

# Competition in Bureaucracy and Corruption\*

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## Abstract

This paper studies the consequences of introducing competition between bureaucrats. Firms are supposed to invest into eliminating negative externalities of production, while bureaucrats administer the process by issuing licences. Some bureaucrats are corrupt, that is, they issue a licence to any firm in exchange for a bribe. The competition regime is found to create more ex ante incentives for firms to invest, while the monopoly regime is better at implementing ex post allocation, that is, distributing the licences given the firms' investment decisions. Additional results on the effect of punishments and bureaucrats' rotation are provided.

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## 1 Introduction

In India, driving licence must be obtained at the police station of the local district where the applicant lives (Bertrand et al. (2007)). In Russia, this licence can be

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obtained at any road police station of the region where the applicant lives.<sup>1</sup> Does this institutional difference have any consequences for welfare and corruption? This is the main question of the paper.

We study this problem in the following setup. There are firms that need a licence to produce. Firms can have either a new clean technology or an old polluting one. The legislation states that only firms with a clean technology are *qualified* for the licence. Firms with a polluting technology are *unqualified*. Production by an unqualified firm creates negative externalities. All firms have an old technology at the beginning, though can change this to a new one by undertaking a costly investment. The licensing process is administered by bureaucrats. While some are *honest* and give a licence only to qualified firms without bribes, others are *corrupt* and would give a licence to any firm in exchange for a bribe. Thus, there exist both *extortion* (when a qualified firm has to bribe) and *collusion* (when an unqualified firm "buys" a licence). The coexistence of the two types of corruption is important for our results.

In the driving licence example, applicants apply for a driving licence. Initially, all applicants do not know how to drive or, at least, not enough to pass the test. They can of course take lessons to learn, but these are expensive. Honest policemen give a licence only to those who drive well enough, while corrupt policemen will try to obtain a bribe from an applicant, whether or not he can drive well.

We will refer to the Indian case as the *monopoly regime*. In this regime the licence must be obtained from a pre-specified bureaucrat; hence, this bureaucrat has a monopoly power over the applicants in his district. The Russian case is the *competition regime*. Any applicant can request a licence from any bureaucrat; thus, bureaucrats compete for applicants. Reapplication to the same or another bureaucrat will involve some costs.

The main finding of the paper is the following. The monopoly regime results in a better *ex post allocation* of licences; that is, how licences are distributed given the investment decisions of firms. While, in the competition regime, firms have more *ex ante incentives* to invest and become qualified. To understand the intuition for the result, consider first *ex post* allocation of licences. In the monopoly regime, unqualified firms cannot obtain a licence in districts served by honest bureaucrats. In the competition regime, upon meeting an honest bureaucrat an unqualified firm can

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<sup>1</sup>"Pravila sdachi kvalifikacionnyh jekzamenov i vydachi voditel'skih udostoverenij", decree of the Government of the Russian Federation #1396 of the 15th December 1999.

reapply and reapply until it meets a dishonest bureaucrat. Thus, in the competition regime, unqualified firms more frequently obtain a licence.

Now turn to ex ante incentives of firms to invest and become qualified. In the monopoly regime, the only reason to invest is to avoid costly reapplication if the bureaucrat turns out to be honest. In the competition regime, there are two reasons to invest. The first is exactly the same as in the monopoly regime: to avoid reapplication. The second reason is to increase the outside option in the bargaining with a corrupt bureaucrat about the bribe. Indeed, the outside option depends on the qualification since a qualified firm will obtain a licence (for free) if the next bureaucrat turns out to be honest, while an unqualified firm will not. Then, a qualified firm pays a lower bribe than an unqualified one. The competition regime gives an additional strategic reason to invest.

The trade-off between competition and monopoly is now clear. Introducing competition will encourage more firms to invest and become qualified, but those firms that still do not invest will obtain more licences. The total effect on welfare is ambiguous and depends, among other things, on the distribution of investment costs. If these are quite low for most firms, ex ante incentives to invest are important and competition is likely to be better. If they are high and firms do not invest anyway, monopoly is to be preferred. The former case corresponds to the provision of driving licences: as almost everybody is able to learn how to drive properly at relatively low cost, ex ante incentives are crucial. Provision of passports is closer to the latter case: it is difficult to become a citizen of a country, therefore, ex post allocation is more important.

An important extension of the basic model is the inclusion of punishment for corrupt behaviour. We find that it is the competition regime in which punishments have a greater effect on the incentives to invest. The intuition is that, in the competition regime, the bargaining over the bribe involves consideration of the non-trivial outside option of the firm to apply to other bureaucrats in the future, which is negatively affected by a possible punishment. Also, in this regime, extortion of a bribe from a qualified firm can be completely deterred. The optimal punishment for extortion in the competition regime is then either very low to give more incentives to become qualified or very high to deter this sort of corruption. Polinsky and Shavell (2001) also obtain that extortion should not be punished for the same reason of providing incentives for good behaviour. However, they argue that, even if extortion could be

deterred, it is not optimal to do so as bureaucrats will switch to framing innocent individuals.

Competitive bureaucracy is more prevalent than it may seem. Firms can usually re-register in another region if they are unhappy with the bureaucracy of their current region, for example, if the local tax authority is too corrupt or, on the contrary, incorruptible. At the individual level, in most European countries passports are provided in the monopoly regime, while in the US applications can be made in any of more than 9000 passport acceptance facilities.<sup>2</sup> Another example is that of notaries who may or may not have exclusive territories where they certify the documents.

The literature on the effects of competition in bureaucracy on corruption is almost non-existent. Rose-Ackerman (1978) was the first to suggest that competitive bureaucracy might help to fight corruption; this was then discussed in Shleifer and Vishny (1993).<sup>3</sup> In the same way as competition among firms reduces prices of the goods they sell, competition among bureaucrats reduces the prices they charge for their services, i.e., bribes. Shleifer and Vishny (1993) say (p. 607):

"A citizen can obtain a U.S. passport without paying a bribe. The likely reason for this is that if an official asks him for a bribe, he will go to another window or another city. Because collusion between several agents is difficult, bribe competition between the providers will drive the level of bribes down to zero."

As in this paper, they also distinguish between corruption involving qualified and unqualified firms (they refer to extortion "corruption without theft", as it only distributes the surplus between the applicant and the bureaucrat, and collusion "corruption with theft", since it imposes negative externalities on the rest of the society). Introducing competition is good when extortion is present since its only effect is to reduce the level of corrupt payments. It is less so when there is collusion because, by reducing the level of payments, it allows more unqualified firms to buy the bureaucrats' service imposing larger negative externalities on the rest of the society.<sup>4</sup> This

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<sup>2</sup>[http://travel.state.gov/passport/passport\\_1738.html](http://travel.state.gov/passport/passport_1738.html).

<sup>3</sup>The papers that look at corruption and competition, such as Bliss and Di Tella (1997), Ades and Di Tella (1999) and Laffont and N'Guessan (1999), study the effect of competition in the regulated market and not in bureaucracy.

<sup>4</sup>Strangely enough, Shleifer and Vishny (1993) do not speak about the possibility that a *non*-citizen can obtain a US passport without or with a small bribe.

observation has been made by Rose-Ackerman (1978, 1999) and Shleifer and Vishny (1993). However, they do not study the *incentives* of the firms to become qualified in the two regimes, and this is the novelty of this paper.<sup>5</sup>

No other paper, to the best of our knowledge, compares the two regimes. From the modelling point of view, the bargaining procedure between a firm and a corrupt bureaucrat is close to the one in Cadot (1987). He considers only the competition regime and is interested in how information structure of the game (that is, whether the bureaucrat and applicant himself know if the applicant is qualified) affects the delivery of the licence. Qualification is exogenous in his model. In Mookherjee and Png (1995) and Acemoglu and Verdier (2000), firms decide on their behaviour; there is, as we call it, endogenous qualification. In these models, firms may be inspected by a bureaucrat with a certain probability and, once a firm is inspected, it has to deal with a given bureaucrat. Thus, both papers have the monopoly regime; it is quite difficult to think about the competition regime there.<sup>6</sup>

In our model, there is complete information about the applicant's type. This implies that the tape red (application costs in terms of both time and money) is used only to provide incentives to the applicants for the desired behaviour; it is not used by bureaucrats to screen different types of applicants as in Banerjee (1997), Saha (2001) and Guriev (2004). Of course, both here and in those papers, red tape also makes it possible to extract bribes from applicants. Complete information about the type of the applicant also implies that, in the competition regime, qualified and unqualified applicants pay different bribes and both types are served immediately. In Ahlin and Bose (2007), in a setting similar to our competition regime, bureaucrats do not know the applicants' type and, therefore, ask for the same bribe from qualified and unqualified applicants. When the proportion of honest bureaucrats becomes higher, the reapplication becomes a better option for the qualified applicants and they may reject the bribe demand and, thus, experience a delay which may lead to a lower welfare. This effect is absent in our model and a higher proportion of

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<sup>5</sup>Rose-Ackerman (1999) also argues that competition is beneficial in a dynamic setting as it pushes down the size of bribe when there are more corrupt bureaucrats decreasing the incentives to become corrupt. We make a preliminary analysis of this argument in the working paper version, Drugov (2007).

<sup>6</sup>Lambert-Mogiliansky et al. (2008) also consider the incentives to become qualified in the monopoly regime. They focus on the setting where several complementary licences issued by different bureaucrats are needed. In our model, there is only one licence to be obtained.

honest bureaucrats always increases the welfare both by boosting incentives to become qualified and by improving the allocation of licences.

The rest of the paper is organized as follows. The model is introduced in Section 2 and the equilibrium outcomes are found for both monopoly and competition regimes. Section 3 compares the two regimes and Proposition 3 presents the two main results discussed above. Section 4 introduces punishments for giving and accepting bribes. Section 5 discusses the case when the type of bureaucrats is known before applying. Section 6 concludes.

## 2 The model

There is an industry in which the production process involves negative externalities in terms of pollution, hygienic risk, etc. There are identical firms that can improve the production process at a cost  $c \leq 1$ , for example, they can recycle their waste or switch to a better technology.<sup>7</sup> These investment costs  $c$  reflect how polluting the current production process is. If a firm produces without investing it imposes a negative externality of size  $1 + lc$ ,  $l > 0$ , on the rest of the society. The externality increases with the investment costs since the latter is a proxy for how far the current technology is from being clean.<sup>8</sup>

This industry is regulated in the following way: there are bureaucrats that grant licences to the firms and only licensed firms can produce. We say that a firm is *qualified* (for a licence) if it has invested in a better technology, otherwise, it is *unqualified*. Denote with superscripts  $q$  and  $u$  the variables relevant for qualified and unqualified firms, respectively. Firms produce at zero costs and earn profits normalized to one. A producing qualified firm generates welfare equal to  $1 - c$ , a producing unqualified firm generates welfare equal to  $-lc$ .

The bureaucrats are supposed to grant licences if and only if the firm applying for the licence is qualified. A share  $h$  of bureaucrats does precisely this, they are

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<sup>7</sup>The investment costs are assumed to be the same and less than one only to simplify the exposition. In Section 3 we relax both assumptions.

<sup>8</sup>We believe that this assumption is a very natural one. In the driving example, these costs  $c$  reflect the driving skills of the candidate. If they are low, the candidate has to spend a lot of time, effort and money to learn how to drive properly. If he obtains a driving licence with his current skills, the chances of an accident are higher the lower the skills. However, all the results are still valid if the size of the negative externality is independent of  $c$ .

*honest*. Moreover, they do not ask for bribes. The remaining bureaucrats, of share  $1 - h$ , are *dishonest*: they give a licence in exchange for a bribe, irrespective of the firm's qualification. In other words, they engage in both extorting the bribe from qualified firms and colluding with the unqualified ones "selling" them the licence. The bureaucrats know the type of the firm (at no cost).<sup>9</sup> There is a unit mass of bureaucrats.

We study two regimes of bureaucracy: monopoly and competition. Under the monopoly regime, each firm can apply for a licence only from a certain bureaucrat, for example, the firms are in different districts and there is a single bureaucrat in each district. Under the competition regime, each firm chooses randomly the bureaucrat to apply to, and it can reapply to the same bureaucrat or to another chosen at random.<sup>10</sup> The firms do not know the honesty of a given bureaucrat until they apply. In both regimes, a firm that faces a dishonest official bargains about bribe  $b$ . The bargaining proceeds under complete information and ends with no delay; the two parties split equally the surplus from the relationship.<sup>11</sup> Denote with subscripts  $m$  and  $c$  the variables relevant for monopoly and competition regimes, respectively.

The timing of the game is the following. There is an infinite horizon and a common discount factor  $\delta < 1$ . Initially, all the firms are unqualified. At the beginning of each period an unqualified firm decides whether to invest in a better technology. A qualified firm stays qualified forever. Then, the firm applies to a bureaucrat. If the licence is granted, the firm produces, earns 1 and quits the game.<sup>12</sup> Otherwise, the firm enters the next period. Under the monopoly regime the firm always reapplies to the same bureaucrat. Under the competition regime, the firm can reapply to the same bureaucrat or another random bureaucrat. Since there is a continuum of these,

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<sup>9</sup>This is the same assumption as in Acemoglu and Verdier (2000). Cadot (1987) analyses a setting where the bureaucrat is informed better than the applicant about the applicant's qualification. In Banerjee (1997), Saha (2001) and Guriev (2004) the bureaucrat does not know the type of the applicants and screens them using red tape. In Mookherjee and Png (1995) the bureaucrat may undertake a costly effort to find out the applicant's type.

<sup>10</sup>We assume throughout the paper that bureaucrats are numerous enough and cannot collude.

<sup>11</sup>None of the results depends qualitatively on this assumption. See Drugov (2007) for an arbitrary bargaining power of the bureaucrat.

<sup>12</sup>The profit of the firm is treated as if it occurs only in the period when production takes place. It can be also interpreted as a discounted stream of all future profits, that is, once a firm gets the licence it produces for all future periods. Then, its per period value will be  $1 - \delta$ . The same applies to the externality  $1 + lc$ .

in every period the firm meets an honest bureaucrat with probability  $h$ . Note that the only cost of reapplication is the loss in profits because of discounting. In an earlier version, Drugov (2007), we also introduce an application fee which has a similar effect.

In the welfare calculation we do not include bribes as these are considered purely as transfers. There are many reasons to believe that bribes do enter (negatively) the welfare function. For instance, high bribes may deter some firms from entering the industry; part of the bribes may be wasted because of the secret and non-enforceable nature of these contracts, as is often assumed in the hierarchical (principal-supervisor-agent) models of collusion (e.g. Laffont and N’Guessan (1999));<sup>13</sup> higher bribes and/or higher prevalence of corruption create tolerance of the corruption in the society, which makes anti-corruption policies less effective. However, it is important to disentangle the two issues, welfare and the volume of bribes, aiming to understand the exact effects of introducing competitive bureaucracy.

Let us now consider the two regimes in more detail.

## 2.1 Monopoly regime

Under the monopoly regime, the firm cannot switch to another bureaucrat. The surplus of their relationship is the firm’s profits 1 *independently* of whether the firm is qualified or not. Then, any firm facing a dishonest official will have to pay half of its profits as a bribe to obtain the licence<sup>14</sup>

$$b_m^q = b_m^u = b_m = \frac{1}{2}.$$

In other words, extortion and collusion result in the same bribe.

Consider the firm’s decision to improve its technology. When the firm does improve it, it will obtain a licence in the same period from any bureaucrat; but it will have to pay the bribe  $b_m$  if the bureaucrat is dishonest:

$$\Pi_m^q = h + (1 - h)\frac{1}{2} - c. \tag{1}$$

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<sup>13</sup>It was first shown in Laffont and Tirole (1991), in the framework of interest-group politics, and was then developed for different setups in the subsequent literature.

<sup>14</sup>We assume that bureaucrats can commit not to renegotiate the bribe in future periods. If they cannot, the equilibrium bribe is smaller,  $\frac{1-\delta}{2-\delta}$ , but does not depend on the applicant’s qualification either and none of the results is affected.



If the firm decides not to improve its technology, it will still obtain a licence from a dishonest bureaucrat in exchange for a bribe. If the bureaucrat is honest, the firm will have to invest in the next period:

$$\Pi_m^u = \delta h(1 - c) + (1 - h)\frac{1}{2}. \quad (2)$$

Comparing (1) and (2), we see that there is a threshold level of investment costs  $c_m^{q*}$

$$c_m^{q*} = \frac{(1 - \delta)h}{1 - \delta h} \quad (3)$$

such that the firm improves its technology if and only if its costs are lower than  $c_m^{q*}$ . This threshold increases in  $h$  from 0 to 1 as we would expect: when more bureaucrats become honest, the chances to "buy" the licence decrease while the chances to get the licence without a bribe increase, so that the investment into a better technology justifies the higher costs. It decreases with the discount factor  $\delta$  as the cost of delay which occurs when an unqualified firm meets an honest bureaucrat becomes smaller.

Once we know if the firm invests or not, we can easily compute the welfare. Proposition 1 summarizes the main results of this Section.

**Proposition 1** *Under the monopoly regime, there exists the threshold  $c_m^{q*} \in [0, 1]$  given by (3), such that if the investment costs  $c$  are lower than  $c_m^{q*}$  the firm invests and the resulting welfare is*

$$W_m^q = 1 - c. \quad (4)$$

*If the investment costs  $c$  are higher than  $c_m^{q*}$  the firm does not invest initially and the resulting welfare is*

$$W_m^u = \delta h(1 - c) - (1 - h)lc. \quad (5)$$

## 2.2 Competition regime

Under the competition regime the analysis becomes more complicated. When an unqualified firm meets an honest bureaucrat, it may invest and reapply to him in the next period or may not invest and reapply to a random bureaucrat. When a firm meets a dishonest bureaucrat and bargains about the bribe, its outside option depends on whether it is qualified or not, and if it is unqualified, whether it will invest having met an honest bureaucrat.

As there is a continuum of bureaucrats, the outcome of reapplication to a random bureaucrat depends only on the type of firm and not on its history; the environment is stationary. Lemma 1 shows that there are three possible strategies for the firm.<sup>15</sup>

**Lemma 1** *The firm uses one of the following three strategies:*

- *Invest in the first period;*
- *Never invest;*
- *Invest once an honest bureaucrat has been met.*

Lemma 1 is simple and intuitive (see Drugov (2007) for a formal proof). A firm with costs sufficiently close to zero will obviously invest in the first period since the costs of being possibly delayed are higher. A firm with costs close to one will never invest as even a small chance of meeting a corrupt bureaucrat and bribing him is better. A firm with some intermediate costs may not be willing to invest if it does not know the type of the bureaucrat since a corrupt bureaucrat will always ask for a bribe. However, if it meets an honest bureaucrat, it will be rejected and it might be optimal to invest and reapply to the same bureaucrat getting the licence without a bribe for sure. Finally, if a firm has not made the investment after meeting an honest bureaucrat for the first time, it will never make it since its benefits are not higher at any moment afterwards.

Consider now the three strategies in turn.

**Invest in the first period.** Let us first derive the expected profits of the firm that decides to invest in the first period. It will always obtain the licence but, if the bureaucrat is dishonest, it will have to pay the bribe  $b_c^q$ :

$$\Pi_c^q = h + (1 - h)(1 - b_c^q) - c.$$

The bribe is determined through a bargaining process.<sup>16</sup> The surplus of the relationship between the firm and dishonest bureaucrat is  $1 - \delta(\Pi_c^q + c)$  as the firm may

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<sup>15</sup>In the monopoly regime, the firm also has three strategies. When it does not invest in the first period, its further choice depends on whether the district bureaucrat is honest or not. As this choice is trivial, we did not make these two strategies explicit.

<sup>16</sup>We use the Nash bargaining solution despite the game being non-cooperative. If the bargaining breaks down, the firm can still reapply to another bureaucrat, that is, use its outside option; in this case, Nash solution is valid. Alternatively, one could interpret a breakdown in negotiations as

leave the bureaucrat and reapply, in which case it will earn  $\delta [h + (1 - h)(1 - b_c^q)]$ . The equilibrium bribe splits the surplus equally and it is

$$b_c^q = \frac{1 - \delta}{2 - \delta + \delta h}. \quad (6)$$

Note that  $b_c^q$  is decreasing in the share of honest bureaucrats  $h$  and in the discount factor  $\delta$  because both of them increase the firm's outside option. In particular, a higher  $h$  means higher chances of obtaining the licence without a bribe.

The qualified firm's expected profits are

$$\Pi_c^q = \frac{1 + h}{2 - \delta + \delta h} - c. \quad (7)$$

**Never invest.** Let us now turn to the firm that decides not to invest. It can obtain the licence only from a dishonest bureaucrat; if it meets an honest one, it has to reapply to a random bureaucrat in the next period. Its expected profits are

$$\Pi_c^u = \delta h \Pi_c^u + (1 - h)(1 - b_c^u).$$

It can be found that the bribe  $b_c^u$  is

$$b_c^u = \frac{1 - \delta}{2 - \delta - \delta h}. \quad (8)$$

The bribe  $b_c^u$  is decreasing in the discount factor  $\delta$  as is the case of the bribe for qualified firms. However, it increases with the share of honest bureaucrats  $h$  since a higher  $h$  decreases the firm's chances of meeting a dishonest bureaucrat, the only source of a licence for an unqualified firm.

The unqualified firm's profits are

$$\Pi_c^u = \frac{1 - h}{2 - \delta - \delta h}. \quad (9)$$

**Invest once an honest bureaucrat has been met.** Finally, consider the third possible strategy. Denote the relevant variables by superscript  $uq$ . If the firm meets

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some corruption investigation and that, if a firm is caught negotiating a bribe, it can no longer have a licence. In this case, the outside option does not affect the outcome of the bargaining unless it binds. The qualitative results of the model will still be the same as the outside option may bind for a qualified firm but not for others. See Binmore, Rubinstein and Wolinsky (1986) for the original paper.

an honest bureaucrat, it invests and reapplies to him in the next period. If it meets a dishonest one, it pays the bribe as do the other two types. The profits are

$$\Pi_c^{uq} = \delta h(1 - c) + (1 - h)(1 - b_c^{uq}).$$

The bribe  $b_c^{uq}$  is found to be

$$b_c^{uq} = \frac{1 - \delta^2 h(1 - c) - \delta(1 - h)}{2 - \delta + \delta h}. \quad (10)$$

The most important thing to note is that  $b_c^{uq} > b_c^q$ , given by (6), as the consequence of a lower outside option of the unqualified firm. That is, bureaucrats can sell the licence to unqualified firms for a higher bribe that they can extort from qualified ones. The bribe  $b_c^{uq}$  falls with the discount factor  $\delta$  and the share of honest bureaucrats  $h$ , as  $b_c^q$  does, since both increase the firm's outside option. A higher cost  $c$  increases the bribe as investing becomes less attractive. The profits are

$$\Pi_c^{uq} = \frac{1 - h + 2\delta h(1 - c)}{2 - \delta + \delta h}. \quad (11)$$

**Optimal strategy.** We can now find the optimal strategy for a firm that has investment costs  $c$ .

The comparison of (7) and (11) yields the threshold level of costs  $c_c^{q*}$  below which the firm invests in the first period

$$c_c^{q*} = \frac{2h(1 - \delta)}{2 - \delta - \delta h}. \quad (12)$$

Comparing (9) and (11), we obtain the threshold level of costs  $c_c^{u*}$  above which the firm never invests

$$c_c^{u*} = \frac{(1 + h)(1 - \delta)}{2 - \delta - \delta h}. \quad (13)$$

Both  $c_c^{q*}$  and  $c_c^{u*}$  increase with  $h$  from 0 to 1 as  $c_m^{q*}$  does: when  $h$  is higher, it pays more to be qualified and it pays less to be unqualified. Both decrease with the discount factor  $\delta$  since, though a higher  $\delta$  benefits both the qualified firm and the unqualified, the impact on the latter one is bigger than on the former one.

Proposition 2 summarizes the main results of this Section.

**Proposition 2** *Under the competition regime, there exist two thresholds  $c_c^{q*} < c_c^{u*} \in [0, 1]$  given by (12) and (13), such that if the investment costs  $c$  are lower than  $c_c^{q*}$  the firm invests in the first period and the resulting welfare is*

$$W_c^q = 1 - c. \quad (14)$$

*If the investment costs  $c$  are between  $c_c^{q*}$  and  $c_c^{u*}$ , the firm invests only when it meets an honest bureaucrat and the resulting welfare is*

$$W_c^{uq} = \delta h(1 - c) - (1 - h)lc. \quad (15)$$

*If the investment costs  $c$  are higher than  $c_c^{u*}$ , the firm never invests and the resulting welfare is*

$$W_c^u = -\frac{1 - h}{1 - \delta h}lc. \quad (16)$$

The expression for  $W_c^u$  may need some comment. When the firm never invests, it can obtain the licence only if it meets a dishonest bureaucrat. This event occurs with probability  $1 - h$  in the first period, with probability  $h(1 - h)$  in the second period, with probability  $h^2(1 - h)$  in the third period, etc. The expected social value of production is  $-lc(1 - h)(1 + \delta h + \delta^2 h^2 + \dots)$ , which gives (16).

### 3 Comparison of the two regimes

Comparison of the monopoly and competition regimes proceeds in two steps. First, we find out which regime is the better if the firm's behaviour is the same in the two regimes. That is, we compare the welfare of the two regimes if the firm invests and if it does not. Second, we find out which regime gives more *incentives* for firms to invest into a better technology; that is, we compare the investment thresholds in the two regimes.<sup>17</sup>

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<sup>17</sup>In the comparisons of the two regimes we always assume, unless explicitly stated otherwise, that  $0 < h < 1$  to avoid non-strict inequalities and explanations that the equality is reached only at  $h = 0$  or 1.

**Proposition 3 *Ex post allocation.*** *If the first-period investment decision is the same under the two regimes, the monopoly regime is (weakly) better, that is,  $W_m^u = W_c^{uq} > W_c^u$  and  $W_m^q = W_c^q$ .*

***Ex ante incentives.*** *The firm has more first-period investment incentives under the competition regime, that is,  $c_c^{q*} > c_m^{q*}$ .<sup>18</sup>*

**Proof.** Direct comparison. ■

Let us explain the intuition for these results. Start with the simplest one, the one showing that if the firm invests, the welfare is the same,  $W_m^q = W_c^q$ . If the firm is qualified, it will obtain a licence from any bureaucrat under any regime. The only difference is the bribe it will have to pay. As the bribes do not affect the welfare, the welfare is the same under both regimes.

If the firm never invests in the competition regime, the monopoly regime turns out to be better,  $W_m^u > W_c^u$ , for two reasons. First, the unqualified firm gets the licence with probability  $1 - h$  in the monopoly regime and with (discounted) probability  $\frac{1-h}{1-\delta h}$  in the competition regime. The latter is higher than the former, that is, the unqualified firm is more likely to obtain the licence under the competition regime. Second, in the monopoly regime the unqualified firm invests if it meets an honest bureaucrat creating welfare of  $\delta h(1 - c)$ . In the competition regime the unqualified firm reapplies until it encounters a dishonest bureaucrat.

Finally, if the firm invests only after having met an honest bureaucrat, it behaves exactly as an unqualified firm in the monopoly regime. The two regimes result in the same welfare,  $W_m^u = W_c^{uq}$ .

Now, why does the competition regime provide more incentives for the investment? In the monopoly regime the only reason to invest is to avoid costly reapplication if the bureaucrat turns out to be honest. In the competition regime there are two reasons. The first is exactly the same: to avoid reapplication. The second reason is to increase the outside option in the bargaining with a corrupt bureaucrat which leads to a lower bribe,  $b_c^q < b_c^{uq}$  (in the monopoly regime the bribe does not depend

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<sup>18</sup>In the monopoly regime all the firms invest if they meet an honest bureaucrat, that is,  $c_m^{u*} = 1 > c_c^{u*}$ . The monopoly regime gives more ex post incentives to invest. We place it under "ex post allocation" to make the comparison clearer. Moreover, it is not crucial for comparing ex post allocation. The monopoly regime is still better than the competition one when unqualified firms do not invest, having met an honest bureaucrat (for example, if firms have investment costs higher than one). The welfare is  $-(1 - h)lc$ , which is higher than  $W_c^u = -\frac{1-h}{1-\delta h}lc$ .

on the qualification).

To complete the comparison of the two regimes, note that the bribes can be ranked as follows:

$$b_c^q < b_c^{uq} < b_c^u < b_m.$$

Thus, competition reduces the size of the bribes.<sup>19</sup>

It should be stressed that corruption involving both qualified and unqualified firms is necessary for the trade-off we study to be non-trivial. When extortion is not possible (for example, if it is easy to denounce a bureaucrat), qualified firms obtain their licences from any bureaucrat without a bribe. As unqualified firms pay higher bribes in the monopoly regime, it is now this regime that provides higher incentives to invest. Then, the monopoly regime is unambiguously better than the competition regime. When collusion is not possible (for example, the bureaucrats do not have much discretion) bureaucrats may still ask for "speed money" from qualified firms. All the firms have to invest and the two regimes result in the same welfare if the bribes are considered purely as transfers. Otherwise, the competition regime is unambiguously better due to lower bribes in this regime.

### 3.1 Heterogenous Firms

Suppose now that the firms are heterogeneous. A firm  $i$  has investment costs  $c_i$  which is distributed on  $[0, \bar{c}]$ ,  $\bar{c} > 1$ , according to a cumulative distribution function  $F$ . There are *inefficient* firms with  $c_i > 1$  that never invest.

Given a certain share of honest bureaucrats  $h$ , the thresholds of investment  $c_m^{q*}$ ,  $c_c^{q*}$  and  $c_c^{u*}$  are (3), (12) and (13), respectively. Every firm compares its costs  $c_i$  with the threshold(s) of the appropriate regime and chooses the optimal strategy. In the market both qualified and unqualified firms coexist and there is both extortion and collusion at the same time. Welfare in the monopoly regime is

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<sup>19</sup>If the model is extended to include an earlier stage in which firms decide whether to enter the industry, lower bribes in the competition regime will attract more firms. Depending on the distribution of investment costs, this is welfare enhancing if most firms are low cost and invest and is otherwise detrimental for the welfare.

$$W_m = \int_0^{c_m^{q*}} W_m^q f(c) dc + \int_{c_m^{q*}}^1 W_m^u f(c) dc + \int_1^{\bar{c}} [-(1-h)lc] f(c) dc, \quad (17)$$

where  $W_m^q$  is (4) and  $W_m^u$  is (5). The last term is the welfare generated by an unqualified firm with costs higher than one. As it never invests, it produces only if it meets a dishonest bureaucrat.

In the competition regime it is

$$W_c = \int_0^{c_c^{q*}} W_c^q f(c) dc + \int_{c_c^{q*}}^{c_c^{u*}} W_c^{uq} f(c) dc + \int_{c_c^{u*}}^{\bar{c}} W_c^u f(c) dc, \quad (18)$$

where  $W_c^q$  is (14),  $W_c^{uq}$  is (15) and  $W_c^u$  is (16).

The difference in welfare  $\Delta W = W_c - W_m$  equals

$$\Delta W = \int_{c_m^{q*}}^{c_c^{q*}} [W_c^q - W_m^u] f(c) dc + \left[ \int_{c_c^{q*}}^1 [W_c^u - W_m^u] f(c) dc + \int_1^{\bar{c}} [W_c^u + (1-h)lc] f(c) dc \right]. \quad (19)$$

From Proposition 3,  $c_c^{q*} > c_m^{q*}$  and  $W_m^u > W_c^u$ , by an easy inspection  $W_c^q > W_m^u$  and  $-(1-h)lc > W_c^u$ . Then, the first term in (19) is positive and the second term is negative. Introducing competition has two opposing effects: the first, positive, is that more firms invest into a better technology; the second, negative, is that the firms that still do not invest decrease the welfare. The total effect is therefore ambiguous.

Suppose that there are more firms with costs  $c_i$ . This is good for the competition regime as compared to the monopoly regime if  $c_m^{q*} < c_i < c_c^{q*}$  and bad if  $c_i > c_c^{u*}$ . As all the thresholds depend on the share of honest bureaucrats  $h$ , it can be good for some  $h$  and bad for others. However, if these firms are inefficient,  $c_i > 1$ , they never invest and so they are always bad for the competition regime. Proposition 4 makes a formal statement. For the sake of exposition it assumes a uniform distribution but nothing qualitatively depends on this assumption.

**Proposition 4** *Assume  $c_i \rightsquigarrow U[0, \bar{c}]$ . For any positive share of dishonest bureaucrats,  $h < 1$ , there exists high enough  $\bar{c}$  so that the monopoly regime is better than the competition regime.*



The proof is to solve the equation  $\Delta W = 0$  for  $\bar{c}$  which has a unique solution.

As ex ante incentives become less important when firms are less efficient, the competition regime becomes relatively less attractive when the distribution of costs shifts towards more high cost types. Therefore, if the new technology is a minor improvement over the old one, and it is relatively cheap to switch to it, the competition regime is likely to be superior. When the new technology is a leap forward and requires a lot of investment, the monopoly regime is likely to be better. Other examples can be easily thought of. Learning how to drive is probably not very costly for most people and then the competition regime is preferred. Obtaining nationality (legally) is usually quite difficult, and so decisions to give it, or the provision of passports should be carried out in the monopoly system.

## 4 Punishments

Corrupt transactions may be discovered and participating parties may be punished. We do not model the discovery and/or punishment technology; since both bureaucrats and applicants are risk-neutral, we discuss the effects of expected punishments. We distinguish punishments when the firm is qualified,  $p^q$ , and when it is not,  $p^u$ , that is, for extortion and collusion. Different societies may have different considerations about which kind of corruption is more serious and which should be punished more severely. As the bargaining is efficient and the utility is transferable, it does not matter how the punishment is divided between the bureaucrat and the firm. The equilibrium bribe equalizes the shares of the net surplus obtained by the two parties.

Let us see how investment thresholds are affected by punishments. Proceeding as in Section 2, it can be shown that both  $c_c^{q*}$  and  $c_m^{q*}$  are increasing in  $p^u - p^q$ . Both qualified and unqualified firms that invest when they meet an honest official pay the bribe with the same probability,  $1 - h$ , and the difference in punishments increases the benefits of investing.<sup>20</sup>

Comparing the two thresholds,

$$c_c^{q*} - c_m^{q*} = \bar{c}_c^{q*} - \bar{c}_m^* + \frac{\delta(1-h)^2}{2(1-\delta h)(2-\delta-\delta h)}(p^u - p^q),$$

where  $\bar{c}_c^{q*}$  and  $\bar{c}_m^*$  are (12) and (3), respectively. The difference  $c_c^{q*} - c_m^{q*}$  is increasing

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<sup>20</sup>This is the same intuition as in Polinsky and Shavell (2001).

in  $p^u - p^q$ , that is, ex ante incentives increase more rapidly in the competition regime. This is because a higher punishment decreases the outside option of the firm in its bargaining with the bureaucrat since future expected profits decrease. Therefore, the firm's profits are more sensitive to punishments than in the monopoly regime. Also, it can be shown that  $c_c^{u*}$  increases in  $p^u$  and becomes closer to one which is its monopoly analogue. When a firm is not qualified and decides whether to invest if the official is honest, it will not pay a bribe if it becomes qualified. Punishment  $p^q$  is then irrelevant for threshold  $c_c^{u*}$ .

We have assumed above that dishonest bureaucrats do not change their behaviour and punishments affect only the size of the bribe. However, if the punishment is high enough, the corrupt activity becomes unprofitable and dishonest bureaucrats stop taking bribes and start to behave as honest ones. The next Proposition describes the behaviour of dishonest officials in the two regimes.

**Proposition 5** *Dishonest bureaucrats stop asking for a bribe if and only if the punishment is higher than the threshold  $\hat{p}$ . In the monopoly regime it equals one,  $\hat{p}_m = 1$ . In the competition regime*

- *When the firm is qualified  $\hat{p}_c^q = \frac{1-\delta}{1-\delta+\delta h}$ .*
- *When the firm is unqualified and never invests  $\hat{p}_c^u = 1$ .*
- *When the firm is unqualified but invests when it meets an honest bureaucrat and has investment costs  $c$*

$$\hat{p}_c^{uq} = \frac{1 - \delta + \delta h - \delta^2 h(1 - c)}{1 - \delta + \delta h}.$$

**Proof.** In the monopoly regime the surplus from a corrupt transaction is  $1 - p$ . It is negative when  $p \geq 1$ . In the competition regime when a qualified firm bribes the surplus is  $1 - \delta(\Pi_c^q + c) - p^q$ . Equating it to zero and solving for  $p^q$  gives the result. Two other cases are solved similarly. ■

The punishment that is equal to the value of the licence is a very high punishment (remember, this is an expected punishment). If such a punishment were available, the problem of corruption would be trivial: what is needed is to introduce this high punishment. This case is not very interesting from a practical point of view.

The result for deterring corruption when the firm is qualified or potentially qualified in the competition regime is more encouraging.<sup>21</sup> The punishment can be lower than the value of the licence and it still deters corruption. The intuition is that these firms can obtain the licence from honest bureaucrats and this option is unaffected by punishments. Thus, there is an upper limit of how much of a bribe they are ready to pay. The outside option of firms that never invest decreases with the punishment and they are ready to bribe up to the value of the licence.

Until now punishments have been treated as given, while they are obviously policy instruments. To make the problem non-trivial, suppose that there is a maximum punishment  $P < 1$ , that is, all corruption cannot be deterred. The next Proposition derives optimal punishments.

**Proposition 6** *The optimal punishment is*

- *When an unqualified firm bribes,  $p^{u*} = P$  in both regimes.*
- *When a qualified firm bribes,  $p_m^{q*} = 0$  in the monopoly regime. In the competition regime  $p_c^{q*} = 0$  if  $P < \frac{1-\delta}{1-\delta+\delta h}$  and  $p_c^{q*}$  is any number in  $[\frac{1-\delta}{1-\delta+\delta h}, P]$  otherwise.<sup>22</sup>*

Collusion should always be punished at the maximal available level. Punishing extortion has a positive effect only if it deters this type of corruption; otherwise, it is optimal not to punish at all. Then, when the available punishment is high enough, extortion is completely deterred in the competition regime while it is not in the monopoly regime. The model therefore predicts a high variation in punishments for extortion.

## 5 Known types of bureaucrat

In many instances, bureaucrats are known for their honesty or corruption. They might hold the office for many years and eventually people become aware of their

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<sup>21</sup>Obviously, if qualified firms never pay bribes, the investment threshold becomes even higher and the competition regime provides even more ex ante incentives.

<sup>22</sup>In a dynamic framework where agents decide on their entry to bureaucracy, as in Drugov (2007), setting  $p^{q*} = 0$  may not be optimal as it increases the revenues of the dishonest bureaucrats as compared to a positive punishment. The optimal punishment will then trade off static incentives for firms to invest and dynamic incentives of agents to become dishonest bureaucrats.

type. It is also plausible when firms have contacts with bureaucrats on a regular basis as is the case of fire or tax inspections. In the competition regime, corrupt bureaucrats have incentives to actually advertise themselves as corrupt to attract unqualified firms. Often there are intermediaries. Bertrand et al. (2007) report that applicants for a driving licence do not bribe the police directly. Instead, they pay fees to special "agents" who help them to get a licence. The same is also true in Russia where these "agents" are often found through driving schools; sometimes they are driving instructors. Many companies in developing countries often use and even hire "consultants" who have good government connections.<sup>23</sup>

The rotation of bureaucrats is usually proposed as a way of destroying cosy relationships in the public sector (see Das-Gupta and Mookherjee (1998) for the case of tax authorities in India and Rose-Ackerman (1999) for more references and examples), but it can also be thought of as a way of making types of bureaucrat unknown to the public. In this Section we explore whether rotation is a good policy in our setup.

As in Section 3 we take investment costs  $c_i$  distributed on  $[0, \bar{c}]$ ,  $\bar{c} > 1$ , according to a cumulative distribution function  $F$ .

In the monopoly regime, firms invest if and only if the bureaucrat of their district is honest (and their investment costs are smaller than 1). There is no threshold of investment as before; even very efficient firms do not invest if their district bureaucrat is dishonest and very inefficient firms invest if their bureaucrat is honest. The total welfare is

$$W_m = h \int_0^1 (1 - c) f(c) dc - (1 - h) l \int_0^{\bar{c}} c f(c) dc. \quad (20)$$

Comparing (20) with (17) we see that the information about bureaucrats' honesty has two opposing effects. The positive one is that, in the districts served by honest bureaucrats, all the firms invest in the first period. Without the information, firms with costs between  $c_m^{q*}$  and 1 invest in the second period when they find out that their bureaucrat is honest. The negative effect is that no firm invests in the districts with corrupt bureaucrats while, without the information, firms with costs lower than  $c_m^{q*}$  invest. Also note that the discount factor  $\delta$  does not enter (20) since all the licences

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<sup>23</sup>In Drugov (2007) we discuss in more detail the case when the intermediaries provide some but not complete information about bureaucrats.

are obtained in the first period, with or without the bribe.

In the competition regime a firm may invest in the first period and then apply to an honest bureaucrat or it may not invest and apply to a corrupt bureaucrat. As the firm does not learn anything when applying there are no other strategies, in particular, the strategy to "invest once an honest bureaucrat has been met" does not make sense. Computing the threshold level of investment costs yields

$$c_c^* = \frac{1 - \delta}{2 - \delta}. \quad (21)$$

It can be seen that  $c_c^* \leq c_c^{u*}$  given by (13) (equality is reached at  $h = 0$ ).

The total welfare in the competition regime is

$$W_c = \int_0^{c_c^*} (1 - c) f(c) dc - l \int_{c_c^*}^{\bar{c}} c f(c) dc. \quad (22)$$

Comparing it to (18) we should distinguish two cases. First,  $c_c^* < c_c^{q*} < c_c^{u*}$  which holds for  $h$  high enough. The consequences of the information about the type of bureaucrats are unambiguously bad. Firms with costs between  $c_c^*$  and  $c_c^{u*}$  no longer invest. Also, unqualified firms obtain their licence more quickly as they go to the corrupt bureaucrats immediately. The second case is when  $h$  is low and  $c_c^{q*} < c_c^* < c_c^{u*}$ . The negative effects of the information are the same as in the first case, but there is a positive effect: firms with costs between  $c_c^{q*}$  and  $c_c^*$  invest in the first period while in the case without the information these firms either do not invest at all or invest in the second period. Also note that the share of honest bureaucrats  $h$  does not enter (22) as firms meet the bureaucrats they want with probability one.<sup>24</sup>

Now let us compare the two regimes when the types of the bureaucrats are known. The monopoly regime is still better at ex post implementation. Unqualified firms cannot get a licence unless they are in the districts with corrupt bureaucrats while in the competition regime they get it with probability one. Ex ante incentives are not directly comparable, as before. However, Proposition 4 is still valid. The welfare in the monopoly regime, (20), does not depend on the distribution of costs while the one in the competition regime, (22), does. A shift in the distribution towards more high

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<sup>24</sup>This is also a consequence of our assumption that bureaucrats have an unlimited capacity of serving firms.

cost firms will result in more unqualified firms, and thus will decrease the welfare in the competition regime.

We can also compare the two regimes as a function of the share of honest bureaucrats. In the competition regime the welfare does not depend on this share, while in the monopoly regime it is increasing in it. When  $h = 0$ , nobody invests in the monopoly regime while everybody does when  $h = 1$ . There is a threshold value of  $h$  such that, if the share of honest bureaucrats is lower, the competition regime is better, and if it is higher, the competition regime is worse than the monopoly regime.

The effect of information about the types of bureaucrat, or the effect of non-rotating the staff, is therefore two-fold. First, information makes obtaining a licence faster. This is beneficial for the welfare if the licence is obtained by a qualified firm, and not if it is otherwise. The second effect is on the incentives to invest. Both investing and not-investing strategies become more attractive as firms can go to the bureaucrat that suits them best. Which strategy becomes relatively more attractive is not clear. This can be seen better when reapplication to the same bureaucrat is impossible which is the case, for example, when a firm applies not to a specific bureaucrat but to a department that assigns it randomly to some bureaucrat. The firm has then only two strategies, invest in the first period or never invest, and the investment threshold equals  $\frac{4(1-\delta)h}{(2-\delta)^2-\delta^2h^2}$  which can be either higher or lower than (21).

## 6 Conclusion

This paper studied the effects of competition in bureaucracy. The benefits are higher incentives for applicants to invest into eliminating negative externalities. Indeed, competition creates a positive outside option of reapplying to a different bureaucrat which is more valuable for qualified applicants than for unqualified ones. Then, applicants pay different bribes depending on whether they are qualified for the licence or not and this makes the investment to become qualified more profitable. The costs of competition are higher chances to obtain a licence for those who do not invest since they can continue reapplying until they meet a corrupt bureaucrat that will sell them the licence. Until now, the literature has focused only on the costs. And though it considered lower bribes due to competition (that we also obtain), it did not recognize the differential impact on qualified and unqualified applicants and, therefore, the positive effect on incentives. Another new and important result of the paper is that

punishments for corruption are more effective under competition since the benefits of a corrupt transaction are smaller and more easily destroyed.

In this paper we abstracted from some important dimensions along which the monopoly and competition regimes may differ. In particular, introducing competition may give the government more scope for benchmarking the bureaucrats. In the context of this paper, however, competition does not seem to allow the better detection of corrupt bureaucrats as the performance of bureaucrats is qualitatively the same in the two regimes. Indeed, in both regimes, dishonest bureaucrats give more licences than do honest ones, and the rejection of an applicant reveals that the bureaucrat is honest. If the government makes such conclusions, corrupt bureaucrats will reject some applicants to pool themselves with the honest ones. If some frictions are introduced in the bargaining process, for instance, asymmetric information as in Cadot (1987), corrupt bureaucrats will reject some applicants in the equilibrium.

Several directions are promising for future research. People are not born bureaucrats or entrepreneurs, they choose the activity comparing the expected incomes. The number of honest bureaucrats is then endogenous. In Drugov (2007) we analyzed such a setup and found that competitive bureaucracy results in more honest bureaucrats in the equilibrium in some cases. The analysis was very basic but the framework could then be extended to consider optimal policies with respect to the bureaucrats' salary, size of the bureaucracy, fines for unqualified applicants, etc. in a way similar to Acemoglu and Verdier (2000).

Another direction is to introduce imperfect information about applicants' type as in Cadot (1987), Banerjee (1997) and others. Applicants, and more importantly, bureaucrats often do not know whether the applicants satisfy the requirements for the licence they ask for. Bureaucrats may take a costly action to find out, as in Mookherjee and Png (1995). For example, a bureaucrat may visit the firm's site to see the technology it uses, or he can give or refuse the licence without the visit saving time and effort. It is an open question as to which regime will result in more efforts made by bureaucrats. Bureaucrats can also use red tape to find out which applicants are qualified for the licence, as in Banerjee (1997), Saha (2001) and Guriev (2004). Red tape will then serve a double goal: it will create the incentives to invest and, once investment decisions are taken, it will allow screening of applicants.

Finally, optimal policy in licence administration should be also looked for. Besides choosing the regime, monopoly or competition, policy makers also choose the

minimum delay between applications and the other costs of applications, that is, they choose red tape. The optimal red tape is likely to be different in the two regimes.

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