TI 2007-096/1
Tinbergen Institute Discussion Paper

Selecting less Corruptible Buraucrats

*Audrey Hu**
Liang Zhou

University of Amsterdam.

** Tinbergen Institute.*

Tinbergen Institute
The Tinbergen Institute is the institute for economic research of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam, and Vrije Universiteit Amsterdam.

Tinbergen Institute Amsterdam
Roetersstraat 31
1018 WB Amsterdam
The Netherlands
Tel.: +31(0)20 551 3500
Fax: +31(0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Selecting Less Corruptible Bureaucrats: A Quasi-Auction Approach*

Audrey Hu

University of Amsterdam School of Economics

Liang Zou

University of Amsterdam Business School

*We are grateful to Jan Boone, Jacob Goeree, Michelle Goeree, Theo Offerman, Sander Onderstal, Joachim Voth and Zaifu Yang for their helpful suggestions. We have benefited from the comments of session participants at the 2007 EEA-ESEM Annual Meetings, the 2007 Public Choice Meeting, the 2007 WEAI Conference, and the ENABLE workshop and the Tinbergen Institute seminar. The first author also acknowledges the financial support of NWO via a VICI project on licence auction. Any remaining errors are our own responsibility.

Selecting Less Corruptible Bureaucrats: A Quasi-Auction Approach

Abstract

A government official's propensity to corruption, or corruptibility, can be affected by his intertemporal preference over job benefits. Through a dynamic model of rent-seeking behavior, this paper examines how endogenously determined corruptibility changes with monitoring intensity, salary growth, and discount factor for expected future income. The paper illustrates credible circumstances in which the less an official values his job the more he seeks rents. This negative relation suggests a simple quasi-auction mechanism for selecting less corruptible public servants. While straightforward to implement, the quasi-auction also tends to circumvent the corrupt influence that is often associated with standard auction of jobs.

Key words: rent seeking, corruption, selection of officials, quasi-auction, sale of jobs

JEL Classification: D73, H11, D44

1 Introduction

A government post entails a bundle of benefits to its beholder – some being official compensations for public services, others being personal rents, such as bribes or any regulatory capture, that might be obtained through corruption. Although bureaucratic corruption may occasionally arise as a way to achieve efficient resource-allocation (e.g., Leff, 1964; Lui, 1985; Beck and Maher, 1986; Shleifer and Vishny, 1994), its overall detrimental effects on economic growth, quality of public services, social stability and so on, have been well documented (e.g., Rose-Ackerman, 1978, 1999; Shleifer and Vishny, 1993; Mauro, 1995, 1998; Wei, 2000; and the recent surveys by Bardhan, 1997; Jain, 2001; and Aidt, 2003).[1] In recent years, considerable effort has been devoted to the analysis of corruption in order to understand how bureaucratic behavior interacts with various features of government institutions, including monitoring, enforcement, payment policies, or the level of competition among government officials. An important objective is to improve or reform the incentive structures of public bureaucracies so as to realign their interest with that of the society. Although suggested reform policies are often inconclusive, there is a common understanding that since combating corruption consumes social resources, quite likely a trade-off has to be made resulting in a necessary degree of tolerance for corruption even under an optimally designed institution (e.g., Besley and Mclaren, 1993; Mookherjee and Png, 1995; Acemoglu and Verdier, 1998).

The present study incorporates the selection phase into the agency problem of bu-

[1] As in most of the literature on corruption, we focus in this paper on corrupt activities, or rent-seeking behavior, that are harmful for the society and therefore should be discouraged.

reaucratic corruption. The aim is to identify conditions under which a selection mechanism can be employed that helps select less corruptible government officials, or bureaucrats, at the start. More specifically, we focus on the economic aspect of the problem and assume that, after preliminary screening about education, past records, demonstrated professional aptitudes and so on (e.g., Spence, 1973), the recruiter now faces a number of remaining candidates for government jobs who are observationally indistinguishable in terms of their quality. We then ask whether each candidate's propensity to corruption, or corruptibility (that will be defined later), can be elicited through simple, incentive compatible, mechanisms. As Besley (2005, p.58) argues, this selection issue is important because "no society can run effective public institutions while ignoring the quality of who is recruited to public office..." Besley stresses honesty and civic virtue while focusing on the selection of politicians; our concern here is the selection of officials who will serve as the government's agents and who may not be as honest or virtuous. Although these two issues are similar, they entail quite different selection processes: politicians may rise to the reign through election, heredity, or revolution; whereas bureaucrats can be selected through a top-down recruiting process. Following the mainstream economic literature, we formulate this top-down selection problem as one involving a benevolent government (principal) and a number of potentially non-benevolent prospective officials (e.g., Banerjee, 1997).

Admittedly, economic analysis of the above-mentioned selection issues has been relatively scarce (see Rauch, 2001; Caselli and Morelli, 2004; Besley, 2005 for related studies). This lack of attention is probably due to the popular *disbelief* that the key to a good government could ever lie "in the selection of morally superior agents who will use their powers in some public interests." (Buchanan, 1989, p.18).[2] Indeed, all bureaucrats endowed with discretionary power are susceptible to potential corruption. Even though some individuals may possess compassionate and missionary motivations for public services, others may not. Recent experience in most developing countries reinforces the economists' view that rules or institutions fundamentally determine the aggregate behavior of government bureaucracies (e.g., Shleifer and Vishny, 1993; Mookherjee, 1998). However, honesty or virtue on the one hand, and individual rationality on the other, need not be always in conflict under a judiciously designed incentive mechanism. What is important, in our view, is to acknowledge that selection of officials is not an isolated issue: the effect of any selection mechanism can only be adequately assessed with a good understanding of the expected behavior of the officials once they are appointed.

To motivate the interdependence between selection and expected behavior, consider Shleifer and Vishny's (1993) proposition: "If jobs are distributed among officials through an auction mechanism, whereby those who pay the most for a job get it, then the prospective officials who do not collect bribes simply cannot afford jobs. Conversely, those who will collect more (perhaps through more effective price discrimination), will offer the higher officials more for the jobs, and so will be able to get them." Thus, according to Shleifer and

[2] Besley (2005) maintains a different view from that of Buchanan. He argues that honesty, virtue, and public service motivation can imply that "a politician who upholds his duty to pursue the public interest will do so even when it means forgoing an increase in his wealth or income by doing so (p.49)." Meritocratic selection of bureaucrasies is no doubt important (e.g., Evans and Rauch, 1999; Rauch and Evans, 2000), but with a narrower focus on incentive-based selection mechanism that recognizes self-interest behavior we show that Buchanan and Besley need not disagree on whom to select.

Vishny, the auction of jobs is a mechanism that selects the most corrupt officials because they have most bribes to collect and hence value the jobs most. This explanation, however, is oversimple as will be seen, and in our view it runs the risk of treating incidental associations as causal connections, thereby overlooking potential opportunities to mitigate corruption through selection (see Jain, 2001, p.72).

A fundamental reason why the issue of selection is complex is that, depending on how it is construed, the "more corruptible relation" among prospective officials is not necessarily an exogenous relation. One's level of corruptibility can change, just as one's level of honesty (see Tirole, 1996). Since it is the action, rather than the unobservable willingness, of corruption that matters, we think it is helpful to define corruptibility by deeds and not by traits. Thus, between any two officials A and B, if under the same situations A spends less effort to seek rents than B, then we say that A is less corruptible than B. With this definition we can abstract away the controversial comparative morality issues and, instead, focus on the effect of a selection mechanism directly. The real issue now is to understand how the rent-seeking behavior is endogenously embodied in the prevailing institutions and compensation policies.

Our dynamic rent-seeking model incorporates some basic elements and structures of the employment model of Shapiro and Stiglitz (1984), the career model of Holmström (1999), and the enforcement models of Becker and Stigler (1974) and Mookherjee and Png (1994). In our model, prospective officials differ in their type θ, which is private information, and they may spend effort e in seeking rents, which is private action. The type θ represents a personal, job-specific, discount-growth factor. Having a higher θ means two things: (i) that one expects a higher discounted salary growth on the job, and (ii) that one is more efficient in seeking rents (or collecting bribes). To ease expositions, we use Holmström's (1999) term "talent" to describe θ – a term that is morality-neutral and job-specific in the present setup. We also introduce a simple monitoring mechanism m, under which the corrupt official faces a probability of being caught and fired by the principal. The magnitude of m stands for the intensity of monitoring, and is assumed to be exogenous. The probability of being caught, however, is endogenous: it increases directly with the rent-seeking activity e as well as m. The official's intertemporal decision is to choose e that optimally trades off the current rents with the discounted future rent-cum-salary job benefits.

The model yields some major results as follows. First, officials' corruptibility generally declines with m and θ, indicating the desirability to hire high-talent officials. Second, given any monitoring mechanism m, there is a cutoff point c that is a strictly increasing function of m. Any official's expected level of corruption (to be defined in the main text) increases with his talent θ for all $\theta \leq c$ and decreases with θ for all $\theta > c$. Consequently, for sufficiently high m relative to the support of the probability distribution of θ, it is possible that the corruption level decreases with θ in general. This result derives from the relative strengths of the two countering effects of θ, (i) and (ii), as mentioned above. Third, each official's optimal rent-seeking choice does not depend on the absolute level of salary. Instead, the rent-seeking effort is negatively related to the salary growth rate. If combined with a relatively strong monitoring mechanism m, a high salary growth can help reduce the aggregate level of bureaucratic corruption effectively. Finally, the higher talent officials derive higher valuations for the job. Therefore a quasi-auction mechanism, in which the candidates bid an initial salary for the job and the lowest bidders win, can be used to select higher quality officials (with higher talent and lower corruptibility).[3] The principal can also impose a maximum initial salary in the quasi-auction, possibly at the cost of not filling all vacant positions, to further improve the average quality of the recruited officials.

The quasi-auction may be implemented as follows. Suppose there are K (≥ 1) identical jobs and a number of candidates. The recruiter first screens the candidates using all available information. Suppose there are N ($> K$) candidates left, who are all qualified and with equal expected performance. Then the recruiter can invite each candidate for an interview and asks him privately about a *minimum* initial salary that he finds acceptable for the job. The candidate will be told that with K (≥ 1) job vacancies, the K lowest bidders will be appointed. The actual salary level for the hired official(s) depends on how the pricing rule in the quasi-auction is specified. We adopt a uniform-price rule under which all the K winner(s) receive(s) the same initial salary that is equal to the highest loser's bid, namely the $(K+1)$th lowest bid. This pricing rule, perhaps for its apparent fairness, is popular in the standard auctions where multiple-units of good are sold (e.g., Milgrom, 2004). In our context, the quasi-auction will ensure that the K

[3] These results show that Shleifer and Vishny's (1993) proposition concerning the effect of auctioning government jobs is partially correct in our model. The prediction that auctioning jobs tends to increase bureaucratic corruption holds for sufficiently low m (a nonbenevolent principal or weak government institutions), or sufficiently low range of θ (a pool of low-talent prospective officials). But the prediction does not hold generally, e.g., when m and the range of θ are high.

highest talented, and least corruptible, officials will be appointed to the jobs. In situations where the monitoring system is poor, extremely low talented candidates can be excluded by imposing an upper bound on the bids, i.e., a reserve salary, that serves like the reserve price in standard auctions.

The advantages of the quasi-auction are analogous to that of the standard auctions, namely, to elicit information from the bidders and to achieve allocation efficiency. In the auction literature, closer to our model is the study of auctioning incentive contracts (or project) to monopolistic firms (e.g., Demsetz, 1968; Williamson, 1976; Laffont and Tirole, 1987, 1988). For instance, in a setting where the government needs a natural monopolistic firm to carry out a large project, but does not know the firm's productivity and subsequent effort, Laffont and Tirole (1987) demonstrate that the optimal auction awards the project to the firm that announces the lowest expected cost. In order to focus on corruptibility, we do not consider the officials' other (than rent-seeking) effort incentives. Inclusion of other incentives in our model may not change the qualitative results concerning corruptibility, but it would require a careful specification of the multiple-objectives that the public bureaucracies typically face (Tirole, 1994). When compared to the standard auction of government jobs (or offices), however, the quasi-auction has distinctive advantages that seem to deserve special attention. This is the reason that we use the term quasi-auction to distinguish it from the standard auction of jobs that target the highest payers. The two auction formats differ significantly in purpose, effect, feasibility, and practical implications, even though theoretically they may select the same officials. In light of the complex reciprocal relations between buying or selling government jobs and corruption, we devote a subsection (3.2) to discussing major differences between the two auction formats in terms of their implications for corruption.

The rest of this paper is organized as follows. The next section presents the dynamic rent-seeking model. We derive the optimal rent-seeking strategy by an appointed official, and perform some comparative statics analyses as to the monitoring effectiveness and the official's talent. Section 3 analyzes the equilibrium bidding strategies under a uniform-price quasi-auction for the official posts, with and without a reservation salary. We also compare quasi-auction with the standard auction of jobs, and discuss each mechanism's practical implications. Section 4 concludes the paper with further remarks.

2 An Intertemporal Rent-Seeking Model

2.1 The Model

Consider a simple model of bureaucracy with a benevolent government (e.g., a minister; henceforth the principal) who is endowed with a number of offices (henceforth, jobs). The principal appoints officials for the jobs, and monitors and controls their performance. Suppose an arbitrarily number K (≥ 1) of identical jobs are vacant, and there are N ($> K$) preselected candidates i ($\in N$), with equal observed qualification. Since only K candidates can be appointed, if no further distinction can be made then the principal will randomly choose any K candidates with equal probability.

The job offers a periodical salary of s_t, commensurate with the official rank, in exchange for public services over period $t = 1, 2, ...$ Salary s_t is broadly interpreted as the total periodical contractual payment including pecuniary and non-pecuniary benefits that are measured in monetary terms. The job also offers the possibility for the official to seek (illegal) rents through corruption. Let e_t (≥ 0) denote the official's rent-seeking effort (or actions, attempts, etc.). The benevolent principal does not welcome corruption because for any level of rents created and extracted by the official, there is a greater social cost borne by the society. The principal is only able to discover verifiable rent-seeking behavior with some probability p_t, however, and will fire any official who is found guilty of corruption. Conceivably, the probability p_t may depend on the scale of the official's rent-seeking activities as well as the effectiveness of the monitoring system.

Let $m \in (0, 1)$ denote the effectiveness of the monitoring system and assume that $p_t = me_t$. This assumption captures, parsimoniously, the effects that a higher m or a higher e_t leads to a higher probability that the corrupt official will be fired. It will be clear that for m close to zero it describes a rapacious government or kleptocracy; whereas for m close to 1 it describes a clean bureaucracy that is free of corruption. In the ensuing analysis we first assume that m is exogenously given, and then study the effect of changing m on the officials' rent-seeking behavior and social welfare.[4]

Both salary and rents are received by the end of each period. Rents, if any, are sought during the period. If the official is fired in period t, then he receives no salary nor rents from that period on. Thus, conditional on being incumbent at the beginning of

[4]Conceivably, the principal may not have the full discretion to change m if the monitoring system has to be implemented by other officials who are themselves susceptible to corruption. Especially for a bureaucracy that is well entrenched in some low-m system, internal barriers to any reform of the monitoring and control system can be high (e.g., Carrillo, 2000).

period t, the official's job payoff follows a binomial process:

$$\left\langle \begin{array}{ll} s_t + r(e_t, s_t) & \text{with probability } 1 - p_t \\ 0 & \text{with probability } p_t \end{array} \right.$$

where $r(e_t, s_t)$ denotes the total rents acquired by the official in time-t if he is not caught. Mookherjee and Png (1995) show that a higher salary could increase the amount of bribes and the total level of corruption. Casual observation also suggests that higher-rank officials are capable of receiving more rents than lower-rank ones even with the same effort. We capture these ideas by assuming that $r(e_t, s_t) = e_t s_t$ so that r is an increasing function of both e_t and s_t.

All candidates are risk neutral, having the same valuation of the status of being fired that is normalized to be zero,[5] as well as the same opportunity cost W of taking up the job. For instance, W can be the candidate's valuation of the best alternative employment in the private sector. Each candidate, however, may have a different job-specific type $\theta_i \in [a, b] \subset [0, 1)$. These types are commonly known to be independently distributed ex ante, and the realized value θ_i is known to candidate i privately. The magnitude of θ_i is assumed to be the product of a discount factor δ_i and a growth factor g_i. Both factors

[5] This is consistent with the insight of Becker (1968), Mirrlees (1974), and Becker and Stigler (1974) that when monitoring is costly, maximizing penalty is optimal for deterring malfeasant behavior. See Shapiro and Stiglitz (1984) for a similar assumption and a proof that penalty should result in the individual receiving minimum utility, independent of how much he shirks (here, takes bribes). It can be verified that as long as the status of being fired has the same valuation for all, the zero normalization is innocuous. Note also that the *expected* penalty is still gradual in our context because the probability of detection declines with the level of corruption. In a sense, this is a "dual" approach to Mookherjee and Png (1994) who assume fixed probability and variable penalty levels.

can be interpreted quite flexibly. For instance, by writing $\theta_i = \delta g_i$, we can interpret δ as a common discount factor and g_i the individual's private assessment of his job growth potential. In this case θ_i may reflect the official's hidden "talent."[6] Alternatively, by writing $\theta_i = \delta_i g$, we can use g to indicate a common rate of salary growth (that may be decided by the principal) and δ_i the official's private discount factor for the job. In this case δ_i may indicate a personal intertemporal preference for the job, or a personal assessment of the transitional probability that the current political regime will survive, or the probability that the official will not die (by working for the government) from period t to $t+1$ and so on.

Since δ and g are glued together via $\theta = \delta g$, without ambiguity it often suffices, as we do, to focus on θ and leave the reader with more room for interpretations of the results. Literally, θ is a "discount-growth factor", generally indicating some degree of the candidate's time preference over the job's payoff flows. In discussing the results, however, we use the more specific term "talent" to mean θ. It is worth stressing that θ is defined here to be *job-specific*: individuals may have different talent for different professions and their talent may be shaped by the job environment as well. For instance, the principal can use compensation or promotion policies to affect the overall growth prospect of the job and thereby the officials' growth factor g. This job-specific view about discount-growth factor has an analogy in the field of finance, where the discount rate used for pricing a financial

[6] To bring this interpretation closer to Holmström's (1999) career model, we could introduce some uncertainty and assume that the official's salary grows according to the principal's expectation of his talent conditional on observed performances, which converges to g. We skip such embellishment for the sake of simplicity.

asset varies with the riskiness of the asset. In defining θ, therefore, we assume that the job environment is given. For simplicity, we assume that both δ_i and g_i are constant over time so that $s_{t+1} = g_i s_t$. Under risk neutrality, extending the model to random growth rates will not affect the main results. Note that g_i need not be greater than one; a low-talent official may expect a decline in salary as well. The initial salary is $s_1 = s$.

Each official is assumed to evaluate the job by the present value of an expected life-time payoff[7]

$$\begin{aligned}
\pi &= s_1(1+e_1)(1-p_1) + \delta s_2(1+e_2)(1-p_1)(1-p_2) + ... && (1) \\
&= \sum_{t=1}^{\infty} \left(\delta^{t-1} s_t (1+e_t) \prod_{j=1}^{t} (1-p_j) \right) && (2) \\
&= s \sum_{t=1}^{\infty} \left(\theta^{t-1} (1+e_t) \prod_{j=1}^{t} (1-me_j) \right) && (3)
\end{aligned}$$

where the term $\prod_{j=1}^{t}(1-p_j)$ or $\prod_{j=1}^{t}(1-me_j)$ is the probability that the official is not fired up to time t. Since this probability decreases in t, corrupt officials face increasingly higher probability to be fired as t increases. In other words, *ex ante*, any period's rent-seeking activity affects not only the expected job payoff of that period, but also the expected payoffs in each and all of the ensuing periods. We now turn to the optimal rent-seeking decisions of the official.

[7] As in Shapiro and Stiglitz (1984) and Holmström (1999), risk neutrality allows us to restrict attention to rent-seeking effort e_t and neglect other possible decisions such as consumption and savings plans. Also, cost of e_t (apart from the probability of being caught) is assumed away for notational efficiency since it does not add any new insight.

2.2 Intertemporal Rent-Seeking Decisions

Consider an arbitrary candidate $i \in N$ and drop his subscript i. If appointed to the job, he will choose a rent-seeking plan $e_1, e_2, ...$ until his job terminates. Maximization of π in (3) with respect to $\{e_t\}$ involves a dynamic programming problem that can be analyzed recursively. At any time t, let π_t denote the official's valuation of the remaining job benefits conditioning on being currently hired. Then

$$\begin{aligned}
\pi_t &= s_t \sum_{k=0}^{\infty} \left(\theta^k \left(1 + e_{t+k}\right) \prod_{j=t}^{t+k} (1 - me_j) \right) && (4) \\
&= s_t(1+e_t)(1-me_t) + s_t \sum_{k=1}^{\infty} \left(\theta^k \left(1 + e_{t+k}\right) \prod_{j=t}^{t+k} (1 - me_j) \right) \\
&= s_t(1+e_t)(1-me_t) + \theta(1-me_t)s_t \sum_{k=0}^{\infty} \left(\theta^k \left(1 + e_{t+1+k}\right) \prod_{j=t+1}^{t+1+k} (1 - me_j) \right) \\
&= s_t(1+e_t)(1-me_t) + \delta(1-me_t)\pi_{t+1} \quad \text{(recall that } \theta s_t = \delta g s_t = \delta s_{t+1}) && (5)
\end{aligned}$$

It is easily seen that conditional on not caught, past efforts in seeking rents are "sunk" in that the function π_t depends only on rent-seeking plans $e_t, e_{t+1}, ...$

Let π_t^* denote the optimal valuation of (4), defined by the Bellman optimality equation

$$\begin{aligned}
\pi_t^* &= \max_{e_t \geq 0} \left\{ s_t(1+e_t)(1-me_t) + \delta(1-me_t)\pi_{t+1}^* \right\} && (6) \\
\text{s.t. } 0 &\leq me_t \leq 1 && (7)
\end{aligned}$$

Clearly, the constraint $me_t \leq 1$ will not be binding since π_t^* is guaranteed to be strictly positive (by choosing $e_t = 0$). So the only possible constraint is $e_t \geq 0$.

Lemma 1 *If e_t^* is a solution to the problem (6)-(7), then*

$$\pi_t^* = \begin{cases} s_t \frac{(1-me_t^*)^2}{m} & \text{if } e_t^* > 0 \\ \frac{s_t}{1-\theta} & \text{if } e_t^* = 0 \end{cases} \tag{8}$$

Proof. The first-order condition characterizing e_t^* for problem (6)-(7) is

$$s_t(1 - m - 2me_t^*) - \delta m \pi_{t+1}^* - \lambda_t = 0 \tag{9}$$

where λ_t is the multiplier for constraint $e_t \geq 0$. Twice differentiating π_t^* with respect to e_t yields $-2ms_t < 0$, so the second-order condition is satisfied. If $e_t^* > 0$, then $\lambda_t = 0$ and equation (9) can be rewritten as

$$\pi_{t+1}^* = \frac{s_t(1 - m - 2me_t^*)}{\delta m}$$

Substituting into (6) we obtain

$$\begin{aligned} \pi_t^* &= (1 - me_t^*)\left(s_t(1 + e_t^*) + \delta \pi_{t+1}^*\right) \\ &= s_t(1 - me_t^*)\left(1 + e_t^* + \frac{(1 - m - 2me_t^*)}{m}\right) \\ &= s_t \frac{(1 - me_t^*)^2}{m} \end{aligned}$$

If $e_t^* = 0$, then substituting 0 for e_t in (6) yields

$$\pi_t^* = s_t + \delta \pi_{t+1}^* = s_t + \delta g \pi_t^* \Rightarrow \pi_t^* = \frac{s_t}{1 - \theta}$$

where the second equation uses a property $\pi_{t+1}^* = g\pi_t^*$ as shown in Proposition 2. ■

Equation (8) shows a clear-cut negative relation between e_t^* and the induced valuation π_t^* (since $me_t^* < 1$). The next lemma derives e_t^* explicitly.

Lemma 2 *The optimal rent-seeking plans $e_1, e_2, ..$ that maximize (4) are characterized by a constant plan $e_t^* = e^*$ for all $t \geq 1$ given by*

$$e^* = \begin{cases} e(\theta, m) & \textit{if } \theta < 1 - m \\ 0 & \textit{if } \theta \geq 1 - m \end{cases} \tag{10}$$

where

$$e(\theta, m) = \frac{1}{m\theta}\left(\sqrt{1-(1+m)\theta} - (1-\theta)\right) \tag{11}$$

Proof. The structure of π_t, as can be seen from (4), implies that

$$\begin{aligned} \frac{\pi_t^*}{s_t} &= \max_{e_t, e_{t+1}, \ldots} \sum_{k=0}^{\infty} \left(\theta^k \left(1 + e_{t+k}\right) \prod_{j=t}^{t+k} (1 - me_j) \right) \\ &= \max_{e_1, e_2, \ldots} \sum_{k=0}^{\infty} \left(\theta^k \left(1 + e_{1+k}\right) \prod_{j=1}^{1+k} (1 - me_j) \right) = \frac{\pi^*}{s} \end{aligned}$$

Consequently, π_t^*/s_t is a constant that is independent of t and $\pi_{t+1}^* = g\pi_t^*$ for all t. It follows that equation (9) can be rewritten as

$$s_t(1 - m - 2me_t^*) - \theta m \pi_t^* - \lambda_t = 0$$

For $e_t^* > 0$ so that $\lambda_t = 0$, we have

$$\begin{aligned} e_t^* &= \frac{(1 - m - \theta m \frac{\pi_t^*}{s_t})}{2m} \\ &= \frac{(1 - m - \theta(1 - me_t^*)^2)}{2m} \end{aligned}$$

where the last equation comes from (8). Solving this quadratic equation yields $e_t^* = e(\theta, m)$ as defined in (11), which holds for all t.[8] Note that $e(\theta, m)$ is a well defined real number

[8] One can also use the "guess and verify" approach by assuming e_t to be constant so that $\pi_{t+1} = g\pi_t$,

because $\theta < 1 - m$ implies $\sqrt{1-(1+m)\theta} \geq m$. It remains to verify that the constraint $e \geq 0$ is not binding. This follows from the fact that

$$e(\theta, m) > 0 \text{ iff } \sqrt{1-(1+m)\theta} - (1-\theta) > 0 \text{ iff } \theta < 1 - m \tag{12}$$

The equivalence relations in (12) in fact shows that if $\theta \geq 1 - m$, then necessarily the constraint $e \geq 0$ is binding so that $e^* = 0$. ■

According to Lemma 2, the official behaves "honestly" as long as the control mechanism m, or the discount factor δ, or the growth rate g is sufficiently high. The reverse is also true that the official will seek some positive amount of rents in each period under sufficiently low m, δ, or g provided that $m < 1 - \delta g$.

We shall say that the optimal rent-seeking decision e^* in (10) defines an official's *corruptibility*. Thus, under any monitoring mechanism m, official i is *more corruptible* than official j if and only if $e(\theta_i, m) \geq e(\theta_j, m)$. The officials with type $\theta \geq 1 - m$ are shown to be *incorruptible* under m because $e(\theta, m) = 0$. The next proposition shows how corruptibility changes with mechanism m and type θ (see Figure 1).

Proposition 1 *For all $m, \theta \in (0,1)$ and $\theta < 1 - m$, the official's corruptibility e^* strictly decreases in m and θ.*

Proof. Assume $\theta < 1 - m$. Differentiating $e(\theta, m)$ with respective to m and θ yields

---

and substituting into (1) to derive

$$\pi_t = \frac{s_t(1+e)(1-me)}{1-\theta(1-me)}.$$

It can be shown that maximizing the above function yields the same $e^* = e(\theta, m)$.

straightforwardly that

$$
\begin{aligned}
\frac{\partial e}{\partial m} &= -\frac{1}{m}\left(\frac{1}{2\sqrt{1-(1+m)\theta}} + e(\theta, m)\right) < 0 \\
\frac{\partial e}{\partial \theta} &= -\frac{1}{m\theta^2}\left(\sqrt{1-(1+m)\theta} - 1 + \frac{\theta(1+m)}{2\sqrt{1-(1+m)\theta}}\right) \\
&= -\frac{1}{2m\theta^2\sqrt{1-(1+m)\theta}}\left(1 + 1 - (1+m)\theta - 2\sqrt{1-(1+m)\theta}\right) \\
&= -\frac{1}{2m\theta^2\sqrt{1-(1+m)\theta}}\left(1 - \sqrt{1-(1+m)\theta}\right)^2 < 0
\end{aligned}
$$

■

It is worth remarking that corruptibility, or the rent-seeking effort e, is independent of the absolute level of salary. Rather, it is the *increase* in salaries over time, as measured by g that is important in discouraging corruption. Since $\theta = \delta g$ with $\delta, g > 0$, $e(\theta, m)$ is a strictly decreasing function of δ, g, and m. Therefore a policy implication of Proposition 1 is to maximize the salary growth rate (conceivably, under some budget constraint) while adjust the initial salary of government jobs downward (conceivably, under some minimum salary constraint).[9] This result seems to be consistent with common practices in many democratic countries, where the private sector typically offers a higher initial salary than the public sector – at least for those with higher educations and capacity. At the same time, the higher job uncertainty in the private sector implies a lower expected income

[9] See, e.g., Lazear (1981) for a similar wage structure where workers may shirk. Lazear shows that the initial wage should be lower than the worker's marginal productivity but the wage should increase over time even when productivity remains constant. Thus the potential higher wage in the future serves as a "bond" (e.g., Becker and Stigler, 1974) that offers work incentives. Note that Lazear's concern about the employer credibility is absent in our model given that the government does not default – at least in nominal terms.

growth than in the public sector.

The traditional view about efficiency wages, or using sufficiently high salary to deter corruption, has been developed in “single-act frameworks”, as termed by Mookherjee and Png (1994). In addition, the existing anti-corruption models mostly formulate the problem in a static setting. These limitations may have prevented theoretical studies of the effects of long-term job-growth potential on the agent's rent-seeking behavior. The role of salary growth in curbing corruption is consistent with the empirical evidence that jobs offering a rewarding long-term career are significantly associated with better bureaucratic performance (e.g., Evans and Rauch, 1999). Empirical evidence also seems to support the prediction that corruptibility declines with monitoring effectiveness (e.g., Olken, 2007).

Given mechanism m, we now define the *corruption level* of an official by the total discounted value of rents $r(e_t, s_t)$ that he expects from the job:

$$
\begin{aligned}
R(\theta, m) &\equiv \sum_{t=1}^{\infty}\left(\delta^{t-1} r(e_t, s_t)\prod_{j=1}^{t}(1-me_j)\right) && (13)\\
&= s\sum_{t=1}^{\infty}\theta^{t-1}e^*(1-me^*)^t && (14)\\
&= \begin{cases} s\frac{e(\theta,m)(1-me(\theta,m))}{1-\theta(1-me(\theta,m))} & \text{if } \theta < 1-m \\ 0 & \text{if } \theta \geq 1-m \end{cases} && (15)
\end{aligned}
$$

where in (14) we used $r(e_t, s_t) = e_t s_t$, $s_t = sg^{t-1}$, and $e_t = e^*$. The corruption level incorporates the probability of detecting corruption and the increased effectiveness of rent-seeking effort as one's rank, or salary, goes up. By this definition, the corruption level indicates directly the expected social losses due to corruption.

Proposition 2 *Let $m \in (0,1)$ be given. Then the corruption level $R(\theta, m)$ is a strictly decreasing function of θ on $(0,1)$ if $m \geq 0.5$. For $m \in (0, 0.5)$, there exists a cutoff point $c \in (0,1)$ that is a decreasing function of m given by*

$$c(m) = \frac{1}{1+m}\left(1 - \frac{m}{2} - \frac{9}{8}m^2 - \frac{3}{8}\sqrt{8m^3 + 9m^4}\right) \tag{16}$$

such that $R(\theta, m)$ strictly increases in θ on $(0, c]$ and strictly decreases in θ on $(c, 1)$.

Proof. It is obvious that c is a decreasing function of m, satisfying $c(0) = 1$ and $c(0.5) = 0$. Let any $m \in (0,1)$ be given. Then for all $\theta \geq 1 - m$ we have $R(\theta, m) = 0$, and that

$$(1+m)\theta \geq 1 - m^2 > 1 - \frac{m}{2} - \frac{9}{8}m^2 - \frac{3}{8}\sqrt{8m^3 + 9m^4} = (1+m)c \Rightarrow \theta > c$$

For $\theta < 1 - m$, substituting $e(\theta, m)$ into R and differentiating yields

$$\text{Sign}(\frac{\partial R}{\partial \theta}) = \text{Sign}\left(\left(\frac{3}{2}m + 2 - \frac{2}{\theta}\right)\sqrt{1 - (1+m)\theta} + (1+m)\theta + \frac{2}{\theta} - \left(\frac{5}{2}m + 3\right)\right) \tag{17}$$

It can be shown with some tedious manipulations that the second-order derivative $\partial^2 R / \partial \theta^2 < 0$ whenever $\partial R / \partial \theta = 0$. This implies, by continuity, that R is quasi-concave in $\theta \in (0,1)$. The unique maximum of R is attained by forcing the right-hand side of (17) to be zero, which yields $\theta = c$ as defined in (16). However, c is negative for $m > 0.5$, implying that $\partial R / \partial \theta < 0$ for all $\theta \in (0,1)$. This completes the proof. ■

Figure 2 depicts the corruption level as a function of θ for various monitoring intensity m. To develop some insight, consider the extreme case where $\theta = 0$. This reduces our model to a single-period problem of maximizing $s(1+e)(1-me)$. The optimal rent-seeking effort and the expected rents are, respectively,

$$e_0 \equiv \lim_{\theta \to 0} e(\theta, m) = \frac{1-m}{2m} \text{ and } R_0 \equiv s e_0 (1 - m e_0) = \frac{s}{4m}\left(1 - m^2\right)$$

Now let θ increase a bit so that it becomes positive. Then there are additional benefits of not being fired in time-1, as reflected in the denominator of $R(\theta, m)$ in (15). The expected value of the future rent-flows, discounted with θ, will be strictly larger than the single-period rent if effort e_0 is not changed. That is, $se_0(1 - me_0)/(1 - \theta(1 - me_0)) > R_0$. But since the official's objective is to maximize the job value rather than rents, it is not immediate that $R(\theta, m) > R_0$. Proposition 2 shows that this is indeed the case, but only for sufficiently small θ and for $m < 0.5$. When θ is sufficiently high, the desire to keep the job is more pronounced. The marginal effect of increasing θ will then induce a sharper decrease in rent-seeking effort, resulting in a decline in the corruption level R.

The next proposition shows the sensitivity of job valuations to θ and m. The valuation of the job equals π_1^* in (8) with $e_t^* = e^*$. It is given by

$$\pi(\theta, m) = \begin{cases} s\frac{(1-me(\theta,m))^2}{m} & \text{if } \theta < 1 - m \\ \frac{s}{1-\theta} & \text{if } \theta \geq 1 - m \end{cases} \tag{18}$$

Proposition 3 *The valuation of the job $\pi(\theta, m)$ strictly increases in θ for all $\theta \in 0, 1$ and strictly decreases in m for $\theta < 1 - m$.*

Proof. That $\pi(\theta, m)$ strictly increases in θ is obvious for $\theta \geq 1 - m$. For $\theta < 1 - m$, note that $\pi(\theta, m)$ is an increasing function of e and $\partial e/\partial\theta < 0$. As with m,

$$\frac{\partial \pi}{\partial m} = s\left(-\frac{(1 - me)^2}{m^2} - \frac{2(1 - me)}{m}\left(e + m\frac{\partial e}{\partial m}\right)\right)$$

Noting that

$$e + m\frac{\partial e}{\partial m} = -\frac{1}{2\sqrt{1 - (1 + m)\theta}}$$

we have

$$
\begin{aligned}
\frac{\partial \pi}{\partial m} &= \frac{s(1-me)}{m}\left(-\frac{(1-me)}{m}+\frac{1}{\sqrt{1-(1+m)\theta}}\right) \\
&= \frac{s(1-me)}{\theta m^2\sqrt{1-(1+m)\theta}}\left(\theta m-\sqrt{1-(1+m)\theta}+1-(1+m)\theta\right) \\
&= -\frac{s(1-me)}{m\sqrt{1-(1+m)\theta}}e\left(\theta,m\right)<0
\end{aligned}
$$

■

Figure 3 shows how the corruption level and the job valuation go in opposite directions for $m = 0.2$ and $\theta \in [c, 1)$.

3 Quasi-Auction of Government Jobs

From the preceding analysis, the effectiveness of the monitoring mechanism m and talent θ determine the rent-seeking behavior of a government official. An immediate thought is to let the principal improve the system m so as to curb the rent-seeking behavior, or to increase g, thereby giving the official more incentives to secure his job. In reality, however, the principal's ability to affect m can be limited by traditional, social, and/or political constraints. The salary growth rate g cannot be set too high either, because of the expected future financial constraints on government spending.

In these situations, the quasi-auction becomes a useful mechanism to select potentially less corruptible individuals to public office. As shown in the previous section, the less corruptible are the ones who have higher talents θ. Alternatively, they are the ones who have the highest personal valuations for the official posts. Since talent is unknown, a natural way to find out these officials is to let the candidates bid for the posts through auctions. The equilibrium bidding strategies will reveal the highest valuations and hence the highest $\theta's$, who will then be appointed.

We consider a sealed-bid uniform-price quasi-auction in the present context (although other pricing rules can do as well). The rule stipulates that each candidate bids a minimum initial salary that he finds acceptable for the job, and that the lowest K bidders get appointed. The salary will be the same for all K appointed officials, which is equal to the lowest losing bid or the $(K+1)$th lowest bid. If there are more than one Kth bidders, then one of them will be selected with equal chance. The quasi-auction can be implemented, say, by interviewing each candidate behind a closed door, telling him the selection criterion, and asking him to state his minimum salary. The uniform-pricing rule is desirable for placing little demand on knowledge about the distribution of the candidates' types, and for being fair from the viewpoint of the candidates. The least corruptible official will receive the "happiest surprise" in that the difference between the actual pay and his bid is the highest. The expected salary will be bounded from below by the candidates' outside options, and from above by a reserve salary imposed by the principal or due to the lower bound of θ.

3.1 Equilibrium bidding strategy

Assume that by participating in bidding the candidate commits to working for the principal if he is a winner. Such a commitment can be enforced by telling the candidate that there would be a (small) fine if he reneges after winning (e.g., a reputation damage). Let $m \in (0,1)$ be given and fixed. Define $v(\theta_i) = \pi(\theta_i, m)/s$, which is candidate i's job valuation per dollar of initial salary.

Since the situation is similar to the standard uniform-price auctions in which each bidder has a private and independently distributed value $\pi(\theta_i, m)$ for the job, the following proposition is immediate. We sketch a proof for completeness and refer the interested reader to the excellent books by Krishna (2002) and Milgrom (2004) for more details. Recall that W is the candidate's opportunity cost of working for the principal.

Proposition 4 *In the quasi-auction, (i) the equilibrium strategy of each candidate i is to bid a salary equal to*

$$S(\theta_i) = \frac{W}{v(\theta_i)} \tag{19}$$

(ii) among the N candidates, the K appointed officials are the least corruptible ones; and (iii) if $[a, b] \subseteq [c, 1)$, where $[a, b]$ is the interval containing all possible θ and c is defined in (16), then the K appointed officials also have the least corruption levels. In other words, for all $i \neq j$, $e(\theta_i, m) < e(\theta_j, m)$ and $R(\theta_i, m) < R(\theta_j, m)$ whenever $S(\theta_i) < S(\theta_j)$.

Proof. (i) Suppose the bidder with θ_i bids $s > S(\theta_i)$. If the $(K + 1)$th bid, say $s^{(k+1)}$, is higher than s then bidder i wins and receives an initial salary equal to $s^{(k+1)}$. But this will happen also if he bids $S(\theta_i)$. If $s^{(k+1)}$ is lower than $S(\theta_i)$ then bidder i loses, but it is also the case with bidding $S(\theta_i)$. If $S(\theta_i) \leq s^{(k+1)} \leq s$, however, bidder i will run the risk of losing the opportunity of getting a better paying job since $s^{(k+1)}v(\theta_i) \geq S(\theta_i)v(\theta_i) = W$. Analogously, by bidding $s < S(\theta_i)$ the bidder will run the risk of getting the job at a loss while any other outcomes are not affected.

(ii) By propositions 1 and 3, both $e(\theta_i, m)$ and $S(\theta_i)$ are continuous (indeed, differentiable) and strictly decreasing functions of θ_i.

(iii) By propositions 2, $R(\theta_i, m)$ is a strictly decreasing function of θ_i when $[a, b] \subseteq [c, 1)$. It follows straightforwardly that the strategy of (19) implies that the lower bidder has a lower corruption level. ■

To fix ideas about the bidding strategy in a quasi-auction, consider a numerical example with the outside alternative employment being valued at $W = 1$ (say, one million dollars in excess of the status of being fired). For more concreteness, let θ be the product of a common salary growth of 4 percent per year, i.e., $g = 1.04$, and the candidates personal job discount factor δ. From the preceding analysis, the official seeks positive level of rents if and only if $\delta g < 1 - m$ or $\delta < (1 - m)/1.04$. The following table shows the corresponding rent-seeking plans e and salary bidding strategies s, as δ varies from 0.6 to 0.9.

$g = 1.04$	$m = 0.1$		$m = 0.2$	
δ	e	S	e	S
0.9	0	0.064	0	0.064
0.8	1.55	0.140	0	0.168
0.7	2.44	0.175	0.56	0.254
0.6	2.98	0.203	0.99	0.312

For instance, under monitoring regimes $m \geq 0.1$ the prospective official with discount factor $\delta = 0.9$ never plans to seek rents. Therefore his optimal bid for the job is the same initial salary of $0.064 \times W$ (or $64,000$ dollars per year) for both $m = 0.1$ and $m = 0.2$. If the prospective official has $\delta = 0.8$, however, then he will seek 1.55 times salary of the rents under monitoring regime $m = 0.1$ and does not seek any rents under regime $m = 0.2$.

In order to compensate for the lost rents, he will bid a higher salary $0.168 \times W$ (or $168,000$ dollars per year) under $m = 0.2$ than the $0.14 \times W$ (or $140,000$ dollars per year) under $m = 0.1$. The general tendency is clear: since higher m makes the job less attractive for those who plan to seek rents, they will have to bid for higher initial salaries.

If reducing corruption is the primary concern and there is some flexibility in not filling all the jobs, then a reserve salary can be used to further decrease the expected corruption level.

Proposition 5 *Let c be defined as in (16) and function $S(\cdot)$ be defined as in (19). Define reserve salary to be an initial-salary cap that all salary bids must not exceed. Then (i) the quasi-auction selects only incorruptible officials who never seek rents under a reserve salary equal to $S(1-m)$; and (ii) the quasi-auction selects the officials with least corruption levels among the N candidates under a reserve salary equal to $S(c)$.*

Proof. Since $S(\theta_i)v(\theta_i) = W$, any candidate with $S(\theta_i)$ higher than the reserve salary will find the alternative job offering a value of W more attractive, hence will not participate in bidding. From Proposition 3, $S(\theta)$ strictly decreases in θ. It follows that (i) the reserve salary $S(1 - m)$ attracts only those with $\theta \geq 1 - m$ (the incorruptible officials); and that (ii) the reserve salary $S(c)$ attract only those with $\theta \geq c$. From Propositions 2 and 4, these are officials with least corruption levels among all candidates. ■

Continuing with the previous example, if $m = 0.2$ and the principal wishes to make sure that no official would take bribes, then setting a maximum annual salary of $168,000$ dollar will exclude all potentially corruptible officials. Note that a reservation salary cap may also be used when the principal has a fixed budget that cannot be exceeded. Of course, since quasi-auction helps minimize the costs of hiring government officials, depending on the distribution of types, competition among the candidates is likely to generate a much lower salary than the salary cap stipulated by the principal.

In situations where all positions have to be filled and some corruptible officials are appointed, then in line with the rent-dissipation models (cf., Hillman and Katz, 1987) the quasi-auction serves also as a means to recover some of the potential social losses of corruption. To see this, note that the total value of expected rents can be inferred from

$$\text{Value of rents } + \frac{s}{1-\theta_i} = sv(\theta_i)$$

where s is the bidding outcome or the $(K+1)$th lowest bid of salary. For instance, consider again the above example under $m = 0.1$. Suppose the official with $\delta = 0.8$ is the Kth bidder and is offered the job, then depending on s, his expected rents can be "taxed" up to breaking even point (i.e., when $s = 0.14$). In this case if he does not seek rents he will value the job as $s/(1 - \delta g) = 0.14/(1 - 1.04 \times 0.8)W = 0.833\,33W$, which is smaller than his opportunity cost of W. The remaining $0.166\,67W$ is the expected value of rents, which become entirely dissipated through the quasi-auction. In general, the quasi-auction "taxes" progressively less rents as the official's corruptibility goes down.

3.2 Comparison with standard auction of jobs

The preceding analysis raises a natural question that, since it is desirable to select the officials who value the jobs most, why not directly selling the jobs to them? Indeed, in a society where corruption is not effectively contained, substantial personal or commercial benefits could be derived from a government job. A market would naturally arise in response to the demand for these government jobs – overtly or covertly. In those regimes, a government job could be viewed as a kind of an asset entailing, apart from regular salaries, the potential rents to its beholder. In this subsection, we discuss some practical implications of the quasi-auction and highlight its potential advantages over standard auction of government jobs. To this end, we shall depart from the simple model presented above and include some practical concerns that go beyond the assumptions made in the model.

3.2.1 Quasi-auction vs. legally organized auction of offices

We first compare the quasi-auction with legally organized standard auction of government positions (offices or jobs), under which the highest payer gets the job. Historically, the first formally recorded auction of public offices was held in the Qin dynasty of China, 243 BC. Because of a locust pestilence and the ensuing plague, food supply was in acute shortage. Qin Shi Huang, the first emperor of the Qin dynasty decided to auction low-ranked aristocratic titles to the rich commoners for their private storages of "Su" (grains). This innovative idea to raise revenue in times of need was later adopted by many of the ensuing Chinese emperors, who often found themselves in financial distress – partially due to the long lasting wars against the nomads from the North. European monarchs in the 17th and 18th century also have frequently relied on selling public offices to finance their expenditure. In France, for example, the venality under Francis I and Henry II was notoriously popular (e.g., Swart, 1980). Local government positions were also sold in nineteenth-century America (Azfar et al. 2001).

Since the standard auction of offices is primarily motivated by the desire to collect revenues rather than selection of officials, it is typically an indication that corruption has become endemic (Azfar et al., 2001). A market for offices has to be organized so that their future payoffs can be capitalized and traded in terms of present values. For this market to function well, the state must ensure certain property right to the office holders. Apart from state protection, the office may be transferred, inherited, or pledged as collateral. In order to maximize the value of an office, some of its monopoly rents will have to be legalized even though they entail higher social costs. The quality of the candidates is not of the major concern but their financial capacity. The buyer of an office may have to take out personal loans, incurring substantial transaction costs and uncertainty.

Now, turn back to our rent-seeking model and maintain all the assumptions in this paper including, among others, a benevolent principal wishing to select less corruptible bureaucracies and an institution under which corrupt officials will be fired once they are caught. Despite the theoretical similarities, there is still a difference between the quasi-auction and the standard auction in terms of feasibility. Namely, the price of an office can be exceedingly high since it represents the present value of all future expected payoffs (in excess of the alternative job). Consequently, the candidates may face budget constraints under a standard auction but not under a quasi-auction. If the budget constraints affect some of the high-talent candidates, then the standard auction will be inefficient in selecting the less corruptible officials.[10] Clearly, banks may have little help for budget-constrained

[10] This budget-constraint problem is analogous to the criticism of the pay structure proposed by Becker and Stigler (1974). In Becker and Stigler's payment scheme, each bureaucrat posts a bond with sufficiently high value. This bond will be lost as part of the penalty for malfeasant behavior. Although theoretically

buyers because they run the risk of losing the loan when the borrower is fired. This is a market-for-lemmon problem due to asymmetric information as well as limited liability of the borrowers. As with quasi-auctions, on the other hand, such credit risk is minimal. Even in cases where a high-talent official bids an initial salary that is below his current living standard and has to borrow, the loan size will be substantially small compared to standard auctions. Further, the bank can adjust the loan size over time as the official's salary increases and stop the loan as soon as the official is fired.

3.2.2 Quasi-auction vs. illegal buying or selling of offices

"Money for office" can also be initiated by the buyers. Turning to illegal practices of buying or selling government jobs, let us keep the benevolent-principal assumption but add a middle level in the bureaucracy, a "chief" who hires officials for the jobs on behalf of the principal. Suppose that the chief is corruptible, and that each candidate may now influence the chief's decision by paying him a bribe that can be made in money or in any kind or services. If the highest K bribers get the jobs, then the situation resembles an all-pay auction. It is "all-pay" because the bribes are not returned even if some candidates do not get the job. In order to maximize the bribes, the chief now has an incentive to expand the number of jobs for sale and to protect the jobs' privileged rents. Incentives are also created for the bribers to keep bribing the boss in order to maximize rents and recoup the bribing costs for the job. If the principal has no control of the chief's activities, corruption will propagate within and outside the hierarchy of the bureaucracies along with

appealing, the scheme has a practical limitation due to credit constraints.

these covert sales of offices (see, e.g., Carrillo, 2000; Zhu, 2007).

Suppose now that the principal controls m and imposes the use of quasi-auction for hiring officials. Then any candidate who pays a bribe has to bid a higher salary to compensate for the loss. But then, as long as the outcome of the quasi-auction can be monitored or verified, the briber stands a higher chance of losing the bid and forfeit his bribe. As a result, it can be argued that the dominant strategy is not to bribe but to bid the true value as in Proposition 4. Of course, this equilibrium strategy depends on the assumption that the principal knows the quasi-auction outcome, and that the existence of a corruptible chief does not change the job prospects of the candidates. In situations where the chief may collude with the bribers or manipulate the quasi-auction outcome, the principal could consider imposing a maximum salary as described in Proposition 5. For instance, a salary cap equal to $S(1-m)$ attracts only officials with $\theta \geq 1-m$ who do not intend to seek rents. Any other prospective officials would require a higher starting salary, hence for them bribing does not help. In general, though, the problem involving multi-level corruptible bureaucracies is complex and is beyond the scope of this paper.

Summarizing, the quasi-auction is motivated by the anti-corruption concerns rather than the maximization of profits. It does not create a market that allows some players in the bureaucracy to get rich fast by transacting the present values of future benefit flows from government jobs. Although in theory the standard auction could make the same selection of official as the quasi-auction does, in practice there can be credit constraints and other transaction costs associated with standard auctions. As long as the outcome can be monitored by the principal, the quasi-auction has a desirable property of deterring candidates from bribing for jobs. When the chief in charge of recruiting and supervising the lower-level officials does not receive any personal profits, he has no incentive to expand redundant jobs, or to protect the lower-jobs' corrupt rents. In short, the anti-corruption feature of the quasi-auction is in sharp contrast to the pro-corruption feature of the standard auction of government jobs that has been made illegal under most contemporary national legislations.

4 Concluding Remarks

This paper presents an analysis of using economic means to select less corruptible government officials. Corruptibility is not assumed to be each prospective official's personal characteristic of preferences. Instead, we interpret corruptibility as the rent-seeking behavior that is endogenously determined under the prevailing monitoring system and compensation policy. This view leads to an interesting finding that an official's valuation of the job can tell his propensity to corruption. Although neither preference nor corruptibility is directly observable, the negative relation between job valuation and corruptibility allows us to indirectly infer the officials's rent-seeking incentives by way of a quasi-auction. Although talent θ in our model is a morally neutral characteristic, the selected officials who bid the lowest initial salaries are not motivated by seeking the greatest rents. On the contrary, they are shown to be more likely motivated by the long-term growth potentials on the job.

The format of the quasi-auction can vary according to practical circumstances as long as it is efficient in selecting less corruptible officials. We have focused on the uniform-price quasi-auction in which the K lowest salary bidders win the K jobs and receive the same salary equal to the lowest loser's bid. The uniform-price mechanism seems to be fair given that all K jobs are identical. But in other situations the discriminative pricing might be used as well, under which each winner receives the salary he bids. Both of these rules have some resemblance with practical job negotiations, and the expected outcome is likely to be similar in situations where the revenue-equivalence principle of auction theory holds (e.g., see Myerson, 1981; Krishna, 2002, p. 2002).

What is really critical for the quasi-auction to work effectively in reducing corruption, indeed, is to identify conditions that are likely to lead to a negative relation between corruptibility and job valuation. This negative relation is apparently at odds with the traditional view that a higher job valuation reflects a stronger desire to seek rents. Having shown the possibility of the contrary, however, is not to suggest that this traditional view is wrong. Instead, the paper suggests that the selection of less corruptible officials through a quasi-auction makes best sense in a society where a reasonably good social order (high δ), a stable career grow potential (g), and a strong monitoring mechanism (m) are in place. In other situations, the interplay between these parameters as revealed in this study can still be useful for understanding the functioning of public bureaucracies. For instance, a weak monitoring mechanism m need not be disastrous as long as the public service jobs offer a rewarding long-term prospect (see, e.g., Evans and Rauch, 1999). From a dynamic perspective, using quasi-auctions to select officials under the favorable circumstances mentioned above is likely to generate an increasing number of trustworthy public servants along with time.

5 References

Acemoglu, Daron, and Thierry Verdier. 1998. "Property Rights, Corruption and the Allocation of Talent: A General Equilibrium Approach." *The Economic Journal*, 108(450): 1381-1403.

Ades, Alberto, and Rafael Di Tella. 1999. "Rents, Competition, and Corruption." *The American Economic Review*, 89(4): 982-993.

Aidt, Toke S. 2003. "Economic Analysis of Corruption: A Survey." *The Economic Journal*, 113(491): F632–F652.

Appelbaum, Elie, and Eliakim Katz. 1987. "Seeking Rents by Setting Rents: The Political Economy of Rent Seeking." *The Economic Journal*, 97(387): 685-699.

Azfar, Omar, Young Lee, and Anand Swamy. 2001. " The Causes and Consequences of Corruption." *The Annals of the American Academy of Political and Social Science*, 573(1): 42-56.

Banerjee, Abhijit V. 1997. "A Theory of Misgovernance." *The Quarterly Journal of Economics*, 112(4): 1289 -1332.

Beck, P., and Maher, M. W. 1986. "A Comparison of Bribery and Bidding in Thin Markets." *Economic Letters*, 20: 1–5.

Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." *The Journal of Political Economy*, 76(2):169-217.

Becker, Gary S., and George J. Stigler. 1974. “Law Enforcement, Malfeasance, and the Compensation of Enforcers.” *Journal o Legal Studies*, 111: 1-19.

Besley, Timothy, and John McLaren. 1993. “Taxes and Bribery: The Role of Wage Incentives.” *The Economic Journal*, 103(416): 119-141.

Besley, Timothy. 2005. “Political Selection.” *Journal of Economic Perspectives*, 19(3): 43-60.

Buchanan, James M. 1989. “The Public-Choice Perspective.” In: *Essays on the Political Economy*, 3–24. Honolulu: University of Hawaii Press.

Carrillo, Juan D. 2000. “Corruption in Hierarchies.” *Annales d’Economie et de Statistiques*, 59: 37– 62.

Caselli, Francesco, and Massimo Morelli. 2004. “Bad politicians.” *Journal of Public Economics*, 88(3-4): 759– 782.

Demsetz, Harold. 1968. “Why Regulate Utilities?” *Journal of Law and Economics*, 11 (April): 55-65.

Dixit, Avinash. 1997. “Power of Incentives in Private versus Public Organizations.” *The American Economic Review*, 87(2): 378-382.

Evans, Peter, and James E. Rauch. 1999. “Bureaucracy and Growth: A Cross-National Analysis of the Effects of "Weberian" State Structures on Economic Growth.” *American Sociological Review*, 64(5): 748-765.

Groves, Theodore, Yongmiao Hong, John McMillan, and Barry Naughton. 1995. "China's Evolving Managerial Labor Market." *The Journal of Political Economy*, 103(4): 873-892.

Hillman, Arye L., and Eliakim Katz. 1987. "Hierarchical Structure and the Social Costs of Bribes and Transfers." *Journal of Public Economics*, 34(2): 129-142.

Holmström, Bengt. 1999. "Managerial Incentive Problems: A Dynamic Perspective." *The Review of Economic Studies*, 66(1):169-182.

Jain, Arvind K. 2001. "Corruption: A Review." *Journal of Economic Surveys*, 15(1): 71–121.

Krishna, Vijay. 2002. *Auction Theory*. San Diego: Academic Press.

Laffont, Jean-Jacques, and Jean Tirole.1987. "Auctioning Incentive Contracts." *The Journal of Political Economy*, 95(5): 921-937.

Laffont, Jean-Jacques, and Jean Tirole.1988. "Repeated Auctions of Incentive Contracts, Investment, and Bidding Parity with an Application to Takeovers." *The RAND Journal of Economics*, 19(4): 516-537.

Lazear, Edward P. 1981. "Agency, Earnings Profiles, Productivity, and Hours Restrictions." *The American Economic Review*, 71(4): 606-620.

Leff, Nathaniel H. 1964. "Economic Development Through Bureaucratic Corruption." *American Behavioral Scientist*, 8(3): 8-14.

Lui, Francis T. 1985. "An Equilibrium Queuing Model of Bribery." *The Journal of Political Economy*, 93(4): 760-781.

Mauro, Paolo. 1995. "Corruption and Growth." *The Quarterly Journal of Economics*, 110(3): 681-712.

Mauro, Paolo. 1998. "Corruption and the Composition of Government Expenditure." *Journal of Public Economics*, 69(2): 263–279.

Milgrom, Paul. 2004. *Putting Auction Theory to Work*. Cambridge: Cambridge University Press.

Mirrlees, James.1974. "Note on Welfare Economics, Information, and Uncertainty." In: *Essays on Economic Behavior under Uncertainty*, ed. M. Balch, D. McFadden, and S. Wu, 243-58. Amsterdam: North Holland.

Mookherjee, Dilip. 1998. "Incentive Reforms in Developing Country Bureaucracies: Lessons from Tax Administration." In: *1997 Annual World Bank Conference in Development Economics*, ed. Joseph Stiglitz and Boris Pleskovic. Washington D.C.: World Bank.

Mookherjee, Dilip, and I. P. L. Png. 1994. "Marginal Deterrence in Enforcement of Law." *The Journal of Political Economy*, 102(5): 1039-1066.

Mookherjee, Dilip, and I. P. L. Png. 1995. "Corruptible Law Enforcers: How Should They Be Compensated?" *The Economic Journal*, 105(428): 145-159.

Myerson, Roger B. 1981. "Optimal Auction Design." *Mathematics of Operations Research*, 6(1): 58-73.

Olken, Benjamin A. 2007. "Monitoring Corruption: Evidence from a Field Experiment in Indonesia." *Journal of Political Economy*, 115(2), 200–249.

Rauch, James E. 2001. "Leadership Selection, Internal Promotion, and Bureaucratic Corruption in Less Developed Polities." *Canadian Journal of Economics*, 34(1): 240-258.

Rauch, James E., and Peter B. Evans. 2000. "Bureaucratic Structure and Bureaucratic Performance in Less Developed Countries." *Journal of Public Economics*, 75(1): 49–71

Rose-Ackerman, Susan. 1978. *Corruption: A Study in Political Economy.* New York: Academic Press.

Rose-Ackerman, Susan. 1999. *Corruption and Government: Causes, Consequences, and Strategies for Reform.* Cambridge: Cambridge University Press.

Shapiro, Carl, and Joseph E. Stiglitz. 1984. "Equilibrium Unemployment as a Worker Discipline Device." *The American Economic Review*, 74(3): 433-444.

Shleifer, Andrei, and Robert W. Vishny. 1993. "Corruption." *The Quarterly Journal of Economics*, 108(3): 599-617.

Shleifer, Andrei, and Robert W. Vishny. 1994. "Politicians and Firms." *Quarterly Journal of Economics*, 109: 995–1026.

Spence, Michael. 1973. "Job Market Signaling." *The Quarterly Journal of Economics*, 87(3): 355-374.

Tirole, Jean. 1994. "The Internal Organization of Government." *Oxford Economic Papers*, 46(1): 1-29.

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

Wei, S. J. 2000. "How Taxing is Corruption on International Investors?" *Review of Economics and Statistics*, 82(1), pp. 1–11.

Weiss, Andrew. 1980. "Job Queues and Layoffs in Labor Markets with Flexible Wages." *The Journal of Political Economy*, 88(3): 526-538.

Williamson, Oliver E. 1976. "Franchise Bidding for Natural Monopolies-in General and With Respect to CATV." *Bell Journal of Economics*, 7(Spring): 73-104.

Zhu, Jiangnan. 2007. "Why are Offices for Sale in China? A Case Study of the Office-Selling Chain in Heilongjiang Province." FED Working Papers Series FE20070132.

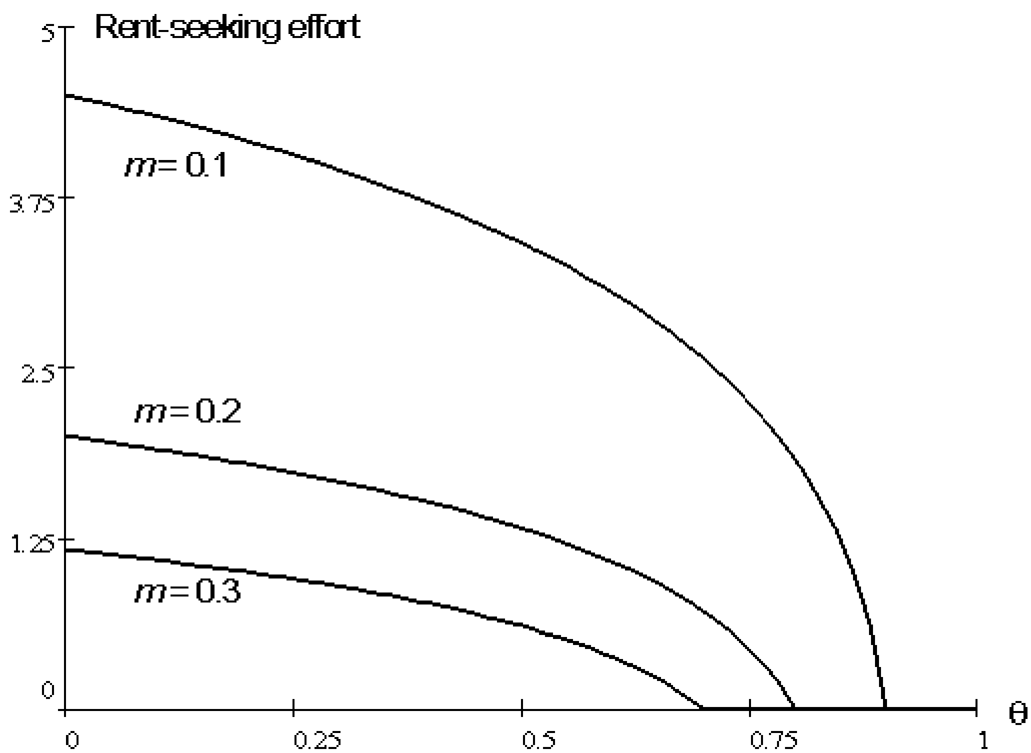

Figure 1: Generally, the rent-seeking effort e declines as θ ($= \delta g$) or as m goes up. These effects indicate the positive roles of having a more effective monitoring system (a larger m) and a more promising long-term job prospect (a higher salary growth rate g or a higher discount factor δ).

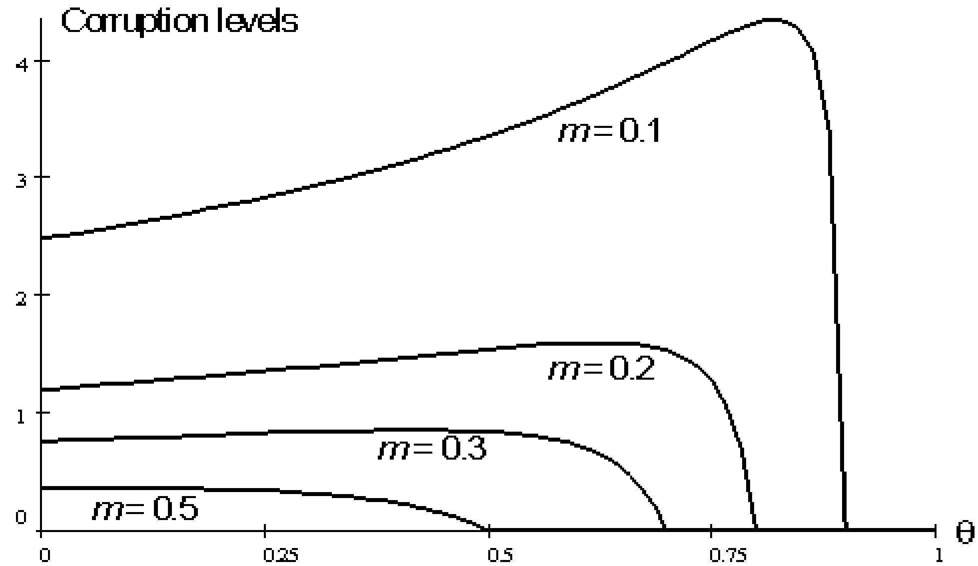

Figure 2: The corruption level first rises with θ and then declines. The peak depends on the monitoring mechanism m. As m goes up, corrption level goes down as well as the peaking point of θ. For $m > 0.5$, the corruption level decreases in θ on $(0, 1)$.

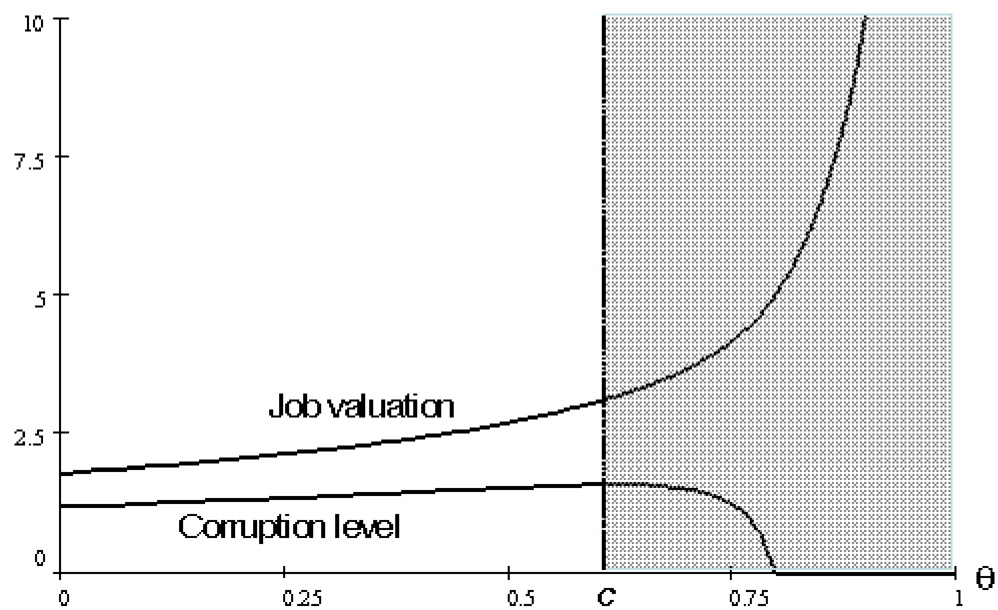

Figure 3: Here, m is fixed at 0.2. There are two distinct intervals of θ. On $[0, c]$, both corruption level and job valuation move higher with θ. On $[c, 1)$, corruption level decreases, whereas job valuation increases, with θ. The quasi-auction selects officials from this interval who are least corruptible and who expect least rents, as indicated by the shaded area.