DISCUSSION PAPER SERIES

No. 3972

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TRANSITION ECONOMICS

Centre for Economic Policy Research

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ISSN 0265-8003

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CEPR Discussion Paper No. 3972

July 2003

ABSTRACT

Red Tape and Corruption*

We study the emergence and interaction of red tape and corruption in a principal-bureaucrat-agent hierarchy. The principal is to provide the agent with a unit of a good that involves externalities so that market mechanisms fail to achieve first best. Red tape partially solves the problem. While imposing a cost on the agent, red tape also produces information about the agent's type. Therefore the socially-optimal level of red tape is not trivial. It is hard, however, to implement the social optimum if the bureaucrat in charge of red tape is corrupt. We consider two types of corruption. First, the bureaucrat may extort bribes from the agent in exchange for reducing the amount of red tape. Second, the bureaucrat may take bribes to conceal the information produced through red tape. The former kind of corruption tends to reduce red tape, while the latter provides incentives for excessive red tape: the more red tape, the more likely the bureaucrat can get the bribes *ex post*. We show that the latter effect prevails, and the equilibrium level of red tape is always above the social optimum.

JEL Classification: D73, K42 and O17
Keywords: corruption, red tape and three-tier hierarchy

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*This is a substantially revised version of a paper that circulated under the title ‘A Theory of Informative Red Tape.’ I am grateful to Abhijit Banerjee, Richard Ericson, Guido Friebel, Vanessa Fuller, Scott Gehlbach, Arye Hillman, Mark Levine, Victor Polterovitch, Andrei Sarychev, Andrei Shleifer, Jean Tirole, Stephen Yeo, Katia Zhuravskaya, two anonymous referees and participants of the MIT Theory Lunch, the EEA Congress in Berlin, the EERC Conference in Moscow and seminar participants in Moscow and St.Petersberg for helpful discussions and comments. Financial support from the US Information Agency and the Moscow Public Science Foundation and the hospitality of MIT Department of Economics where the work was started, are gratefully acknowledged. All views expressed and any remaining errors are my own.

Submitted 29 April 2003

1 Introduction

In this paper we study the emergence and interaction of different types of corruption and red tape in a hierarchy. Red tape and corruption are probably the most ancient and widespread diseases of bureaucracy. They have been observed in all societies; there is no reason to believe that they will soon disappear. Numerous attempts to fight either of them seem to have brought only limited results. One of the problems with corruption and red tape in bureaucracy is that they cannot be treated independently. Corruption in one part of a hierarchy may stem from corruption in another part; excessive red tape may emerge due to potential corruption; bribes may be extorted because of potentially high red tape. When trying to make public bureaucracy more efficient, one should keep these interdependencies in mind in order to fight causes rather than consequences.

Costs and benefits of red tape. The costs of red tape are well known. These are non-pecuniary costs imposed on agents dealing with bureaucracy: firms and households spend substantial time and resources on getting through red tape.[1] In many parts of the world, especially in non-OECD countries, red tape ranks very high as an obstacle to doing business (De Soto, 1989, Brunetti et al., 1997), often being more important than financial constraints (EBRD, 1999, Johnson et al., 2000). Also, excessive regulation breeds corruption (Bardhan, 1997) which in turn is very costly to growth and development (Mauro, 1995).

The benefits of red tape are not yet well understood. One view is that complex rules and regulations are imposed on bureaucracy to reduce favoritism and discretion in order to contain corruption. Among others, Wilson (1989) argues that complicated red tape is created because society has compassion for people who, under simpler mechanisms (e.g. auctions or bribe auctions), would not get what society believes they deserve; red tape helps to overcome certain market failures. Although red tape may be very costly, nobody suggests eliminating red tape altogether; the socially optimal level of red tape is perceived to be positive. The problem is that self-interested bureaucrats tend to overproduce red tape relative to the social optimum.[2] The main goal of this paper is to study why there can be too much red tape and how to implement the socially optimal level of red tape if

[1] See EBRD (1999, p.124) for estimates of the 'time tax' imposed on managers by bureaucrats. Surveys of managers show that the time tax is substantial (about 10% of senior managers' time), while the 'bribe tax' is about 6% of firms' revenues. To register a firm in a median country in Djankov et al.'s dataset (which includes both OECD and non-OECD economies) one has to spend *32* business days.

[2] Excessive red tape is so common that many dictionaries *define* red tape as 'unnecessary' or 'excessive' official routines, rules, or procedures resulting in delays. In this paper, we understand red tape as any non-trivial number of routines, but do show that in equilibrium it tends to be excessive.

bureaucracy is self-interested and (potentially) corrupt.

Interaction between red tape and corruption. The well-known 'grease-in-the-wheels' argument claims that corruption may be good for growth since it relaxes the rigidity of bureaucracy (Huntington, 1969). Through bribes ('speed money'), bureaucrats internalize the costs that regulations impose on other agents. However, this claim is widely critisized for not taking into account the endogeneity of the rigidity. Indeed, 'when rules can be used to extract bribes, more rules will be created' (Tanzi, 1998). Bureaucrats create additional rules to extract bribes, so that the actual level of red tape is then bargained down in exchange for illicit payments. Still, endogenizing rigidities does not explain why the *equilibrium* level of red tape is excessive. Indeed, the official level of red tape is high, but it is then negotiated down to a lower level. Moreover, since the outcome of illicit bargaining maximizes the joint surplus of the bureaucrat and the bribe-giver without taking into account the social benefits of red tape, the equilibrium level of red tape should be below the social optimum! For example, when regulations are intended to provide scarce goods to the poor, corruption reduces red tape too much and allocates the goods to the rich through a bribe auction.

In this paper, we show that excessive red tape can be explained in a more realistic setting where (in addition to speed money) there is also a risk of ex post collusion. We model red tape as a series of costly tests that produce information about the agent. Therefore corruption can occur both ex ante and ex post. *Ex ante* corruption is described above: the agent pays speed money to reduce the amount of red tape *before* the information is produced. *Ex post* corruption occurs *after* the information is produced and the agent's type is known: the bureaucrat can collude with the agent to conceal the information. Ex post corruption provides the bureaucrat with incentives to increase the level of red tape: the more red tape, the greater chance to obtain the information and receive the bribe.

Thus, the effect of ex post corruption on red tape is opposite to that of ex ante corruption. Which of the two effects prevails? We show that a benevolent principal (public) always ends up having too much rather than too little red tape. First, the principal will always try to prevent ex post corruption by paying a high reward for reporting the socially undesirable ('bad') types. Indeed, ex post corruption destroys all the benefits of red tape (the information produced through red tape is not used), while all the costs are present. However, preventing ex post corruption adds a constraint to the mechanism design problem: the reward for reporting bad types cannot be lower than the potential bribe. Whenever this constraint is binding, the social optimum is not implemented, and too much red tape is produced. Indeed, the bureaucrat fully internalizes the cost of red tape (through speed money) but benefits from it more than society does. Whenever red tape produces information, the bureaucrat receives the reward which must be at least the potential bribe (the private valuation of the bad type). If the latter is low, then the collusion-proofness constraint is not binding and the social optimum is implemented. But if the potential bribe is higher than the social benefit of revealing the bad type, then red tape is overproduced in equilibrium.

Literature. Although the economic literature on corruption is relatively young (initiated by Rose-Ackerman, 1978), it has already developed into a well-established field (see surveys in Tirole, 1992, and Bardhan, 1997). Both ex ante corruption and ex post corruption have been studied in detail (Shleifer and Vishny, 1993, refer to them as 'corruption without theft' and 'corruption with theft', respectively). In particular, our setting is similar to the three-tier hierarchy model of Tirole (1986). In the three-tier hierarchy, ex post corruption occurs when the bureaucrat finds out that the agent is of a socially undesirable type but agrees not to report this fact to the principal. Also, the result that the threat of corruption imposes a constraint on the social planner and therefore distorts the equilibrium (even if efficiency wages prevent corruption) is not new; it has been obtained in different settings (e.g. Tirole, 1992, or Acemoglu and Verdier, 2000). The contribution of our paper is to combine ex post and ex ante corruption in one model, and to study the interaction between different kinds of corruption and red tape.[3]

Red tape has received much less attention in the literature. The seminal paper by Banerjee (1997) analyzes red tape in general, and the link between red tape and corruption in particular. In his model, the government wants to provide a cash-constrained agent with a good which may be either of high or low value to the agent. The government prefers to give the good to agents of high type rather than to those of low type. The agent's type is her private information. In order to screen the agents, the government introduces red tape.

In this paper, we use a similar framework, but there are two major distinctions. First, in Banerjee (1997), red tape is a pure cost imposed upon the agent. The bureaucrat can then use red tape as an uninformative costly signal about the agent's type (similar to Spence, 1973). Another screening device is prices, but as long as agents are cash-constrained, red tape is more effective. The model can therefore be applied to any means of non-monetary harassment which bureaucrats are authorized to use (e.g., queues). In this paper, we

[3]Acemoglu and Verdier (2000) consider the interaction of red tape (inspections) and corruption. However, in their model the level of red tape administered by each bureaucrat is fixed; also, they do not consider ex ante corruption.

study the case where red tape is informative *per se*.[4] A simple point that may justify the informativeness of red tape is that it is always related to the social value of the good to be allocated. When applying for a welfare benefit from the government, a person is usually asked to submit a document certifying her low income rather than required to do some physical exercises or taking a course in economics, though all are costly and can be used for screening.

Second, we study a more general case of market failure by considering a setting with externalities rather than cash constraints. We assume that private and social values of the good are different. This setting covers many government activities such as issuing and renewing licenses, passports, visas, and product quality certificates; assigning procurement contracts; and providing certain public goods. Private and social valuations differ even in the case of provision of such seemingly private goods as targeted transfers, welfare benefits, and food rations. Although the poor receive purely private goods (cash or in-kind transfers), the social value is higher than the private value, since society has a preference for equity.

In this case neither prices nor any uninformative mechanisms can help in screening agents even if there are no cash constraints. In Banerjee (1997), the socially desirable types of agents are willing to pay for the good, but cannot pay in cash. In our setting, the market failure is more fundamental: the eligible agents are not willing to pay (in monetary or non-monetary ways). Hence, red tape can screen the agents only when it produces information. Our model therefore formalizes the insights in Wilson (1989) and Bardhan (1997), who argue that regulation is often introduced in order to achieve certain social objectives. The trade-off between informativeness and cost of red tape results in imperfect screening of agents in the social optimum, when all types of agents apply for the good but get the good with different probabilities.

Structure of the paper. In Section 2 we set up a very simple formal model of a three-tier hierarchy with informative red tape and ex ante and ex post corruption. In Section 3 we solve for the equilibrium level of red tape under the threat of ex ante and ex post corruption, and compare it to the social optimum. Section 4 discusses the robustness of the results and potential extensions of the model. Section 5 concludes.

[4] Banerjee (1997, p. 1294) acknowledges that red tape does produce information in the real world, but chooses to concentrate on the case of purely wasteful red tape. In this sense, our paper complements and extends his analisys.

2 Model

2.1 Setting

We consider a hierarchy of a principal P (government or public), an agent A (customer), and a bureaucrat B (government official) who supervises the agent and reports to the principal. B and A are selfish. P maximizes social welfare which is the sum of the utilities of A and B, and of externalities on agents who are not included in the model.

Technology. The principal can supply a unit of a good (or a service) to the agent. The agent's valuation of the good is $\theta > 0$. The cost of provision of the good is c. The net social benefit of provision is therefore $v = \theta - c$. The agent can be either of a 'good' type characterized by private value θ^g and cost of provision $c^g < \theta^g$ or of a 'bad' type with θ^b and $c^b > \theta^b$. Since $v^b < 0 < v^g$, the first best would be to provide the good to the good type and not to provide to the bad one.

The agent's type is her private information. The prior distribution of types is common knowledge: with probability $\pi \in (0, 1)$ the agent is of the bad type and with probability $1 - \pi$ she is of the good type. The model also allows an alternative formulation with a continuum of agents, proportion π of which are of bad type, and $1 - \pi$ of the good type.

The framework is quite general and describes surprisingly many governmental activities: provision of goods and services with externalities on third parties; assignment of procurement contracts; university admission and appointments; recruitment of public servants; etc.[5] A typical example is issuing licenses to firms (or passports/visas to individuals). Firms' operations may involve externalities (e.g. environmental hazard) so that the public does not like the idea of selling the license in an auction. For example, good firms (which care for environment) are willing to pay less for the license than bad ones since the former need to finance the reduction of externalities (e.g. environmental safety procedures). The type of the firm (i.e. the level of environment friendliness) is the firm's private information: bad firms pretend to be good in order to get a license.

Red tape. The principal cannot distinguish the types ex ante. However, types can be screened through red tape. We model red tape as a questionnaire that consists of a number of tests. The greater the amount of red tape (the number of tests), the more it costs the agent, but the more likely the agent's type is revealed. Red tape is measured in terms

[5] The setting is similar to that of Tirole (1996) where the principal wants to assign task 1 to the good type and task 2 to the bad type. In our setting, task 1 is 'providing the good' while task 2 is 'not providing the good'.

of its cost to the agent $r \geq 0$. The outcome ρ of the tests is either 'pass' $\rho = 1$ or 'fail' $\rho = 0$. The good type passes any number of tests with probability 1. The bad type passes r tests with probability $1 - I(r)$. Here $I(r)$ is a measure of the informativeness of red tape. We will assume that $I(r)$ is an increasing concave twice-differentiable function: $I'(r) > 0$, $I''(r) < 0$, $I(0) = 0$, and $I(\infty) \leq 1$ (for simplicity's sake, r is a real number). The share of the good types among those who pass r tests $\frac{1-\pi}{\pi(1-I(r))+(1-\pi)}$ is greater than their share in the whole population $1 - \pi$. Moreover, the former share increases with r.

P is not competent at administering red tape and hires a bureaucrat B. B chooses the level of red tape r, observes its outcome ρ and reports $\widehat{\rho}$. The report $\widehat{\rho}$ may or may not coincide with the true outcome ρ. We assume that B can conceal the evidence of failing the test, but cannot forge the evidence of A's failure if the test is passed successfully; in other words, $\widehat{\rho} \geq \rho$.[6] Thus if $\rho = 1$, B can only report $\widehat{\rho} = 1$. If $\rho = 0$, B may report $\widehat{\rho} = 1$ or $\widehat{\rho} = 0$.

P cannot observe the level of red tape r.[7] However, since the *reported* outcome $\widehat{\rho}$ is verifiable, P can announce a provision rule $\sigma(\cdot) : \{0, 1\} \to \{0, 1\}$ — whether or not to provide the good contingent on the reported outcome of the tests $\widehat{\rho}$. P can choose either of $2 * 2 = 4$ provision rules $\sigma(\cdot)$: (i) provide to everyone $\sigma(\widehat{\rho}) \equiv 1$; (ii) provide to nobody $\sigma(\widehat{\rho}) \equiv 0$; (iii) provide only to those who pass the test $\sigma(\widehat{\rho}) = \widehat{\rho}$, and (iv) provide only to those who fail the test $\sigma(\widehat{\rho}) = 1 - \widehat{\rho}$. As we will show below, it makes sense to use red tape only if the rule (iii) is used: $\sigma(\widehat{\rho}) = \widehat{\rho}$. The choice of this provision rule by P incorporates the common view that P uses red tape to reduce B's discretion: B can only provide the good to those who pass the test.

Bureaucrat's incentives. Following Banerjee (1997), we assume that the bureaucrat's salary can be made contingent on the ex post distribution of types who received the good or who were rejected. The technology for measuring the distribution ex post is as follows. With a very small probability P (costlessly) learns the type of the agent. In the alternative interpretation with a continuum of agents A, P checks a negligible number of agents and extrapolates the share of bad types which received the good. Also, the number of rejected applications is known ex post. In both formulations, the probability of being caught is infinitesimal for every given agent. The bad types who successfully passed through the red

[6] This follows the framework in Tirole (1986) and is based on the concept of 'partial verifiability' (Green and Laffont, 1986). If B could both fabricate and conceal the evidence, red tape would not make sense: reporting would be fully in B's discretion.

[7] As defined above, r is actually *quality* rather than quantity of red tape. The principal can observe the number of tests but not how much the red tape costs the agent and how much information it produces.

tape will keep the good with a probability very close to 1.[8]

Consider the case of licensing firms with environmental externalities. In order to observe the ex post distribution, the government simply needs to measure pollution. A similar logic applies in the case of issuing visas, hiring public servants, or university admissions. Neither the admissions committee (B) nor the trustees (P) can observe the quality of applicants (A) ex ante. On the other hand, quality is observed ex post (for example, via placement of graduates) and P can reward (in pecuniary or non-pecuniary means, or through career concerns) B for admitting better applicants.

Thus, P offers B a contract (s^b, s^g, s^0): B is paid s^b when the bad type gets the good, s^g when the good type does, and s^0 when nobody does.[9] The base salary s^0 is determined by B's reservation utility (for simplicity normalized to zero).[10] We assume that the cost of transfers is zero: a dollar paid to B costs taxpayers (whose utility enters P's objective function) precisely one dollar. In other words, the contract (s^b, s^g, s^0) may include monetary payments or fines as well as non-pecuniary benefits, but does not include imprisonment. To shorten the proofs, we will only consider monotonic rules $s^b \leq s^0 \leq s^g$.

Notation. To simplify notation, we will introduce the marginal incentives $\Delta^g = s^g - s^0$ (the bonus for letting the good type get the good) and $\Delta^b = s^0 - s^b$ (the punishment for letting the bad type get the good). Hence, B's contract (s^b, s^g, s^0) will be replaced with $(s^0 - \Delta^b, s^0 + \Delta^g, s^0)$.

Denote R^g and R^b to be the maximum participation levels of red tape at $\sigma(\rho) = \rho$ for the good and bad types, respectively:

$$\theta^g = R^g, \ \ \theta^b(1 - I(R^b)) = R^b.$$

Also, let us introduce r^0, the maximum amount of red tape which still produces more

[8] The principal can check a small representative sample but not the whole population. If the principal observed types of the whole population ex post and could take the good away from the bad type (or punish the bad type), red tape would not be needed. See Banerjee (1997, p.1295) for a detailed discussion of this assumption.

[9] The technology of observing the distrubution ex post requires B's reward to be linear: B gets $N^g s^g + N^b s^b + N^0 s^0$, where N^g, N^b, N^0 are probabilities that the good was given to the good type, to the bad type, or to nobody, respectively. The results would not change if non-linear contracts were allowed (e.g. in a formulation with a continuum of agents): only marginal rewards ($s^g - s^0$ and $s^0 - s^b$ in a neighborhood of equilibrium) matter. Other parameters of the contract only influence the expected level of compensation which is determined by B's participation constraint.

[10] Instead of the individual rationality constraint $E_i s^i \geq 0$, one could introduce the limited liability constraint: $s^i \geq 0$ for all i. The results would be the same since the level of red tape only depends on the marginal rewards $s^g - s^0$ and $s^0 - s^b$.

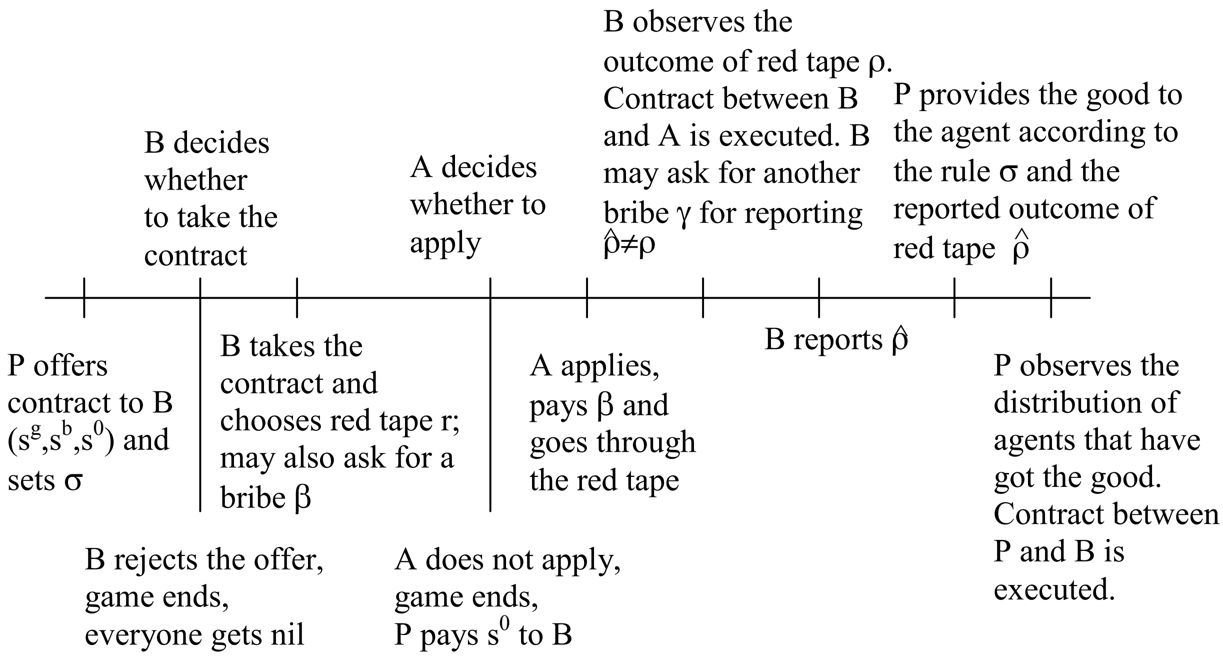

Figure 1: Timing

information than it costs the agent. Apparently, r^0 is the largest root of

$$\pi|v^b|I(r) \ = r.$$

Whenever $\pi|v^b|I'(0) > 1$, this amount is positive, and red tape produces a positive social benefit for all $r \in (0, r^0)$.

2.2 Timing and payoffs

The timing is as in Figure 1. First, A learns her type. Then the principal offers a contract (s^b, s^g, s^0) to B. P also chooses the provision rule $\sigma(\cdot)$. B decides whether to take the contract. If B takes the contract, he sets the level of red tape r. B may also ask A for a bribe β for lowering red tape: B may threaten A with a high level of red tape and offer a lower level for a bribe. Given r and $\sigma(\cdot)$, the agent decides whether to apply for the good. If she quits, the game ends. If she applies, she pays the bribe β to B. Then she undergoes the tests and bears the cost r. B learns the outcome ρ of the tests and reports $\widehat{\rho}$ to the principal. B may misreport the outcome ($\widehat{\rho} > \rho$) in exchange for another bribe γ.

Given the reported outcome of tests $\widehat{\rho}$, P executes the contract. If $\sigma(\widehat{\rho}) = 1$, P provides the good to the agent; otherwise A does not get the good. Then the ex post distribution of agents who received the good is observed, and B gets s^i, $i = 0, g, b$.

We will compare the outcomes with and without corruption. If there is no ex ante corruption, then $\beta \equiv 0$. If there is no ex post corruption, then $\gamma \equiv 0$. If corruption is allowed, then the bribes β and γ are determined through bargaining between B and A. For simplicity's sake, we assign all bargaining power to B: B makes A a take-it-or-leave-it offer.

The agent maximizes her expected payoff net of the cost of red tape. If the good type applies she gets

$$U^g = \theta^g \sigma(1) - r - \beta. \tag{1}$$

If the bad type applies she gets

$$U^b = \theta^b \left[\sigma(1)(1 - I(r)) + \sigma(\widehat{\rho}) I(r)\right] - r - \beta - \gamma I(r). \tag{2}$$

The bureaucrat maximizes her expected salary plus bribes, taking into account the fact that agents may choose not to apply for the good:

$$\begin{aligned} U^B &= s^0 + \left(\Delta^g \sigma(1) + \beta\right)(1 - \pi) \mathbb{1}(U^g \geq 0) \\ &+ \left(-\Delta^b \left[\sigma(1)(1 - I(r)) + \sigma(\widehat{\rho}) I(r)\right] + \beta + \gamma I(r)\right) \pi \mathbb{1}(U^b > 0), \end{aligned} \tag{3}$$

where $\mathbb{1}(x)$ is the indicator function which takes a value of 1 whenever statement x is true, and equals 0 otherwise. The first term represents B's base salary, the second term is B's bonus if A is of the good type and A applies for the good. The last term is B's bonus (or penalty) if A is of the bad type, applies, and gets the good.

The principal maximizes social welfare which includes the welfare of B and A, but also takes into account externalities on third parties, as well as taxpayers' expenditures. Hence all monetary transfers (bribes and B's salary) cancel out; when an agent of type i gets the good, social welfare changes by v^i rather than by θ^i :

$$W = \left(v^g \sigma(1) - r\right)(1 - \pi) \mathbb{1}(U^g \geq 0) + \left(v^b \left[\sigma(1)(1 - I(r)) + \sigma(\widehat{\rho}) I(r)\right] - r\right) \pi \mathbb{1}(U^b > 0). \tag{4}$$

The first term describes the social welfare if A is of the good type (which happens with probability $1 - \pi$). If A expects a negative surplus $U^g < 0$, she does not apply; welfare is zero. If A's expected utility is positive then the agent applies and passes the test $\rho = 1$; welfare equals $v^g \sigma(1) - r$. Similarly, the second term represents welfare if the agent is of the bad type and chooses to apply.

To illustrate (4), let us consider an important special case when both types apply, the good is provided to those who pass $\sigma(\widehat{\rho}) = \widehat{\rho}$, and the outcome is truthfully reported $\widehat{\rho} = \rho$:

$$W = \left[(1-\pi)v^g - \pi|v^b|\right] + \left[\pi|v^b|I(r) - r\right].$$

The first term is welfare without red tape (the good is given to everybody). The second term is the net social benefit produced by red tape: red tape costs r, but saves $\pi|v^b|I(r)$ because the good is not provided to the bad type with probability $I(r)$.

It is important to emphasize the difference between ex ante and ex post corruption. Ex post corruption is collusion between the bad type and the bureaucrat, while ex ante corruption occurs when B has no information on the agent.[11] Ex ante, both good and bad types may give a bribe to reduce the level of red tape. Ex ante corruption seems innocent: unlike ex post corruption, there is no clear 'theft' from the public. On the other hand, this kind of corruption also involves changes in real terms: B and A choose the level of red tape best for their joint surplus, which may well differ from the socially optimal level. P may try to influence the outcome of ex ante collusion by choosing B's incentives Δ^g and Δ^b,[12] but as we show below the choice of Δ^b may be constrained by the threat of ex post corruption.

2.3 Assumptions

In order to concentrate on the most interesting case, we shall make the following assumptions.

Assumption A1. The pooling equilibrium without red tape yields positive social welfare

$$W^0 = (1-\pi)v^g + \pi v^b > 0. \tag{5}$$

This assumption implies that social welfare is greater when the good is provided to everyone rather than when it is not provided at all.

Assumption A2. Agents *cannot be* fully separated: $\theta^b > \theta^g/(1 - I(\theta^g))$.

[11] Policymakers have long understood the distinction between ex post and ex ante corruption. As discussed in Bardhan (1997) and Elliott (1997), U.S. anti-corruption legislation has been stricter in prosecuting the ex post corruption, where the bribe influences the decision made by the bureaucrat, than ex ante corruption, where the decision is not affected and the bribe simply reduces red tape.

[12] We assume that P knows B's propensity for ex post and ex ante corruption. In this setting, P always prevents ex post corruption in equilibrium. If there were asymmetric information and bureaucrats differed in their cost of illicit tranfers (Tirole, 1992), probability of being caught (Acemoglu and Verdier, 2000), or disutility of punishment (Banerjee, 1997), collusion would still occur in equilibrium.

This assumption is equivalent to $R^b > R^g$. The bad type's valuation is so high that she is even ready to go through more red tape than the good type (unlike Banerjee, 1997). A2 directly implies $\theta^b > \theta^g$. Therefore if the good is sold at a given price p or auctioned off, the first best cannot be achieved. Applications with $\theta^b > \theta^g$ are usually related either to externalities or to type-specific cost of provision such as issuing licenses, passports, visas etc. For example, consider issuing licences to firms, some of which want to engage in legal business, and some to engage in semi-criminal activities or activities endangering the environment. The private return on the socially undesirable activities may be much higher. The same logic applies to issuing passports or visas, or awarding certain government contracts. Another application is privatization of public property under imperfect capital markets. Suppose that the government wants to allocate property to the most efficient owner (the 'good' type) but the latter does not have enough cash and the cost of borrowing is high (but finite). On the other hand it may occur that a less efficient owner (the 'bad' type) has enough cash to buy the property. In this case the good type's valuation is NPV of future revenues minus the cost of borrowing, which may be less than the bad type's NPV.

Assumption A3. Interior optimum:

$$\pi|v^b|I'(R^g) < 1 < \pi|v^b|I'(0).$$

This is a technical assumption that assures that the social optimum is interior and is determined by the first order condition. The right-hand-side inequality implies that the marginal social benefit of a small amount of red tape $\pi|v^b|I'(0)dr$ is greater than its cost dr; hence, red tape is not trivial in the social optimum. Similarly, the left-hand side inequality requires that the marginal benefit fall below marginal cost before the good type drops out.

Assumptions A1-A3 are not very restrictive: they impose four constraints on one function $I(\cdot)$ and five scalar parameters π, $v^g, v^b, \theta^g, \theta^b$.[13] A1 requires a sufficiently low share of the bad type π, A2 implies a sufficiently large externality (high θ^b given $v^b < 0$), and A3 assumes that red tape is informative but not 'too informative'. In Section 4, we discuss the robustness of our results to relaxing A1-A3.

3 Solving the model

In this section we solve for the equilibrium. We shall begin by describing the social optimum, i.e. the benchmark outcome that is achieved when B maximizes social welfare. Then we

[13] E.g. the combination $I(r) = r/(r+1)$, $\pi = 0.1$, $v^g = \theta^g = 3, v^b = -15, \theta^b = 15$ satisfies all assumptions.

check whether this social optimum can be implemented if B is selfish, i.e. maximizes (3). Essentially, the model has two layers of agency problems. First, there is an adverse selection problem, with the bad type pretending to be the good one. Second, there is a two-dimensional moral hazard problem, with B choosing red tape r and reporting its outcome ρ. B may want to choose inefficient level of red tape because he does not internalize its social cost fully, or because red tape increases the probability of getting the bribe ex post. B may also want to misreport ρ since he can extort bribes from the bad type ex post.

3.1 Social optimum

Red tape is costly but also informative; therefore the optimal level of red tape is not trivial. If the agent's type were common knowledge, no red tape would be needed $r = 0$; the good type would be given the good and the bad one would not. The first-best level of welfare would be $W^{FB} = (1-\pi)v^g$. In what follows, we will assume that the agent's type is known only to the agent and can only be verified through red tape. We will refer to the resulting *second best* as the social optimum. Essentially, we study how well P would cope with the adverse selection problem if there were no moral hazard related to the choice of red tape and corruption. This is the case if B never takes bribes $\beta \equiv \gamma \equiv 0$ and acts in the interest of P, i.e. always sets the level of red tape that the principal wants to implement and truthfully reports the outcome $\widehat{\rho} = \rho$.

The social optimum is therefore the choice of r and $\sigma(\cdot)$ that maximizes (4) subject to (1)-(2), $\beta = \gamma = 0$, $\widehat{\rho} = \rho$.

Proposition 1 *Under A1-A3, the social optimum is as follows:* $\sigma(\rho) = \rho, r = r^*$ *where*

$$I'(r^*) = \frac{1}{\pi|v^b|}. \tag{6}$$

Both types apply. Welfare is

$$W^* = W^0 + \pi|v^b|I(r^*) - r^*.$$

All proofs are relegated to the appendix.

Thus, in the social optimum, the types are partially screened: both types apply, but the good type gets the good with a higher probability than the bad one. The good type still receives lower expected rent $U^g < U^b$. Indeed, A2 and A3 jointly imply $r^* < R^g < R^b$, hence $\theta^g - r^* < \theta^b(1 - I(r^*)) - r^*$.

3.2 Corruption and excessive red tape

In order to implement the social optimum, P needs to overcome two moral hazard problems. B should have incentives (i) to choose the right level of red tape, and (ii) to report the true outcome of the tests. In this subsection we show that solving both problems may be hard if B is corrupt.

We allow both for ex ante and ex post corruption. Ex ante corruption occurs when the bureaucrat threatens the agent with a high level of red tape r^t, but also offers to lower red tape down to r in exchange for a bribe β to maximize his surplus, which is legal rewards plus bribes (3). Since red tape is not observed by the principal, B can threaten a prohibitively high level of red tape $r^t \geq R^b$ at which both types get zero rent (by taking the outside option). The bureaucrat may choose whether (i) to deter one type and extract all the rent from the other one or (ii) let both types in. If both types apply then B extracts all the rent from the type with lower rent, leaving a certain informational rent to the other type. Assumption A2 implies that the good type gets a lower rent, hence $\beta = \theta^g - r$.

Ex post corruption may occur once the bad type fails the test. If the evidence of failure is concealed and $\sigma(\rho) = \rho$, the bad type gets the good and gains θ^b. On the other hand, the bureaucrat gets a lower salary ($s^0 - \Delta^b$ instead of s^0). If collusion increases the joint surplus of B and A ($\theta^b - \Delta^b > 0$), then the bribe $\gamma \in [\Delta^b, \theta^b]$ redistributes the gain from A to B so that both B and A benefit from collusion. Since B has all the bargaining power, he gets a bribe of $\gamma = \theta^b$.

The principal can prevent collusion by setting $\Delta^b \geq \theta^b$. Indeed, in this case the bureaucrat earns more by reporting the bad type than by accepting the bribe and letting her go.

Definition 1 *B's contract is said to be collusion-proof if* $\Delta^b \geq \theta^b$.

If B's salary is not collusion-proof $\Delta^b < \theta^b$, B will always report that A passes the test $\widehat{\rho} = 1$ while the true outcome ρ may be either success or failure. Therefore, $\sigma(0)$ becomes irrelevant, and the provision rule $\sigma(\rho) = \rho$ ('provide the good only to those who pass the test') performs as badly as the rule $\sigma(\rho) \equiv 1$ ('provide to everyone'). The latter rule does not take advantage of red tape's informativeness and can only achieve welfare W^0. To implement any level of welfare higher than W^0, P must offer a collusion-proof contract.[14] The problem is that collusion-proofness may become a binding constraint for the mechanism design problem.

[14]This is a well-known argument for increasing public servants' incentives in order to prevent corruption (Becker and Stigler, 1974). Anecdotal evidence supports this argument (Klitgaard, 1988) while empirical

Proposition 2 *Suppose that assumptions A1-A3 hold, and both ex ante and ex post corruption is allowed.*

1. *If* $\theta^b \leq |v^b|$, *P implements the social optimum through setting* $\sigma(\rho) = \rho$, $\Delta^b = |v^b|$, *and sufficiently high* Δ^g.

2. *If* $\theta^b > |v^b|$, *P cannot implement the social optimum. The equilibrium is as follows:*

   (a) *If* $|v^b| < \theta^b \leq \left[\pi I'\left(\min\{r^0, R^g\}\right)\right]^{-1}$, *P sets* $\sigma(\rho) = \rho$, $\Delta^b = \theta^b$, *and sufficiently high* Δ^g. *The equilibrium level of red tape is* $\overline{r} > r^*$, *where* $I'(\overline{r}) = \frac{1}{\pi\theta^b}$. *Welfare is*

   $$\overline{W} = W^0 + \pi|v^b|I(\overline{r}) - \overline{r}.$$

   (b) *If* $\theta^b > \left[\pi I'\left(\min\{r^0, R^g\}\right)\right]^{-1}$, *P sets* $\sigma(\rho) \equiv 1$, $\Delta^b = \Delta^s = 0$. *The equilibrium level of red tape is* $r = 0$. *Welfare is* W^0.

The intuition is as follows. If giving the good to the bad type is very costly ($|v^b|$ is sufficiently high, case 1), then P wants to implement a high level of red tape. P provides a large bonus Δ^b for catching and reporting the bad type, the collusion-proofness constraint is not binding, and the social optimum is implemented. However, if the social benefit of red tape is relatively low (case 2), then P would like to reduce red tape by lowering Δ^b, but collusion-proofness requires that the bonus Δ^b exceed the potential bribe θ^b. Hence, the principal can only prevent ex post corruption at a cost of excess incentives to catch the bad type, which in turn results in excessive red tape $\overline{r} > r^*$. If the increase in red tape is moderate (case 2a) then the principal accepts it. If the deviation from the social optimum is too large (case 2b), the principal prefers to abandon red tape altogether. The equilibrium in case 2b is essentially equivalent to firing the bureaucrat.[15]

evidence shows that the effect is rather weak (Rijchenghen and Weder, 2001). Modern contract theory also suggests that high wages can eliminate corruption but may create other problems if P wants B to do multiple tasks. This is what happens in our model: the principal sets high Δ^b to eliminate collusion; B reports the outcome truthfully, but, as in any multi-tasking model, this distorts B's incentives to choose the socially optimal level of red tape.

[15]It not uncommon for both OECD and non-OECD governments to stop regulating certain business activities that have previously been closely controlled. See Klitgaard (1988) for a discussion of the positive effect on corruption of legalizing off-track betting in Hong Kong. Russia's recent deregulation reform has cut the list of licensed activities tenfold; although many of the deregulated activities have clear externalities, corruption makes the cost of red tape too high. Also, see Djankov et al's (2002) discussion of new business registration procedures in New Zealand (takes 3 business days) and France (53 business days).

3.3 Ex post vs. ex ante corruption

In this subsection we shall find out whether it is ex ante or ex post corruption that leads to excessive red tape. We study the cases when B can be involved in one kind of corruption but not in the other one, and compare the equilibrium to the social optimum. Although it is unlikely that the bureaucrat can be honest ex ante but corrupt ex post, this problem does reach beyond theoretical interest. Indeed, if P has limited resources to fight corruption, e.g. through hiring external monitors, which kind of corruption should P focus upon to reduce inefficiency?

Let us start with the case where B can extort bribes ex ante but cannot engage in ex post collusion (i.e. $\gamma \equiv 0$). Collusion-proofness is not a constraint any more, so the main problem of Proposition 2 disappears. Hence, P can align B's incentives with those of society by setting Δ^g sufficiently high (so that the good type is not excluded) and $\Delta^b = |v^b|$ so that the optimal amount of red tape is implemented. Indeed, B gets

$$s^0 + (1-\pi)\Delta^g - \pi\Delta^b(1 - I(r)) + (\theta^g - r).$$

The last term represents the bribe β. The bureaucrat fully internalizes the cost of red tape: if A's cost of red tape increases by one dollar, B can extort one dollar less in bribes. B's individual marginal return to red tape is equal to the social one: $\pi\Delta^b I'(r) = \pi|v^b|I'(r)$. Hence B chooses the level of red tape that maximizes $\pi|v^b|I(r) - r$; the social optimum is implemented.

Now let us see whether potential ex post collusion limits the principal's ability to implement the social optimum in the absence of ex ante corruption. If B does not take bribes either ex post or ex ante, the social optimum is implemented through $\Delta^b = 0$. B gets $s^0 + (1-\pi)\Delta^g$ and is therefore indifferent in choosing the level of red tape, and can set $r = r^*$.[16]

Compare the case of an honest B with the case where he can be corrupt ex post but not ex ante. B maximizes $U^B = s^0 + \Delta^g(1-\pi) - \pi\Delta^b(1-I(r)) + \pi\theta^b I(r)\mathbb{1}(\theta^b > \Delta^b)$, where the last term represents the ex post bribe. The flat contract $\Delta^b = 0$ is not collusion-proof; offering the flat contract would provide incentives for excessive red tape. Indeed, B does not internalize the cost of red tape, and is interested in raising it to increase the probability

[16] The fact that B is indifferent between r^* and other levels of red tape in equilibrium is an artefact of the trivial cost of red tape to the bureaucrat. If the red tape imposed a positive (even infinitesimal) cost on B, the socially optimal level r^* would be B's unique choice: P would set Δ^b such that B's private marginal cost of red tape would be equal to his private marginal benefit $\Delta^b\pi I'(r^*)$.

of detecting the bad type. Through setting Δ^g high enough, P can constrain red tape from above only by R^g (B is afraid to deter the good type from applying). P can prevent ex post collusion by offering $\Delta^b \geq \theta^b$, but this will not reduce red tape. Hence P faces a choice between too much red tape ($r = R^g > r^*$, welfare is $W^0 + \pi|v|^b I(R^g) - R^g < W^*$) and firing the bureacrat ($r = 0$, welfare is $W^0 < W^*$).

The discussion above is summarized in the following Proposition.

Proposition 3 *Assume that A1-A3 hold.*

1. *If there is ex ante corruption but no threat of ex post corruption then P implements the social optimum via the following mechanism: P sets* $\sigma(\rho) = \rho$, $\Delta^g = \max\{v^g, \frac{\theta^b - \theta^g}{1-\pi}\}$ *and* $\Delta^b = |v^b|$. *Then B chooses* $r = r^*$ *and* $\beta = \theta^g - r^*$.

2. *If ex post corruption is allowed but there is no ex ante corruption, then P cannot implement the social optimum. The equilibrium is as follows:*

   (a) *If* $R^g < r^0$, *P sets* $\sigma(\rho) = \rho$, $\Delta^b \geq \theta^b$, *and* Δ^g *sufficiently high. The equilibrium level of red tape is* $R^g > r^*$. *Welfare is* $W^0 + \pi|v^b| I\left(R^g\right) - R^g$.

   (b) *If* $R^g \geq r^0$, *P sets* $\sigma(\rho) \equiv 1$, $\Delta^b = \Delta^s = 0$. *The equilibrium level of red tape is* $r = 0$. *Welfare is* W^0.

3. *If neither ex post no ex ante corruption are allowed then P implements the social optimum through a flat contract* $\Delta^b = 0$, *and sufficiently high* Δ^s.

Propositions 1-3 imply that ex post corruption limits the principal's ability to implement the socially optimal level of red tape. Again, corruption results in too much rather than too little red tape. The excessive red tape may be so costly that P may even prefer to abandon red tape and to provide the good to everybody $\sigma(\rho) \equiv 1$ (i.e. effectively fire the bureaucrat).

Our result runs against a common view best stated by Huntington (1968):

> "... the only thing worse than a society with a rigid, overcentralized, dishonest bureaucracy is one with a rigid, overcentralized, honest bureaucracy."

Why does not this view hold in our model? The question is not trivial. Indeed, our model does include the effect the view is based upon: corruption helps the bureacrat internalize the costs of rigidities imposed on society. However, our model has two other important features. First, we assume that the bureaucrat's incentives are set by a rational benevolent principal. Second, and what is more important, we endogenize the rigidities. Indeed, if the official level of red tape is too high, (ex ante) corruption reduces it to a more reasonable level, which in turn depends on the bonuses that the principal offers to the bureaucrat. Our analysis shows that due to the threat of ex post corruption, the principal cannot provide incentives to bring the equilibrium level of red tape all the way down to the social optimum.

4 Extensions

Models of collusion in a three-tier hierarchy are generally very complex. In order to build a tractable model, we deliberately introduced a few shortcuts. In this section, we will check whether the results are robust to replacing them with more realistic assumptions.

Robustness to relaxing assumptions A1-A3. Assumption A1 assures that the 'default' outcome is to provide the good to everyone (which is equivalent to $r = 0$) rather than to noone. If A1 did not hold we would have to consider additional cases (in particular, what happens when $W^0 + \pi|v^g|I(r) - r < 0$), but the results would not change.

A2 rules out certain potential applications of the model. Indeed, if we consider the case of providing a good that incurs no externalities, with its cost the same for both types $c^g = c^b$, then $\theta^g - \theta^b = v^g - v^b > 0$. An example is a decision on allocation of a good that is in limited supply (e.g. a spectrum-band license). The cost of provision is the shadow price or Lagrange multiplier of the resource constraint $c^g = c^b = \theta^b$, which is the same for both types so that $v^b = 0 < v^g = \theta^g - \theta^b$. Banerjee (1997) provides a comprehensive analysis of this case with cash constraints. If there are no cash constraints, the case $\theta^g > \theta^b$ is rather trivial: the government should only announce that the good can be purchased by any agent at price $p \in (\theta^b, \theta^g)$ and no red tape is needed.

A2 also rules out the case where $\theta^g < \theta^b < \theta^g/(1 - I(\theta^g))$. In this case, types still cannot be separated through prices, but can be separated through red tape: $R^g > R^b$. This (rather involved) case was studied in the previous version of the paper (Guriev, 2000). It turns out that if π is sufficiently high (the bad type is very common), the social optimum is to deter the bad type from applying via high red tape. This social optimum can always be implemented through high Δ^b. However, if π is low, then (similarly to the case where A2 holds) the social optimum is to set the red tape below $\min\{R^g, R^b\}$; both types apply and are only partially screened; thus, the analysis is identical to that of Section 3.

Assumption A3 is purely technical. If the left-hand-side inequality does not hold, then

$r^* = R^g$ and the social optimum is always implemented through a sufficiently high Δ^g. Too much red tape results in the good type dropping out, and, if P rewards B for giving the good to the good type, B sticks to the social optimum. If A3's right-hand side inequality does not hold, then $r^* = 0$. Then the analysis is just slightly more involved; even if collusion-proofness is binding, there may or may not be excessive red tape: one needs to consider one more case $\theta^b \in \left[|v^b|, (\pi I'(0))^{-1}\right]$.

Type I vs. type II errors. Our model allows only for the type II error: the good type always passes the tests. One can imagine a more general setting where both type I and type II errors may occur: the good type passes r tests with probability $P^g(r)$ while the bad type passes r tests with probability $P^b(r)$. The share of the bad type among those who have passed r tests is $\frac{\pi P^b(r)}{\pi P^b(r)+(1-\pi)P^g(r)}$ which is smaller than π whenever $P^b(r) < P^g(r)$. The informativeness (i.e. the difference between $\frac{\pi P^b(r)}{\pi P^b(r)+(1-\pi)P^g(r)}$ and π) increases with $P^g(r)/P^b(r)$.

Propensity for corruption. An important drawback of the analysis in Section 3 is that we study equilibria under an exogenous propensity for ex post and ex ante corruption. For a given propensity for corruption, we solve for red tape and corruption, but we do not explain what determines the propensity. The most important factor of propensity for corruption is enforceability of illicit contracts. B and A cannot take the collusive contract to a court of law. Thus A cannot be always sure that B reports what A has paid for. For example, if A pays B *before* the report $\widehat{\rho}$ is filed, then a subgame-perfect behavior would be to report the true state $\widehat{\rho} = 0$ and get the legal reward Δ^b on top of the bribe γ. On the other hand, if A pays B *after* the report is filed, then A may choose not to pay the bribe. Collusion may therefore occur only if there is some private enforcement mechanism (such as repeated interaction, reputation, organized crime, etc.) or the nature of evidence is such that it can be handed over by B to A in exchange for the bribe (and cannot be duplicated). Ex ante corruption also requires commitment: B sets an (illegally low) level of red tape in return for a payment from A. It may be the case that after getting the bribe, B still sets a high r. Since the initial threat was a high r and there is no legal mechanism to enforce the illicit contract, A may be unable to punish B for withdrawing his promise.

The other explanation of propensity for corruption is B's personal non-pecuniary cost of being involved in corrupt behavior. Let us denote this cost D. If $D > \theta^b$, then there is no danger of ex post collusion and it is easy to achieve the social optimum. The cost of being corrupt may include the personal cost of committing an immoral act or violating a social norm. The cost would also increase if the principal set up a supervisory unit to check potentially corrupt bureaucrats. Then D would include the expected disutility of being caught (the cost of potential punishment times the probability of getting caught). The cost D would be easily endogenized in a model with several bureaucrats, e.g. due to a numerical externality, either of static or of dynamic nature. Dynamic externalities can arise because of the imperfect observability of an individual track record. In Tirole (1996), only collective reputation can be observed; hence, if many group members are corrupt it does not pay to be honest: the outside world will still treat any member of the group as corrupt. A numerical externality of static nature exists in models with an endogenous probability of being caught (see Sah, 1991, Clague, 1993, Banerjee, 1997). If P has only a limited number of skilled and honest supervisors, the probability of being caught for each bureaucrat decreases with the number of potential perpetrators. Therefore there can be at least two stable equilibria (for some parameter values). First, there is an equilibrium where nobody is corrupt; the probability of being caught is very high so D is very high. Second, there is another equilibrium where everyone wants to be corrupt and the probability of being caught is negligible ($D = 0$).

Prices and application fees. Since we study the case of market failure (assumption A2), price alone cannot help achieve the first best. However, if used jointly with red tape, prices – and especially application fees – can improve the allocation. An application fee is a payment made when A applies for the good rather than when she gets the good (similar to all-pay mechanisms studied in Banerjee, 1997). Hence, when $r > 0$, the application fee is costlier to the bad type (she gets the good with lower probability). The setting with both prices and application was studied in the previous version of this paper; the results are similar as long as prices and application fees are non-negative. The analysis becomes more complex while adding only a few minor insights. First, by using prices and application fees P can tax a corrupt bureaucrat. By raising application fee by one dollar, P reduces the bribe β by one dollar, hence redistributing income from the bureaucrat to the public treasury. Second, by using prices, application fees and red tape, one can separate types, which may increase welfare in the social optimum.

If it were possible to charge a negative price, the situation would change. First, the social optimum requires only a negligible amount of red tape, which is sufficient for deterring the bad type (along with a very large application fee and a very large negative price). The agents would have to make a large deposit, then pass a test which would reveal the bad type with a small but positive probability.[17] Those who got through the test would receive

[17] Our model is applicable to the process of reviewing papers for publications in academic journals. In

the deposit back plus the good, while others would not get anything. Second, this social optimum is very easy to implement by setting a large punishment for giving the good to the bad type Δ^b. One can easily show, however, that this contract is not robust even to infinitesimal departures from either of several assumptions of the model: zero cost of transfers, perfect access to credit, and zero probability of type I error.

Distribution of bargaining power. Suppose that the distribution of bargaining power between B and A is $\lambda : 1 - \lambda$, i.e. B gets only a fraction $\lambda \in [0, 1]$ of the {B,A} coalition's joint surplus. The results are similar, the only difference being that the collusion-proofness constraint $\Delta^b \geq \theta^b$ becomes $\Delta^b \geq \lambda\theta^b$; i.e. is less restrictive now. The first statement of Proposition 2 holds whenever $\lambda\theta^b \leq |v^b|$ (instead of $\theta^b \leq |v^b|$). In other words, the less is the bargaining power of the bureaucrat, the more likely P is able to implement the social optimum.

This analysis suggests that the distribution of bargaining power determines the strength of the relationship between the threat of ex post corruption and excessive red tape. Can the government increase the agent's bargaining power? A simple approach is to introduce competition among bureaucrats. Suppose that there are several offices that screen agents, and agents can choose which one to go through. Then the bureaucrat's bargaining power decreases. Unfortunately, competition is not always possible due to indivisibility of the public good or costs of information processing (Bardhan, 1997).

Red tape vs. monitoring. We have built a model of red tape that is informative but costly for the agent. One may argue that red tape is also costly for the bureaucrat. The reason why we have focused on red tape being costly to the agent rather than to the bureaucrat is because it is the cost for the agent that distinguishes red tape from pure monitoring. A pure monitoring technology is costly for the monitor to operate but is free to the agent being monitored. In the case of pure monitoring, the monitor's actions impose no externality on the agent and it is easier to provide incentives for the socially optimal level of monitoring if the ex post distribution is contractable (this is the standard moral hazard problem). If the monitoring technology includes elements of pure red tape and pure monitoring (i.e. is costly for both A and B), then the problem of internalizing the agent's cost is still present.

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the editor-referee-author hierarchy, the editor can ask the author to pay a large submission fee which is paid back if the paper is accepted. The referee's incentives (monetary or non-pecuniary) can be based on the ex post citation scores of the papers he accepts or rejects.

5 Conclusions

We have built a theory of red tape and corruption in a principal-bureaucrat-agent hierarchy. The setting is very simple: a benevolent government provides a good to different types of agents. Provision involves externalities so that agents who are eligible for the good are willing to pay less than agents whom the government wants to exclude. Because of these externalities, the agent's type cannot be perfectly screened by market mechanisms. Red tape can help screening types, albeit partially. Red tape is modelled as a series of costly tests that reveal information about the agent's type. To administer red tape, government hires a bureaucrat, who can take bribes ex ante and ex post. In the model, both red tape and bribes are endogenously determined given the bureaucrat's propensity for each type of corruption.

The government faces a complex web of challenges. On top of the adverse selection problem (the agent's type is her private information), there is a two-dimensional moral hazard problem: the bureaucrat may set an inefficient level of red tape ex ante and misreport the agent's type ex post. In equilibrium, the government manages to solve the latter problem, but this undermines its ability to solve the former. Although the threat of ex post corruption is not realized in equilibrium, it still results in excessive red tape, even after the bureaucrat reduces red tape in exchange for bribes.

The contribution of the paper is in showing that potential corruption results in too much (rather than too little) red tape in equilibrium compared with the social optimum. This result is not trivial because we consider two countervailing effects: (i) corrupt officials can take bribes ex ante to reduce red tape; (ii) corrupt bureaucrats create more red tape in order to reveal information and extort bribes. The first effect alone should predict a high official level of red tape which is negotiated to a lower level in exchange of a bribe. Moreover, since the equilbrium level of red tape is chosen by the coalition of the bureaucrat and the agent without taking externalities into account, one should expect too little red tape compared with the social optimum. The second effect predicts that the equilibrium level of red tape is above the social optimum. We show that the second effect always prevails. Excessive red tape occurs because of the threat of ex post corruption even if there is no corruption in equilibrium. The principal eliminates ex post corruption by offering a collusion-proof contract, but the need to alter the bureaucrat's contract adds a constraint to the mechanism design problem and reduces the principal's ability to achieve the efficient outcome.

The main empirical prediction of the model is that the threat of corruption leads to higher, rather than lower, red tape. The model therefore predicts a positive correlation between corruption and red tape: the threat of corruption leads to excessive red tape. It is hard to test the implications of the model: by its very nature, corruption is not easy to measure, nor is red tape. A common approach to measuring corruption and red tape is to conduct a survey of experts or international businesses who can compare levels of corruption and red tape in different countries. These data show that red tape and corruption are highly correlated: correlation of 'corruption' and 'bureaucratic delays' is 0.86 and is significant at the 1% level (La Porta et al., 1999). Kaufmann et al. (1999) aggregate the indicators from all available sources (including the one used by LaPorta et al., 1999). Their measures of 'government effectiveness' and 'graft' have a 0.92 correlation (also significant). Djankov et al. (2002) use objective measures of regulation such as time, cost, and number of bureaucratic procedure, and show that they are significantly correlated with corruption perception controlling or not controlling for per capita income (the pairwise correlation is 0.7). The firm-level measures of 'time tax' and 'bribe tax'in transition countries (BEEPS survey, discussed in EBRD, 1999) have a significant correlation of 0.25; after adjusting for country means, the correlation is still positive 0.23 and significant; the relationship remains positive and significant in a regression with country, sector and town type dummies.

Certainly, further empirical analysis should be carried out to solve the identification problem (both red tape and corruption may depend on another variable) and to distinguish between observed and potential corruption. On one hand, our model predicts a positive relationship between red tape and *potential* corruption. On the other hand, the numerical externality may result in a correlation between potential and observed corruption. The more the corruption observed in a country, the lower the cost of taking bribes for any single bureaucrat. This, in turn, leads to a greater threat of corruption and excessive red tape. The policy implications are therefore straightforward: the effect of corruption on red tape is not at all innocent. Fighting corruption may indeed reduce red tape and increase welfare.

6 Proofs

Proof of Proposition 1. The structure of the proof is as follows. We divide all contracts into three subsets: those under which both types apply, those under which only the bad type applies, and those under which nobody applies (A2 rules out the case where the good type applies, and the bad type does not). For each subset we find the contract that achieves the maximum welfare. Then we compare the three potential candidates for the social optimum.

First, let us find the optimal provision rule $\sigma(\rho)$. There are four possible rules: provide to everyone, provide to noone, provide only to those who pass, and provide only to those who fail. If P wants to use any non-trivial amount of red tape $r > 0$, then only the rule $\sigma(\rho) = \rho$ (provide to those who pass) makes sense. Indeed, $\sigma(\rho) = \rho$ dominates the $\sigma(\rho) = 1 - \rho$ (provide to those who fail). On the other hand, if P chooses one of the non-discriminating rules $\sigma(\rho) \equiv 0$ or $\sigma(\rho) \equiv 1$, then red tape does not matter and should be abandoned. Thus P should compare the performance of three contracts: (i) provide to nobody, do not use red tape, (ii) provide to everybody, do not use red tape, and (iii) charge positive red tape and provide to those who pass the tests. According to A1, (ii) is better than (i). According to A3, (iii) is better than (ii). Thus P chooses $\sigma(\rho) = \rho$. If the good type applies she gets the good with probability 1, while if the bad type applies she gets the good with probability $1 - I(r)$.

If the contract is such that neither type applies (e.g. $r > R^b > R^g$), P gets zero $W = 0$. If the contract is such that the bad type applies and the good type does not (e.g. $r \in (R^g, R^b)$), then welfare is negative $W = \pi v^b(1 - I(r)) - r < 0$. Now let us turn to the case where both agents apply for the good. P should offer the level of red tape r that satisfies both types' participation constraints. The optimal contract maximizes

$$W = (1 - \pi)(v^g - r) + \pi((1 - I(r))v^b - r) = W^0 + \pi|v^b|I(r) - r.$$

subject to $r \leq R^g$. A3 assures that the optimum is uniquely determined by the first order condition (6). ■

Proof of Proposition 2. The first part is straightforward. The contract is collusion-proof. B compares three outcomes: (a) set $r \leq R^g$, both types apply, extort all the good type's rent ex ante $\beta = \theta^g - r$; (b) set $r \in (R^g, R^b)$, good type does not apply, the bad type does, all the rent of the bad type is paid in bribes ex ante $\beta = \theta^b(1 - I(r)) - r$; (c) set $r \geq R^b$, neither type applies, B gets s^0. In case (a) B maximizes

$$U^B = s^0 + (1 - \pi)\Delta^g - \pi\Delta^b + \pi\Delta^b I(r) + \theta^g - r \tag{7}$$

subject to $r \leq R^g$. Since $\Delta^b = |v^b|$, the solution is $r = r^*$ and $U^B = s^0 + (1-\pi)\Delta^g - \pi|v^b| + \pi|v^b|I(r^*) + \theta^g - r^*$.

In case (b), B gets

$$\max_{r\in(R^g,R^b)} \left[s^0 - \pi\Delta^b(1 - I(r)) + \pi\left(\theta^b(1 - I(r)) - r\right)\right]$$

Hence, by setting a sufficiently high Δ^g, P can make sure that B prefers the outcome when the good type applies (a); the social optimum is implemented.

The proof of the second part is more complex. First, let us prove that the social optimum cannot be implemented. Indeed, if P wants to achieve W^* she needs to offer a collusion-proof contract $\Delta^b \geq \theta^b$. Otherwise B always reports $\widehat{\rho} = 1$ and welfare is $W^0 < W^*$. Suppose that P manages to provide incentives for B to implement an outcome where $r < R^g$, both types apply and $\sigma(\rho) = \rho$ (otherwise welfare is always below W^*). Apparently, B gets the bribe $\beta = \theta^g - r$ where r maximizes (7). Therefore $I'(r) = \frac{1}{\pi\Delta^b} \leq \frac{1}{\pi\theta^b} \stackrel{def}{=} I'(\overline{r})$. By definition $I'(\overline{r}) < I'(r^*)$. Hence, under a collusion-proof contract B strictly overproduces red tape $r \geq \overline{r} > r^*$ and the social optimum cannot be implemented.

The threat of ex post collusion reduces P's choice set to the following: either offer a collusion-proof contract with $r \geq \overline{r}$, or give up and provide the good to everyone $\sigma(\rho) \equiv 1$, $r = 0$. The latter choice yields welfare W^0. The former provides welfare $\overline{W}$ if $\overline{r} \leq R^g$ (otherwise the good type drops out, and welfare becomes negative). P chooses to abandon red tape whenever the total benefit of red tape becomes lower than its cost $\pi|v^b|I(\overline{r}) - \overline{r} < 0$, i.e. when $\overline{r} < r^0$. ■

Proof of Proposition 3. The proof of the first statement is similar to the proof of the first statement of Proposition 2. Proving the third statement is also easy. If B is offered a flat contract $s^g = s^0 = s^b$, he is indifferent as to which level of red tape to use, and therefore can set the socially optimal level r^*.

The proof of the second statement is similar to the proof of the second statement of Proposition 2. Indeed, suppose that B implements social optimum. Then the contract should be collusion-proof ($r^* > 0$), and $r = r^*$ should maximize

$$U^B = s^0 + (1-\pi)\Delta^g - \pi\Delta^b(1 - I(r)) \tag{8}$$

subject to $r \leq R^g$. Since collusion-proofness requires $\Delta^b \geq |v^b| > 0$, B's payoff strictly increases with r, so the best P can implement is $r = R^g > r^*$. ■

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