implement an efficient allocation that is not easy to implement ex post. In particular, the transfers that are required to take place (from the M to P entrepreneurs) create room for corruption. Too much corruption would destroy investment incentives, but preventing all corruption is also too costly.

VI. Political Equilibrium

In many societies important social choices and in particular the role of the public sector are influenced by the wishes of the majority and it is informative to investigate whether the political equilibrium in our economy will differ from the choice of the Social Planner. Once the government budget constraint is imposed to solve for the tax rate, the only political variable we need to determine is the public sector wage rate. We will investigate the determination of this variable as the political equilibrium based on egalitarian voting among all agents in the economy. 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 will influence these decisions. In this section, the main heterogeneity will be between agents who want to become bureaucrats and those who want to become entrepreneurs[10].

To facilitate the treatment we will deal with the case where assumption A holds. As a result, our analysis of section III applies, and for given a public sector wage rate there is a unique equilibrium allocation. The political equilibrium will correspond to a wage rate, w^{pe}, such that while choosing this wage rate agents anticipate the ensuing equilibrium characterized by $a^e(w^{pe})$, $l_B^e(w^{pe})$, $\tau^e(w^{pe})$, $X^e(w^{pe})$ determined from the analysis of section III.

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 $w \leq w^{sup}$, the number of applicants to the public sector $1-a(w)$ is less than 1/2[11]. 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 which will be the political equilibrium public wage rate. Under this assumption we can analyze the political equilibrium of this economy.

In this case, the utility to a representative majority voter will be [gross of the cost of entering

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[10] However, this is not necessarily the most interesting divide if entrepreneurs vote after they know their role in the production relation or after they make some irreversible investment decisions, there will be interesting conflicts among this class too. See earlier version of this paper where some of these arise in the dynamic counter-part of the model.

[11] More precisely we require two conditions; $a^*(w^{sup}) \geq 1/2$ *and* $a^*(\omega_0) \geq 1/2$. This condition makes sure that there are no 'cycles' in voting.

entrepreneurship];

$$U_E(w)=\begin{cases}\dfrac{V_0}{2}+\dfrac{\left(1-\dfrac{2l_B^e(w)(1-x^e(w))(1-p)}{1-l_B^e(w)}\right)[q(V_1-V_0)-e]}{2}-\dfrac{l_B^e(w)w}{1-l_B^e(w)} & \text{if } [x^e+(1-x^e)p]\dfrac{2l_B^e}{1-l_B^e}q(V_1-V_0)\geq e \\ \dfrac{V_0}{2}-\dfrac{l_B^e(w)}{1-l_B^e(w)} & \text{otherwise}\end{cases}$$

where the superscript e denotes the equilibrium characterized in section III. Recall that when $x^e(w)<1$, there is no investment by production entrepreneurs and this has already been incorporated into the expression[12].

The entrepreneur will always receive $V_0/2$ and pay 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 the property rights are enforced to a sufficient degree, each entrepreneur prefers to invest and incurs the cost e (with probability 1/2, i.e. only when he is the production entrepreneur). When there is investment, an entrepreneur anticipates to receive V_1-V_0 in three different scenarios; when he is the marketing entrepreneur and there is no bureaucrat; when he is the production entrepreneur and there is an honest bureaucrat; and finally when he is a production entrepreneur, there is a dishonest bureaucrat who is detected and returns from investment are reimbursed to the entrepreneur. The combination of these terms give the additional expected return of the entrepreneur when there is investment.

From this expression it is clear that the median voter (entrepreneur), like the Social Planner in Proposition 3, will choose the minimum level of bureaucracy sufficient to encourage investment.

Proposition 5: *Suppose assumption A holds. Then,*

a) When $w_{FF}\leq\omega_0$, *if* $q(V_1-V_0)-e>\omega_0$, *then* $w^{pe}=\omega_0$, *there is full size honest bureaucracy. Otherwise,* $w^{pe}=0$ *and no property rights are enforced.*

b) When $w_F\leq\omega_0<w_{FF}$, *if* $\dfrac{q(V_1-V_0)-e}{2}>\dfrac{1-a^{**}(\omega_0)}{a^{**}(\omega_0)}\omega_0$, *then* $w^{pe}=\omega_0$ *and there is less than full size honest bureaucracy. Otherwise,* $w^{pe}=0$ *and no property rights are enforced.*

c) When $\omega_0<w_{FF}$, *if* $\dfrac{q(V_1-V_0)-e}{2}>\dfrac{1-a^{**}(w^{**})}{a^{**}(w^{**})}w^{**}$, *then* $w^{pe}=w^{**}$ *and there is less than full size honest bureaucracy, where* w^{**} *is defined in Proposition 1c. Otherwise,* $w^{pe}=0$ *and no property rights are enforced.*

In the political equilibrium there is never more property rights than the Social Planner's choice, but there can be less.

Although the political equilibrium, which is in a sense the entrepreneurs' choice, involves

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[12] The full expression for taxes paid by agents is given by: $w[1-\tau(w)pq(1-x^e(w)]l^e_B(w)/(1-l^e_B(w))$. In order to simplify the exposition, we have already incorporated the fact that for $x^e(w)<1$, $\tau(w)=0$. Hence taxes can be written directly as $wl^e_B(w)/(1-l^e_B(w))$.

a choice between points A and B in Figures 5, 6 and 7, the exact conditions for this choice are different than in Proposition 3. The conditions for the property rights enforcement to be preferred are considerably more stringent (see proof of Proposition 5 for the comparison) and as a result, quite often, the political equilibrium will lead to less property rights than the Social Planner's choice. What is the intuition? There are two differences between Propositions 3 and 5: first, the decisive voter ignores the *rents* received by the bureaucrats, and secondly, he ignores the *misallocation of talent* induced by these rents since he is not the marginal agent. The first effect causes wages and the enforcement of property rights to be too low, but the second effect opposes the first. However, the second effect can never dominate the first because in the equilibrium misallocation of talent simply refers to the fact that the rents of the public sector are not allocated to the "right" agents. Yet, since the misallocation of talent is induced by these rents, the loss due to this misallocation cannot exceed the size of the rents and thus the first effect will always dominate.

Is this result, that there will be too little property rights, general? The answer is no. There are many reasons for this not to be true. As emphasized by many political philosophers including Rousseau, Marx and Veblen, property rights are related to the distribution of rents across agents with heterogeneous histories and preferences. This can be easily captured in our model by introducing some correlation between the talent level of the individual, a, and the probability of becoming a production entrepreneur. In this case, agents with low a will prefer property rights because they know that they are likely to be the production entrepreneur, and high property rights increase the returns of production entrepreneurs at the expense of marketing entrepreneurs. In particular, agents with low a would prefer a public wage higher than the one that makes investment just profitable (which was the wage that Propositions 3 and 5 picked). Such an extension of our model is conceptually simple, though algebraically cumbersome. Also note that this unambiguous ranking between the Social Optimum and the political equilibrium no longer holds when Assumption A is replaced by Assumption B or if some political decisions are taken after investments are made.

VII. Bureaucratic Self-Control

A number of social scientists have suggested that the organization of bureaucracy is intended to restrain the degree of corruption that may arise (e.g. Crozier [1956], Tirole [1986], Klitgaard [1988]). However, it is not clear how this restraint is achieved in practice, especially because bureaucratic organizations are mostly under the direct control of only the bureaucrats themselves, and this is often used as an argument in favor of reducing the scope of the government.

Our model and the economic forces we emphasize can shed some light on this issue and show that the internal dynamics and the maximizing objectives of bureaucrats can naturally lead to some degree of self-restraint. Let us suppose that after the allocation of talent but before stage 1, bureaucrats themselves determine the value of p without any cost (and commit to this value of p).

Also assume for simplicity that at this level they have not discovered their honesty costs (which implies that there is no heterogeneity and that they will all choose the same level of p). First, if the public sector wage rate and investment decisions are already determined, they will clearly choose $p = 0$. However, the more interesting case is the one in which the dynamic considerations are sufficiently important and that the bureaucracy recognizes that the degree of their corruptibility, and hence the level of their self-restraint, will influence their wages and through the investment incentives, their bribes. Also assume that in this case wages are determined as in the last section as the outcome of an election[13]. Thus the exact sequence of events is as follows; first agents choose their professions, next bureaucrats decide the level of self-control, then the society determines the public sector wage rate by egalitarian voting and then finally investment and bribing decisions are taken.

In this case, with some manipulation, we can write the utility of a bureaucrat as

$$U_B(w^{pe}(p),p)=w^{pe}(p)+\tau p[\alpha\max\{\omega_1-w^{pe}(p);0\}+(1-\alpha)\max\{\omega_0-w^{pe}(p);0\}]$$

where $w^{pe}(p)$ is the public sector wage rate that will be chosen in the political equilibrium as a function of the probability that a bureaucrat taking a bribe will get caught.

We think of the bureaucratic institutions as choosing the degree of self-control, p, in order to maximize the return of their members. The level of p in practice corresponds to many of the rules and discretion that are determined by the history and culture of an organization (e.g. the extent of the paper trail, the degree of supervision, the importance of discretion etc) which influence the likelihood that members who deviate from certain rules will be caught and punished. Here we limit ourselves to the derivation a simple implication of this choice that sheds light on the issue of bureaucratic self-control [and thus abstracting from how p is chosen in practice];

Proposition 6: *The bureaucracy will choose an intermediate level of p $(0<p<1)$ and thus impose internal self-discipline.*

This effect suggests that bureaucracy will often impose self-discipline on its members even if its only objective is to maximize the long-run returns of these members. It illustrates in a stylized way why bureaucrats themselves will be opposed to reducing internal control (as well as to increasing it) and will also tend to be harsh on those among themselves who are discovered to be corrupt.

VIII. Conclusion

In this paper we have developed a model in which agents can behave opportunistically and violate others' property rights. It is therefore beneficial to spend some of the society's scarce

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[13] We could also have a Social Planner making the choice. However, given our simple framework, as far as the Social Planner is concerned the only cost of a high public sector wage is the allocation of talent. Therefore, since the wage determination takes place after career choices, there will be no interesting trade-off.

resource to uphold property rights. This is one of the main roles of the state as accepted by social scientists with very diverse views about government intervention. This paper's contribution is to emphasize that because the enforcement of property rights, like most of the other roles of governments, entails redistribution of economic rents, there will be incentives for corruption. By analyzing these issues in a formal setting, we conclude that in such an environment, rents for government officials, actual instances of corruption and misallocation of talent will occur even if the society is organized optimally and therefore these observations do not indicate government failure.

Although our model treats incentive constraints explicitly, it differs from previous principal-agent approaches to corruption because, firstly, the role of the public sector and the incentives to accept bribes are driven from microfoundations. Secondly and more importantly, our analysis is general equilibrium. This latter aspect has enabled us to derive a number of additional new insights: (i) over certain regions there may exist a free-lunch such that property rights can be increased at no cost; (ii) despite this effect, the optimal degree of property rights is often less than full and in particular, at early stages of development, it may be quite low. In particular, we show that the social optimum will often allow a positive degree of corruption; (iii) finally, bureaucracy, even when it tries to maximize its members utility, will often have an incentive to impose self-control and make it harder for individual bureaucrats to receive bribes as we often observe in practice.

There are a number of directions in which this research can be developed further. First, there is no doubt that not all the corruption, rents and misallocation of resources associated with government intervention are unavoidable costs to be borne by the society. It is therefore important to identify, through theoretical and empirical work, what the optimal contracts, organizations and checks and balances on public sector employees should be. Such an investigation may also indicate why the observed public sector wage premia appear to be very different across countries and time (Heller and Tait [1983], Poterba and Ruben [1994]).

Additionally, the general equilibrium approach of this paper can be developed further and applied in related areas. First, it is possible to consider screening mechanisms for the government that may reduce the misallocation of talent that results from high public sector wages. This would enable a comparison of costs of misallocation of talent to screening costs. Secondly, the exact nature of bureaucratic self-control and how public sector employees can commit to reduce corruption can be studied in more detail. Thirdly, the conflicts among the entrepreneurs on the distribution of rents and the implications for property rights, which become important with a dynamic version of this model, deserve attention and further work.

Appendix:

Proof of Lemma 1: We will just give the proof for $a^{**}(w)$ but the proof is analogous for the other case.

(i) Consider $a^{**}(w) \geq 2/3$, in this case, an increase in the wage rate does not lead to a change in the number of entrepreneurs and thus $a^{**}(w)$ is linearly decreasing in w.

(ii) Now take the case where $a^{**}(w) < 2/3$. Then, substituting for the tax rate and noting that in this case, $\tau=1$ can only be true if $x=1$, we get the following expression for the cut-off level

$$a^{**}(w)=\frac{\frac{q(V_1-V_0)-e+V_0}{2} \pm \sqrt{\left(\frac{q(V_1-V_0)-e+V_0}{2}\right)^2-4w}}{2}$$

Thus there are two roots of the same sign. However, we can see that the smaller root cannot be a cut-off level because around this root $U_E(a)-U_B$ is increasing, thus no one will apply to entrepreneurship. Thus only the larger root is valid and is uniformly decreasing in w. QED

Proof of Proposition 1: This follows straightforwardly from the discussion in the text. It only needs to be noted that in 1(b) when the wage rate reaches ω_0, investment becomes profitable and thus we shift from $a^*(w)$ to $a^{**}(w)$ as the relevant cut-off level. In 1c this happens at the wage rate w^{**}. QED

Proof of Proposition 2: Consider $a^*(w)$ such that $l_B=0$ and thus $T=0$. The minimum wage level that will induce an agent to become a bureaucrat is $V_0/2-1$. At this wage rate the agent with $a=1$ is indifferent between the two professions. Since from Lemma 1, $a^*(w)$ is continuously decreasing in w, for all $w < V_0/2-1$, there is no applicants to bureaucracy and thus $Q_S=V_0/2-1/2$ (-1/2 is the average cost of entering entrepreneurship). The rest of Proposition 2 follows immediately from equations (12) and (13) by substituting respectively $a(w)$ and V with the equilibrium number of people who apply as bureaucrats ($a^*(w)$, $a^{**}(w)$), and the equilibrium value of a project (V_0 *and* $V_0+q(V_1-V_0)-e$) according to the three different cases (a), (b), (c) of Proposition 1. QED

Proof of Proposition 3: Follows straightforwardly from Proposition 2. QED

Proof of Proposition 4: (12) and (13) still apply. Both with full and partial honesty V takes the same value, whichever minimizes a is preferred. When there is partially honest bureaucracy $a(w)=a^P(w)$ and when bureaucracy is fully honest, $a(w)=a^{**}(w)$. QED

Proof of Proposition 5: In equilibrium if there is to be positive investment, it is necessary that $x^e(w)=1$, then the upper part of (14) does not depend on l_B, and the decisive voter will never choose a level of $l_B > l_B^+$ (the level at which the production entrepreneurs will be indifferent between investing and not). The wage rate necessary for this in cases (a) and (b) is $w=\omega_0$ and in case (c), it is $w=w^{**}$. Substituting for these we obtain the highest return that the entrepreneur will get with investment. Obviously the highest level of utility without investment is when there is no tax, thus when $w=0$, this is equal to $V_0/2$. Comparing this to the return with investment obtained above for (a), (b) and (c) gives the first part of the result.

To see that there can never be more property rights than in Proposition 3, first note that in both propositions, it is always the same wage levels that are considered but the critical conditions are different. Thus we need to compare these conditions in (a), (b) and (c).

(a): The condition in Proposition 5 can be written as

$$q(V_1-V_0)-e > \frac{(1-p)(V_1-V_0)}{p}$$

But for any agent to enter bureaucracy we need $\omega_0 = \frac{(1-p)(V_1-V_0)}{p} > \frac{V_0}{2} - 1$, whenever the condition for the property rights enforcement to be elected in Proposition 5(a) is satisfied, the condition for property rights enforcement to be optimal in Proposition 3(a) is satisfied and since the inequalities are never weak, the opposite is not true.

(b): Rearranging the condition in Proposition 3(b) we obtain

$$\frac{q(V_1-V_0)-e}{2} \geq \frac{1-a^{**}(\omega_0)}{a^{**}(\omega_0)}\left(\frac{V_0}{2}-\frac{1}{2}\right)$$

since $\omega_0 > V_0/2-1/2$, condition in Proposition 5(b) implies this.

(c): Same as (b) above with w^{**} replacing ω_0. QED

Proof of Proposition 6: Suppose $p = 0$ in this case, there does not exist a sufficiently high level of efficiency wage to induce bureaucrats to be honest and the entrepreneurs would vote for $w^{pe} = 0$. Thus $p > 0$. If $p = 1$ then no efficiency wage is required and $w^{pe} = V_0/2-1$. Therefore an intermediate level of p will be chosen. QED.

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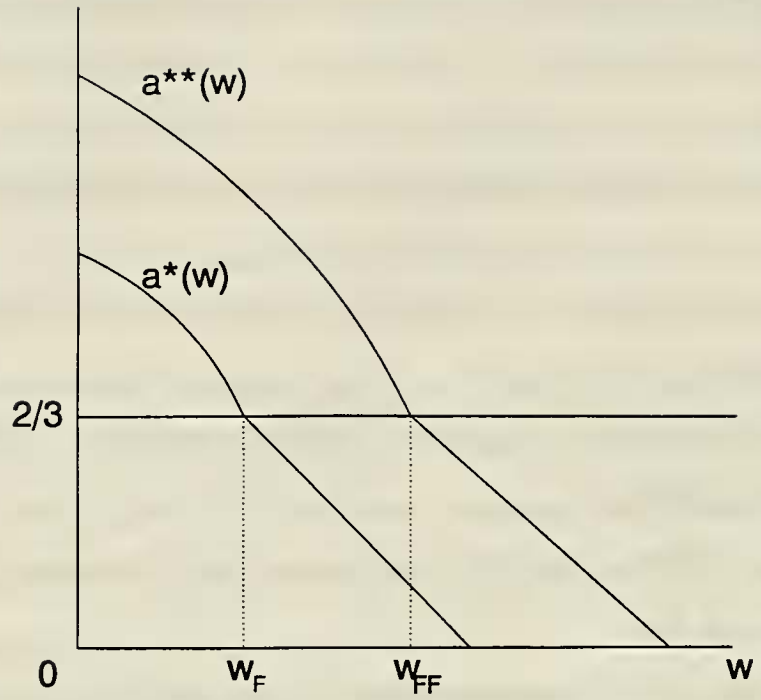
Figure 1



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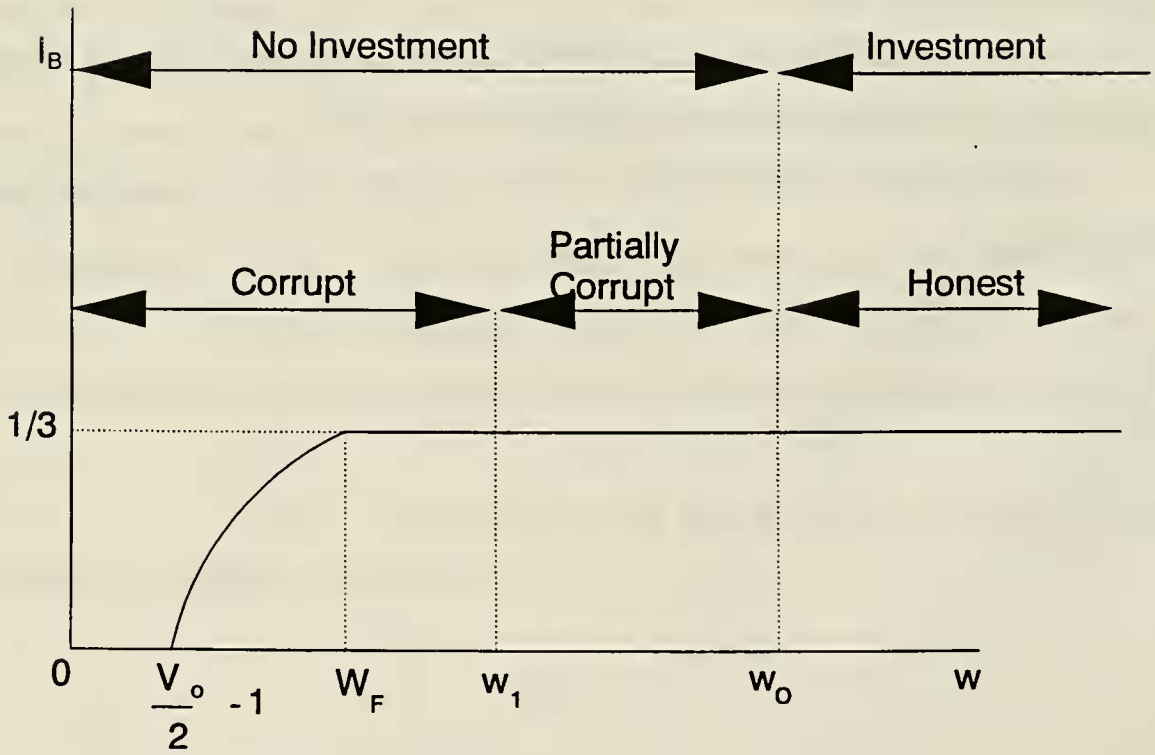

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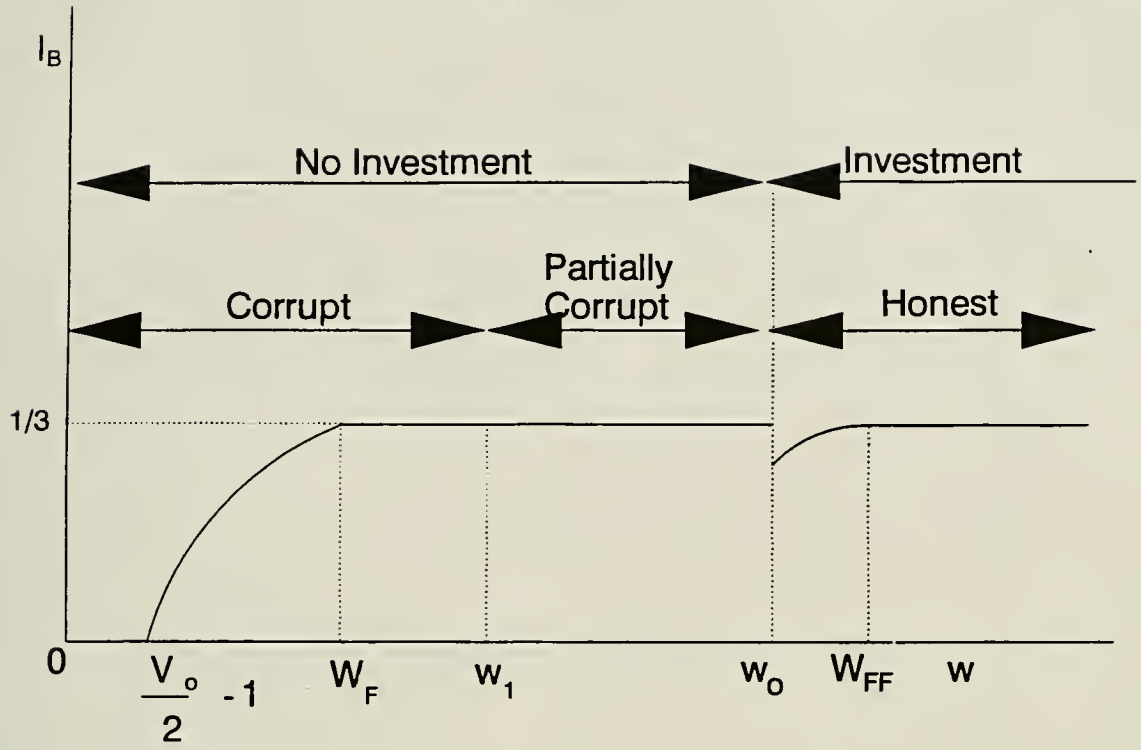

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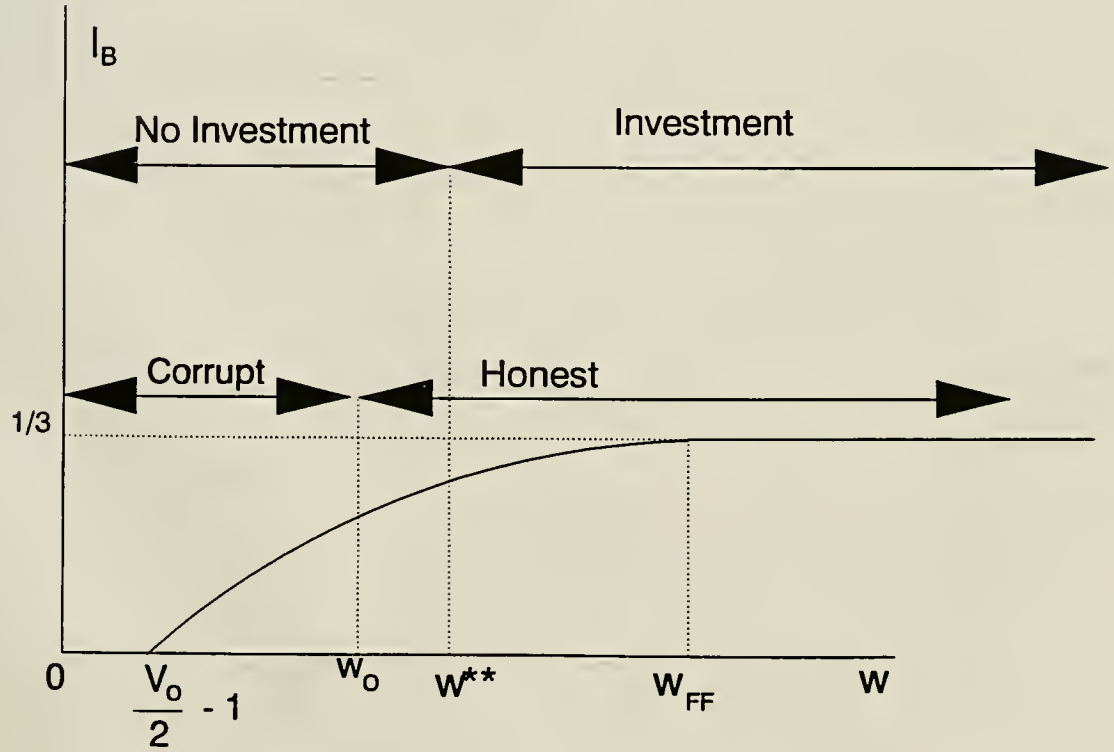

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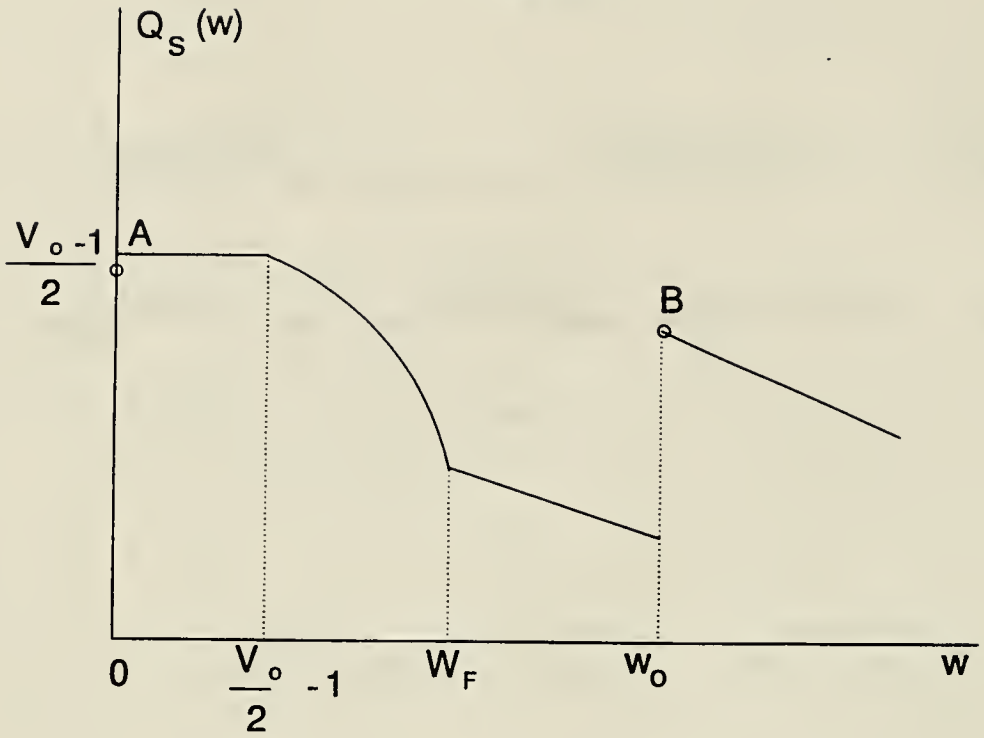

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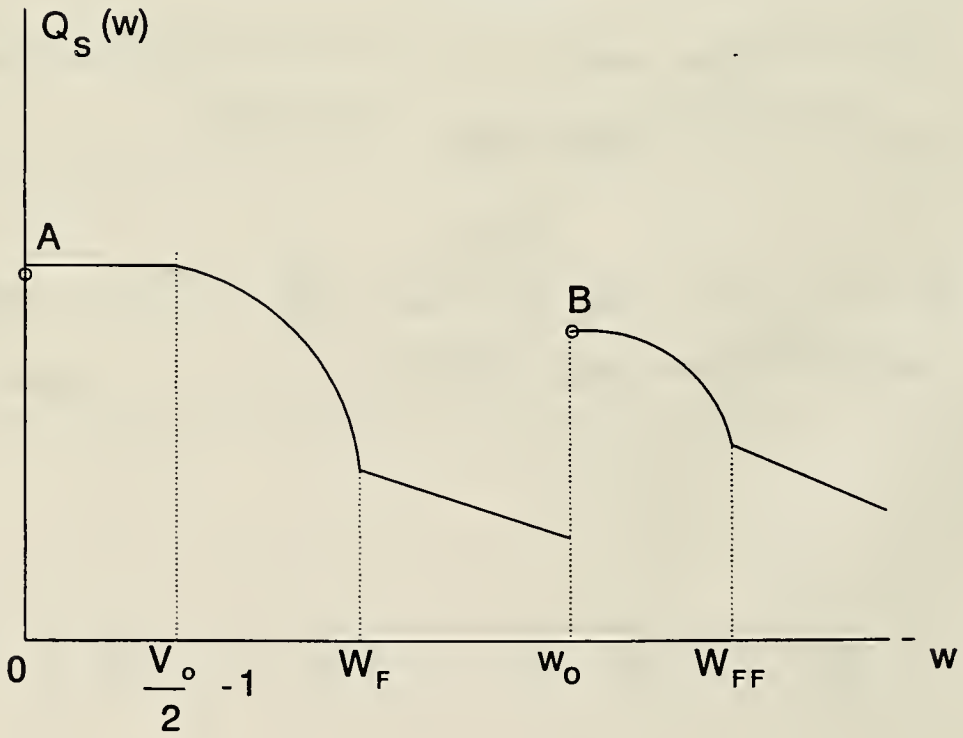

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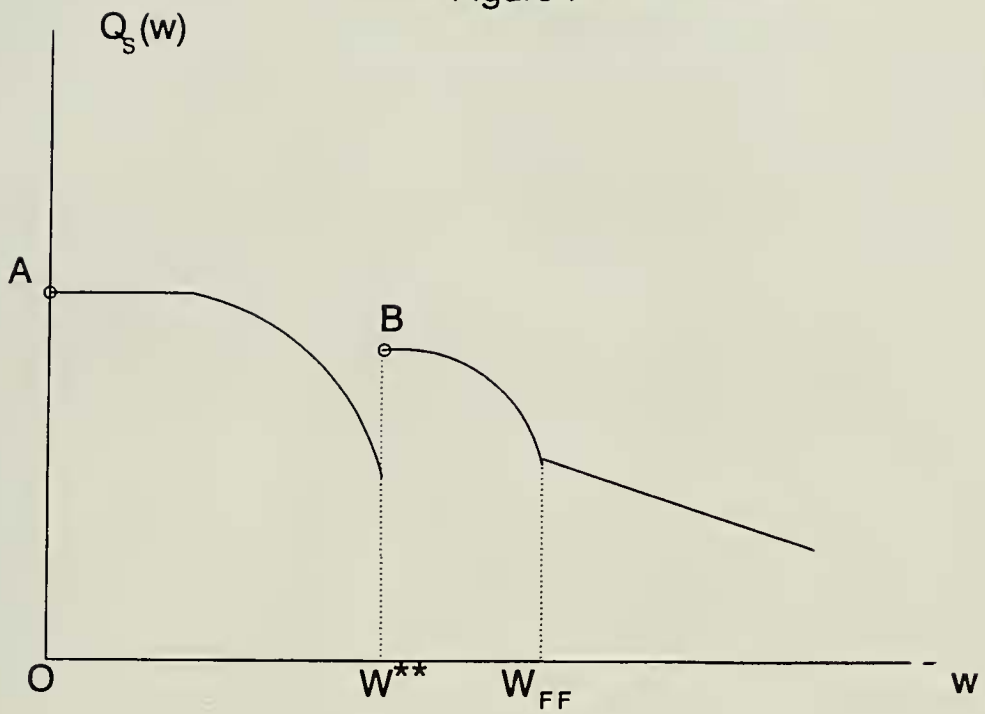

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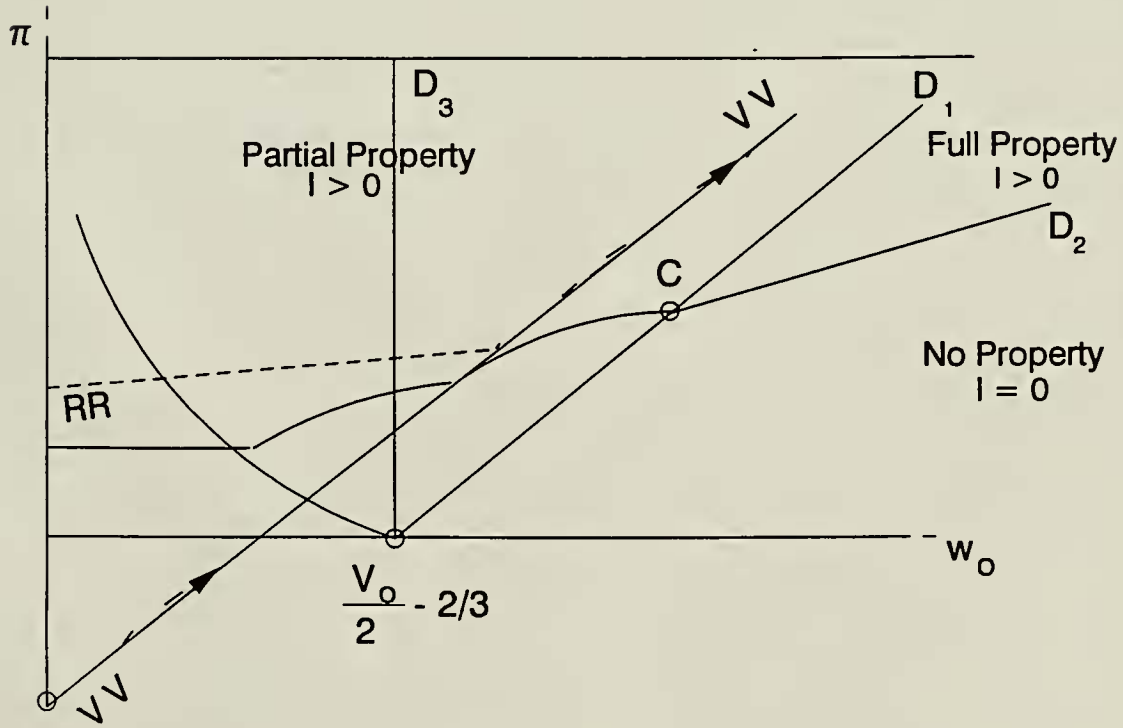
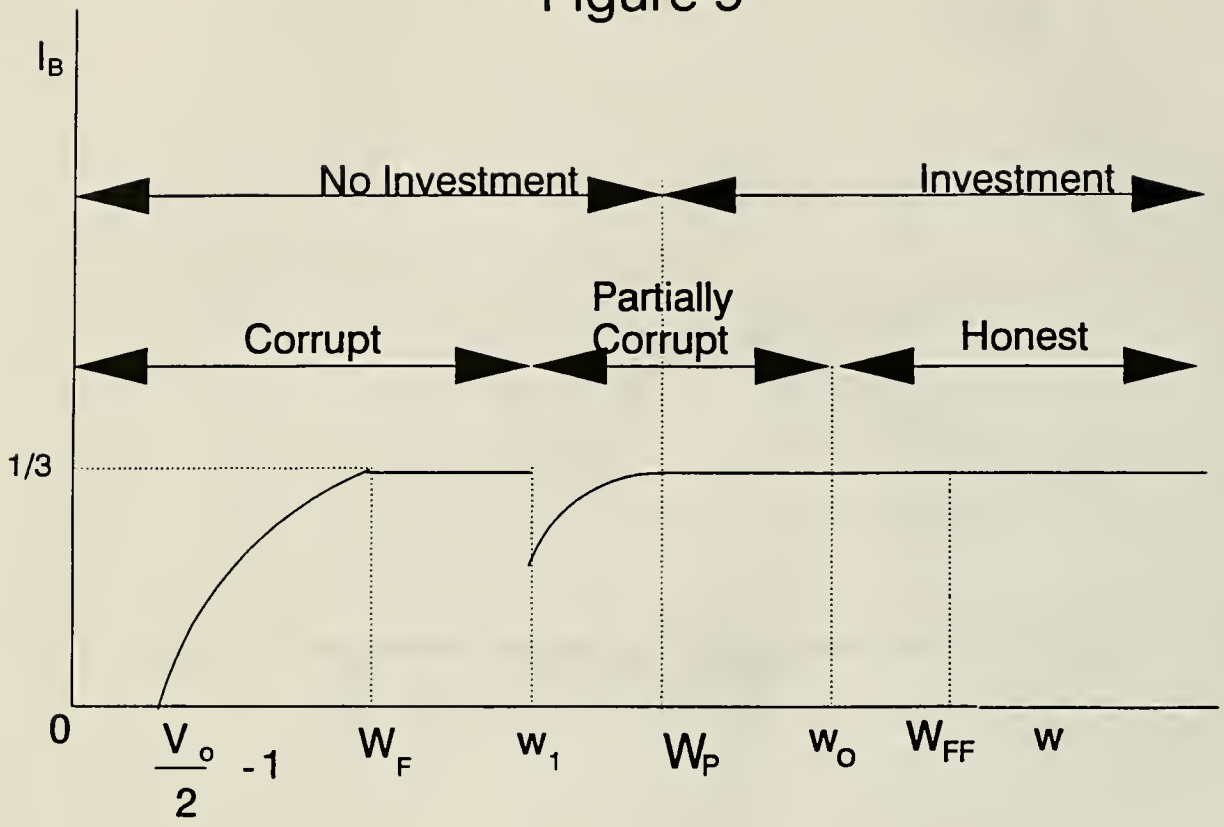


Figure 9


I_B
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Investment
Partially
Corrupt
Corrupt
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1/3
0
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W_F
w_1
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w_o
W_{FF}
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