TRANSFORMATION, INTEGRATION and GLOBALIZATION ECONOMIC RESEARCH
CENTRUM BADAWCZE TRANSFORMACJI, INTEGRACJI I GLOBALIZACJI

TIGER Working Paper Series

No. 90

Corruption and Bureaucratic Structure in a Developing Economy

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Warsaw, May 2006

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Abstract

February 21, 2006

In many transition economies, insiders controlled state-owned firms, *de facto*. For such firms, we model the decision about privatization method, focusing on the choice between free distribution (so called 'mass privatization') and management-employee buyouts. We incorporate a political feasibility constraint that the revenue-maximising government cannot pay insiders to take firms off its hands. Although mass privatization apparently conflicts with revenue maximization, we show that nonetheless it may be the preferred method, and if so it will be complementary with the state continuing to own shares. Mass privatization is more likely to be chosen if the government is politically weak.

Keywords: Corruption, Bureaucratic Structure, Developing Economy

JEL Classification: D73, H11, H77

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[†] We are grateful for helpful comments on earlier versions from John Bonin and Paul Hare and for the advice of two anonymous referees and the editor, Arye Hillman. Any remaining errors are our own.

1 Introduction

Corruption is one of the most serious economic problems in developing countries. It is concentrated in countries that are poorest and have the lowest levels of human capital (Treisman, 2000) and can be substantial.[1] It can be a tax on investment (Mauro, 1995) and bribes may substitute for taxes, thus reducing public service provision or resulting in further taxation, typically with a high excess burden (Goulder *et al.*, 1997). Corruption also provides incentives for bureaucrats and politicians to bias resource allocation decisions to create opportunities for bribery (Shleifer and Vishny, 1998), and it may be associated with expenditure of resources to maintain secrecy (Shleifer and Vishny, 1993). More generally, corruption may undermine respect for the law and may feed on itself (Bardhan, 1997). Econometric evidence suggests corruption is costly for resource allocation (Svensson, 2005).

An extensive theoretical and empirical literature has developed on how the effects of corruption are related to whether the administrative framework is centralized or decentralized (see, e.g., Rose-Ackerman, 1978; Besley and Coate, 1999; Fisman and Gatti, 2002). Theoretical results are found to differ according to what form of decentralization is being examined (a federal system; interjurisdictional competition; or uncoordinated rent-seeking) and which variables are under consideration (revenue and expenditure, or only expenditure). Empirical findings are

[1] For example, according to Reinikka and Svensson (2004), only 18% of funds dispensed by the central government in a public education program in Uganda actually reached schools. The bulk of the remainder was captured by local officials and politicians.

also mixed. For example, Treisman (2000) finds that decentralization is associated with more corruption, while Fisman and Gatti (2002) find the converse, but using a different concept of decentralization (the sub-national share of government spending, rather than federalism).

The conclusions of the literature on the effects of corruption are contradictory in part because the characteristics of corruption and the factors that influence it are context-specific. In this paper we focus on the impact of corruption in a particular situation that has been of considerable significance to developing economies since 1990 - investment in infrastructure and public service provision by a foreign firm.[2] Infrastructure investment typically involves a large sunk element; but it is hard for governments to make credible commitments, and so investors are particularly vulnerable to hold-up, leading to renegotiation (Guasch, Laffont and Straub, 2003; Guasch, 2004).

We analyze the impact of corruption for a centralized and for a decentralized bureaucracy. Our framework has two bureaucrats bargaining sequentially with an investor on behalf of the government.[3] Bureaucrat 1 negotiates a contract provisionally specifying the amount the investor will be paid. Then, after the investment is sunk, bureaucrat 2 can renegotiate terms, using the threat of expropriation. In

[2]The critical importance of the provision of infrastructure services for both growth and the alleviation of poverty is emphasized by the World Bank (2004).

[3]In his study of bribery by firms in Uganda, Svensson (2003) finds that the amounts of bribes paid are consistent with bargaining theory, the payments depending positively on firms' profits and negatively on their alternative earnings.

our benchmark case we assume bureaucrats are 'scrupulous;' that is, they eschew bribery on principle. Their objective is simply to maximize domestic welfare. Corruption is introduced by assuming that bureaucrats are instead willing to take bribes. The investor may offer a bribe to bureaucrat 1 to secure a higher price in the provisional contract, and may offer a bribe to bureaucrat 2 to avert expropriation. However, even if a bureaucrat is corrupt, he or she may have some concern for domestic welfare, perhaps for selfish reasons relating to career prospects (see Becker and Stigler, 1974), but possibly on ethical grounds. Consequently, when offered a bribe, even a corrupt bureaucrat may decline, instead behaving as if he or she were scrupulous. We refer to this behavior as exercising the 'honest option.' We assume that exercise of the honest option is the backstop for any bargaining over a bribe that takes place (this approach is also taken by Dixit, 2004, Ch. 2).

We characterize the willingness of a bureaucrat to take a bribe in terms of a 'corruptibility' parameter, the value of which depends on three factors: concern for domestic welfare; the inefficiency of the domestic tax system; and the institutional structure. (De)centralization plays a critical role in determining outcomes. We define there to be 'centralization' if bureaucrats 1 and 2 collude to maximize their joint payoff. In contrast, in a 'decentralized' bureaucracy each bureaucrat independently maximizes his or her own payoff. Thus, with decentralization, one bureaucrat does not internalize the other's concern for the effect of a higher price

on domestic welfare (the 'price externality'), and this raises corruptibility relative to the centralized case. Whether bribery occurs also depends on the 'private benefit' of a price rise. This is the net benefit, to the investor and the bureaucrat concerned, of agreeing a higher price. The size of the bribe that bureaucrat 2 may be able to negotiate depends on the level of the provisional price agreed by bureaucrat 1 with the investor. With decentralization, bureaucrat 1 does not internalize the effect on the bribe that bureaucrat 2 is able to negotiate (the 'bribe externality'), and this lowers the private benefit of a price rise relative to the centralized case.

In a widely-cited analysis, Shleifer and Vishny (1993) develop a model in which, in social welfare terms, a centralized bureaucracy always dominates a decentralized one.[4] However, consistent with the view that the impact of corruption is highly context-specific, in our model of sunk cost and hold-up, neither centralized nor decentralized bureaucracy dominates unambiguously.[5] The difference between the

[4]In their model, when there are many potential projects and two licences are required for a project to go ahead, the equilibrium supply of licences is greater when a single bureaucrat controls the supply of both licences (centralization) than when a separate bureaucrat is in control of each (decentralization). This is because the single bureaucrat internalizes the effect of granting one licence on the value of the other licence (see also Waller *et al.*, 2002).

[5]In our analysis the investor incurs a sunk cost only once, and the size of the sunk cost is predetermined. See Thomas and Worrall (1994) for an analysis of expropriation in a model where the government explicitly trades off the short-term gain from expropriation against the long-term cost that the country will be less attractive to investors in the future. Also, Choi and Thum (2004) examine how repeated extortion may affect the choice of technology over time. The possibility of extortion causes entrepreneurs to adopt technologies with inefficiently low sunk costs. In their model there is no pure-strategy equilibrium, and they interpret the mixed-strategy equilibrium as representing the reported arbitrary behaviour of corrupt governments.

two institutional arrangements is manifested in two ways.[6] One is that, depending on parameter values, either arrangement may lead to a higher price being paid for the project output. The other is that, for some parameter values, a project that would go ahead under one arrangement would not do so under the other.

Suppose that, under either arrangement, the project goes ahead. Then the failure of bureaucrat 1 to internalize the bribe externality under decentralization, in effect colluding with the investor to hold back price against the interests of bureaucrat 2, is beneficial to the domestic economy. At the same time, the failure of each bureaucrat to internalize the price externality under decentralization has a positive effect on price, and this is damaging to the domestic economy. The net result of these two conflicting effects is that either centralization or decentralization may yield the higher domestic welfare. Yet, although, under our assumptions, the project always goes ahead under centralization, failure to internalize the bribe externality under decentralization can prevent bureaucrat 1 and the investor from finding a mutually acceptable price, thereby preventing the project from starting. Thus, non-internalization of the bribe externality can have a deleterious effect. Moreover, comparisons are complicated by the fact that in some cases price is set so high that the welfare impact of the project is negative.

[6]For an alternative approach that emphasizes other costs and benefits of decentralization, see Bardhan and Mookherjee (2006). In their model, decentralization of decision-making, for example to the local government in the area where a project will operate, may increase accountability and thus reduce corruption; but if vested interests dominate locally, the benefits of the project may be diverted from those with the greatest needs.

In Section 2 we outline the model, and in Section 3 we derive solutions for scrupulousness, and for centralized and decentralized corruption. Section 4 compares the results in these cases, and Section 5 concludes. An appendix contains proofs.

2 The Model

2.1 The Project

In the 1990s there was a shift in developing countries toward the private provision of infrastructure by foreign investors, and by 2001 infrastructure investment totalling £755b had flowed into developing and transition economies in nearly 2500 projects (Harris, 2003; see also Guasch, 2004). In the light of this experience, we model a project that requires a fixed investment to be sunk by a foreign firm (the 'investor') at time $t = 1$ and yields a service at time $t = 2$.[7] Payment of the investor, which is assumed to take place at $t = 2$, is made out of public sector funds.

Let K denote the investor's sunk cost at $t = 1$, and W its running cost at $t = 2$.[8] Let P denote the payment that the public sector actually makes to the investor, and B the total payment of bribes by the investor to bureaucrats. The

[7] This is consistent with the output of the project having a large public good element (e.g., a port or a road) or being a merit good for which a policy decision has been taken that distribution will be free or at a nominal price (e.g., water).

[8] All measures of cost and benefit for each agent are in present-value terms.

investor's net profit Π if it sinks the capital and runs the project is

$$\Pi = P - K - W - B. \tag{1}$$

Payment P has a cost $(1+\theta)P$ to the domestic economy, where $\theta \geq 0$. The parameter θ represents the excess burden of taxation, which can be substantial for developing economies (World Bank, 1997). The funds available for a project will be limited by its anticipated benefits, the competing uses for public funds, and the government's overall financial position. We model this by assuming there to be an upper limit to the budget for any particular project, the maximum feasible expenditure being F. Thus, $P \leq F$. However, we exclude the case of severe underfunding in which F is so small as to prevent the investor from recovering costs; i.e., we assume

$$F \geq K + W. \tag{2}$$

Let U denote the utility of the project output to the domestic population and let N denote the net effect of the project on domestic welfare.[9] Then

$$N = U - (1+\theta)P. \tag{3}$$

[9]To measure domestic welfare, we assign a zero weight to the bribe received by a bureaucrat. There are several ways to motivate this assumption. It may be a value judgement, or reflect the likelihood that the bureaucrat will save and spend the bribe abroad, yielding little domestic benefit. It may also indicate that the bureaucrat has expended resources in rent-seeking, up to the value of the bribe.

Let $U_\theta \equiv U/(1+\theta)$. From (1) and (3), a necessary condition for a project to raise net domestic welfare, as well as being profitable, is that

$$U_\theta \geq K + W. \tag{4}$$

We assume throughout that (4) holds.[10]

The government and the investor sign a contract at the beginning of $t = 1$ specifying that in return for sinking the investment and running the project the investor will be paid amount p at $t = 2$. If the contract is honoured, $P = p$, so that $\Pi = \Pi^c \equiv p - B - K - W$ and $N = N^c \equiv U - (1+\theta)p$. If the project is not undertaken, $N = \Pi = 0$.

At $t = 2$ the investment has been sunk, and the government can renege on the contract, expropriating the asset. Thus, contracts are incomplete, with the government having *de facto* residual control rights over the asset. If expropriation occurs, we assume that it pays partial compensation C, as specified below, and the state sector then operates the asset to produce the service, though inefficiently, with running cost $(1+\gamma)W$, where $\gamma > 0$. The project then still yields utility U, but, because revenue is raised through taxation, the domestic welfare cost of

[10]The surplus S from the project can be defined as net domestic welfare plus the investor's profit, gross of bribes: $S = U - K - W - \theta P$. For all P satisfying (4), the project generates a positive surplus ($S \geq 0$).There is a strictly positive monotonic relationship between domestic welfare, from which we exclude any bribe income, and the total surplus, that is, net domestic welfare plus the investor's profit, gross of the transfers to bureaucrats in the form of bribes. Hence, statements in the text about the relative levels of domestic welfare also apply to the total surplus.

expropriation is $(1+\theta)[C+(1+\gamma)W]$. The upper limit on the project's budget implies that

$$C+(1+\gamma)W \leq F. \tag{5}$$

If, alternatively, the government uses the threat of expropriation to renegotiate terms at $t=2$, the amount actually paid, P, will exceed the contract price p.

If a formula for C were negotiated *ex ante* by the government and the investor it would not be credible, because the government could expropriate but still refuse to pay. However, the government may be concerned to maintain its international reputation as a host for foreign investment, or it may fear that expropriation without compensation would elicit international sanctions. We therefore assume that, up to the point at which the constraint (5) binds, C is a proportion $\delta \in (0,1)$ of the investor's marginal forgone profit $p-W$ (after sinking K).[11] From (5), this implies $\delta(p-W)+(1+\gamma)W \leq F$. Writing $p=p^C$ for the highest value of p satisfying this inequality, we have

$$p^C = \frac{1}{\delta}\left[F-(1-\delta+\gamma)W\right]. \tag{6}$$

For $p<p^C$, $dC/dp>0$; i.e., a higher contract price p is associated with a higher

[11] Since we shall determine p as a function of K, C depends indirectly on K.

cost to the treasury of expropriation. Compensation C is therefore given by

$$\begin{aligned} C &= \delta(p - W) \quad \text{if } p \leq p^C; \\ C &= F - (1+\gamma)W \quad \text{if } p > p^C. \end{aligned} \tag{7}$$

In the event of expropriation, the respective values of Π and N are

$$\begin{aligned} \Pi^e &= C - K; \\ N^e &= U - (1+\theta)[C + (1+\gamma)W]. \end{aligned} \tag{8}$$

Since $\delta < 1$, (7) and (8) imply that the investor prefers the contract to be honoured, rather than the project to be expropriated.

2.2 The Bureaucracy

We assume that government decisions are made by public sector bureaucrats. Bureaucrat 1 deals with the investor at $t = 1$, bargaining over price p, while bureaucrat 2 deals with the investor at $t = 2$, bargaining over price P and potential expropriation. Bureaucrat i may be paid a bribe b_i $(i = 1, 2)$, where $b_1 + b_2 = B$. We regard it as unrealistic to suppose that a bureaucrat in a developing country would be able to use his or her personal wealth to bribe a foreign investor (corruption is often argued to stem from low salaries in the public sector; see Svensson,

2005). Thus, we assume that $b_1, b_2 \geq 0$.

As well as caring about bribe income, a bureaucrat may place a positive weight on net domestic welfare N because of the feedback on career prospects. It is also possible that, when making decisions, a bureaucrat takes into account the effect on N for ethical reasons. To allow for the potential role of these factors, we include a non-negative weight α in the utility function u_i of each bureaucrat i, which is assumed to be

$$u_i = b_i + \alpha N, \quad 0 \leq \alpha \leq 1, \quad i = 1, 2. \tag{9}$$

We consider three cases. In the first, our benchmark case, each bureaucrat i is 'scrupulous;' i.e., on principle, i would never take a bribe ($b_i = 0$; $i = 1, 2$). Thus, $u_i = \alpha N$ in this case, so that i always maximizes N, irrespective of the value of α and of the institutional structure.

In the other two cases each bureaucrat i does not rule out bribe-taking on principle. We label the bureaucrats in these cases as 'corrupt,' though whether i accepts a bribe depends on whether this yields a higher utility. If a corrupt bureaucrat declines a particular bribe offer, we say that he or she has exercised the 'honest' option. We shall see that if bureaucrats are corrupt their behavior will depend on whether the bureaucracy is 'centralized' or 'decentralized.' With a centralized bureaucracy each bureaucrat i maximizes the joint utility function $u(u_1, u_2)$, which is defined below. With a decentralized bureaucracy each bureau-

crat i simply maximizes u_i $(i = 1, 2)$.

We assume that when the investor and a corrupt bureaucrat negotiate over a bribe, the backstop is the solution that would obtain if the bureaucrat exercised the honest option. Bribery takes place if both the investor and bureaucrat i gain, compared to the honest option. Note that if corrupt bureaucrats 1 and 2 both choose to exercise the honest option, the resulting price P will be the same as in the benchmark case of a scrupulous bureaucracy.

We assume that price p is made public knowledge at $t = 1$ and that price P is made public knowledge at $t = 2$. If bureaucrat 2 were to agree with the investor to set P above p, net domestic welfare would be negatively affected, and so bureaucrat 2 could only have agreed to this price rise in return for a (sufficiently large) bribe. In this situation, observers would be able to infer that a bribe was being paid. We assume that sufficiently strong sanctions can be imposed, such as a credible threat of sacking, to deter such behavior.[12] Thus, in the solution, $p \geq P$. Since a necessary condition for an investor to start a project is that, anticipating any renegotiation that will occur, $P \geq K + W$, we therefore have that

$$p \geq P \geq K + W. \tag{10}$$

[12]Thus, we do not assume verifiability of improper behaviour to be a precondition for imposing punishment on a bureaucrat.

3 Bureaucratic Corruption and Welfare

We begin by examining the behavior of a scrupulous bureaucracy, and then consider a corrupt one, first with centralization, and then with decentralization.

3.1 A Scrupulous Bureaucracy

When bureaucrats eschew bribery on principle, each maximizes αN. Consider first $t = 2$. Here, acting on behalf of the government, bureaucrat 2 has control rights, and so may exercise the option to expropriate. With expropriation, bureaucrat 2's utility is αN^e, while (disregarding K, as it is sunk) the investor's payoff is C. Instead, however, bureaucrat 2 may use the threat of expropriation to get price revised to P, below the price p agreed at $t = 1$. For the threat to be credible, N^e must be at least as great as the value of N from honouring the contract, $U - (1 + \theta)p$; i.e., using (8),

$$p \geq \frac{1 - \delta + \gamma}{1 - \delta} W. \tag{11}$$

With (10), (11) implies that

$$(1 - \delta)K \geq \gamma W. \tag{12}$$

(12) indicates that the sunk cost K is relatively large and/or the compensation

parameter δ is relatively small, making the investor particularly vulnerable to hold up. Equivalently, the value of γW, the additional cost of running the project, is relatively low, making expropriation cheap for the bureaucracy. Combined with (2), (12) implies that

$$F \geq \delta K + (1+\gamma)W. \tag{13}$$

The reduction in price emerging from the renegotiation at $t = 2$ can be thought of as a tax T, the investor receiving the (net-of-tax) price P, where $P = p - T$. The respective gains for bureaucrat 1 and the investor are then $\alpha[U - (1+\theta)(p-T)]$ and $p - T - W$. Given (4), these are non-negative.

Lemma 1 *With Nash bargaining over T $(= p - P)$, it is found that the constraint $P \leq F$ does not bind, and that*

$$T = (1-\delta)(p-W) - \frac{\gamma}{2}W. \tag{14}$$

Proof: see appendix

This bargain yields positive gains because expropriation would result in inefficient provision. T is increasing in contract price p, and decreasing in cost parameters, γ and W, and compensation parameter δ. From (11) and (14),

$T \geq (1 - \delta + \gamma/2)W > 0$. Since $P = p - T$,

$$P = \left(1 - \delta + \frac{\gamma}{2}\right) W + \delta p. \tag{15}$$

P depends on p here because, as a constituent of the compensation formula (7), p enters the threat points in the bargain at $t = 2$. We noted above that if an increment were added to p above p^C, compensation C would not change. Such an increment would have no effect on the threat points, and would not affect the price P paid to the investor; i.e., if p exceeded p^C, the excess would be superfluous and could be disregarded. Hence, the role of p^C in (7) effectively imposes an upper bound on the price p agreed at $t = 1$:

$$p \leq p^C. \tag{16}$$

Given (10), we therefore have

$$p^C \geq K + W. \tag{17}$$

Lemma 1 also specifies that the constraint $P \leq F$ does not bind. This, too, is because of the indirect role played by potential compensation. The budgetary limit places an upper bound on any compensation, keeping the threat point in the bargain low for the firm and high for the bureaucracy. This, endogenously,

constrains the Nash bargain solution such that P is strictly less than F. We can therefore disregard the constraint $P \leq F$ in the rest of this section.

Anticipating renegotiation at $t = 2$, the contract at $t = 1$ will be determined by bureaucrat 1 and the investor through Nash bargaining over price p. The payoffs in this bargain are $\alpha[U-(1+\theta)P]$ for bureaucrat 1 and $P-K-W$ for the investor. After substituting from (15), the solution is found to be

$$p = \frac{1}{2\delta}\left[K + U_\theta + (2\delta - \gamma - 1)W\right]. \tag{18}$$

Given (4), (18) is consistent with (11). Substituting (18) into (15), we obtain our first proposition.

Proposition 1 *With a scrupulous bureaucracy, $P = P^*$, where*

$$P^* = (U_\theta + K + W)/2. \tag{19}$$

From (4) and (19), $P^* \leq U_\theta$. Since expropriation does not occur in equilibrium, P^* is independent of compensation parameter δ; but P^* is increasing in utility U and cost parameters K and W, and is decreasing in the excess burden parameter θ. For $P = P^*$, net domestic welfare N and profit Π are each non-negative.

3.2 Bureaucratic Corruption

We now assume that bureaucrats are corrupt: they are willing in principle to take bribes. If the bureaucracy is decentralized, each bureaucrat i maximizes u_i, disregarding any effect on the other bureaucrat's utility. If, however, it is decentralized, we assume that each bureaucrat maximizes the utility function

$$u(u_1, u_2) = b_1 + b_2 + \mu\alpha N = b_1 + b_2 + \mu\alpha[U - (1+\theta)(p-T)], \text{ where } 1 \leq \mu \leq 2. \quad (20)$$

Here, if bureaucrat i exercises the honest option, bribe $b_i = 0$ $(i = 1, 2)$; while if bureaucrat 2 is paid a bribe to prevent expropriation, tax $T = 0$. The coefficient μ is introduced because of the alternative interpretations of parameter α. If α relates to the effect of N on a bureaucrat's career prospects, we can add u_1 and u_2, i.e., $\mu = 2$. However, if α is an ethical concern for doing duty, there is no direct personal payoff, and it would be inappropriate to add u_1 and u_2; rather, we represent this case by assuming that $\mu = 1$.[13] More generally, the combination of these interpretations is captured by the assumption that $1 \leq \mu \leq 2$.

We now define some terms. The first is the 'corruptibility' of a bureaucrat: the value he or she puts on receiving £1 as a bribe, rather than having the £1 to go to the treasury. In a centralized bureaucracy, bureaucrat 2 places a value of unity

[13] It is also possible that the bureaucrat will enjoy a direct personal satisfaction from N. This would be equivalent, in the model, to a career benefit.

on £1 of bribe, and, from (3) and (20), a value of $-\mu\alpha(1+\theta)$ on a £1 cut in P. Thus, with a centralized bureaucracy, the corruptibility of bureaucrat 2 is

$$\kappa_2^c = 1 - \mu\alpha(1+\theta). \tag{21}$$

With decentralization, although bureaucrat 2 puts a value of unity on any £1 of bribe he or she receives - as when the bureaucracy is centralized - he or she puts a value of only $\alpha(1+\theta)$ on the receipt of £1 by the treasury. The corruptibility κ_2^d of bureaucrat 2 is therefore

$$\kappa_2^d = 1 - \alpha(1+\theta). \tag{22}$$

The fact that bureaucrat 2 (or 1) is corrupt does not necessarily mean that he or she would accept a bribe offer. Corruptibility must be positive for a bribe to be taken. Bureaucrat 2's corruptibility depends on welfare weight α, and on the inefficiency θ of the tax system; and, with centralization, it also depends on parameter μ. The difference between (21) and (22) indicates that corruptibility depends on the institutional structure.

We also define the 'private benefit,' to the investor plus bureaucrat 1, from a £1 increment to contract price p. For a centralized bureaucracy this is denoted by β_1^c. Consider, however, a £1 increment that keeps p no greater than p^C. This

has an effect dP/dp on the price P paid at $t = 2$. For every £1 increment to P, the investor gains unity, but the bureaucracy loses $\mu\alpha(1+\theta)$. But any loss to the investor through a resulting increase in b_2 is exactly offset by the corresponding gain to the bureaucracy. Hence,

$$\begin{aligned} \beta_1^c &= [1-\mu\alpha(1+\theta)]\frac{dP}{dp} \text{ for } p \leq p^C; \\ \beta_1^c &= 0 \text{ for } p > p^C. \end{aligned} \tag{23}$$

For a decentralized bureaucracy, we similarly have that, for $p \leq p^C$, if p is set £1 higher at $t = 1$, there is an effect dP/dp on the price P paid at $t = 2$. For every £1 increment to P the investor again gains unity, but now bureaucrat 1 loses $\alpha(1+\theta)$. Also, the bribe the investor pays to bureaucrat 2 will rise by db_2/dp, which is a cost to the investor, but, with decentralization, is disregarded by bureaucrat 1. The private benefit β_1^d from the rise in p is therefore

$$\begin{aligned} \beta_1^d &= [1-\alpha(1+\theta)]\frac{dP}{dp} - \frac{db_2}{dp} \text{ for } p \leq p^C; \\ \beta_1^d &= 0 \text{ for } p > p^C. \end{aligned} \tag{24}$$

There are two significant differences between centralized and decentralized bureaucracy. First, if $\mu > 1$, when, with decentralization, bureaucrat 2 makes decisions in terms of κ_2^d rather than κ_2^c, he or she is putting a smaller weight on

treasury receipts, so that corruptibility is higher. Thus, parallel to the Shleifer-Vishny (1993) analysis, decentralization has a negative effect on domestic welfare, relative to centralization. The second difference, however, relates to the private benefit being β_1^d rather than β_1^c. When bureaucrat 1 bargains with the investor under decentralization, he or she disregards the effect that of a higher price p on any bribe income b_2 of bureaucrat 2. In terms the impact on of domestic welfare, this factor favours decentralization.

At $t = 2$ bureaucrat 2 and the investor negotiate on the basis of price p agreed by bureaucrat 1 and the investor at $t = 1$. Suppose first that corruptibility κ_2^c or κ_2^d, as appropriate, is positive. If bureaucrat 2 were to exercise the honest option, the investor would pay tax T to the treasury, as shown by (14). However, since corruptibility is positive, bureaucrat 2 would not exercise the honest option, preferring instead to pocket this payment, i.e., to take it as a bribe. Given this possibility, bureaucrat 2 would not accept a bribe lower than the right-hand side of (14). Conversely, since expropriation would reduce N and yield no bribe, it would not be credible for bureaucrat 2 to threaten to expropriate if a bribe higher than this were not paid. Hence the bribe in this case equals T in (14), which we have seen is positive:

$$b_2 = (1 - \delta)(p - W) - \frac{\gamma}{2}W. \tag{25}$$

However, if corruptibility (κ_2^c or κ_2^d as appropriate) is non-positive, bureaucrat

2 will accept the payment by the investor as a tax accruing to the treasury, rather than as a bribe.

Lemma 2 *With a corrupt bureaucracy, the investor pays the amount* $(1-\delta)(p-W)-\frac{\gamma}{2}W$ *at* $t=2$. *With a centralized bureaucracy, if* $\kappa_2^c > 0$ *this amount is taken as a bribe, while if* $\kappa_2^c \leq 0$ *it is paid to the treasury as a tax. The same considerations apply with a decentralized bureaucracy, but with* κ_2^d *replacing* κ_2^c.

To examine what happens at $t=1$, we consider centralization and decentralization separately.

3.2.1 Centralized Corruption: $t=1$

Suppose first that $\kappa_2^c > 0$. Then bribery occurs at $t=2$ and price is not renegotiated, i.e., $P=p$. Consider the honest option at $t=1$. This backstop for any negotiation over a bribe b_1 is determined in the knowledge that there will be bribery at $t=2$. Note first that, *if*, exercising this honest option, p were set equal to p^C, then investor would make a positive profit Π, and the bureaucracy would get a positive utility $u(u_1,u_2)$.[14] Thus, for the honest option at $t=1$, p^C is a feasible outcome. Now consider the option of bribery at $t=1$. Since a unit price rise at

[14]In the solution for a scrupulous bureaucracy the investor receives price P^* and makes a positive profit. Holding price at P^*, if we replace the tax T with the bribe b_2, profit is unchanged. But, for any $p < p^C$, from (25), an increment to p would cause an increase in P greater than that in b_2, and so the investor would gain. (This statement is true provided p does not rise to a level at which the bureaucracy would expropriate at $t=2$. But the gain to the bureaucracy from expropriation is $\mu\alpha\{U-(1+\theta)[C+(1+\gamma)W]\}-\mu\alpha[U-(1+\theta)P]-b_2 \equiv \Delta$. Using (25), $P=p$, and the fact that $\kappa_2^c > 0$, it is found that $d\Delta/dp < 0$. Thus, raising p will not make expropriation advantageous to the bureaucracy.) Hence $\Pi(p^C) > 0$ with the bribe give by (25).

$t = 1$ yields private benefit β_1^c, which has the same sign as corruptibility $\kappa_2^c (> 0)$, there is an incentive to raise p by bribery as far as possible. We conclude that p is sure to be raised to p^C. Exercise of the honest option may result in $p = p^C$; but, if it does not, p will be raised to p^C through bribery.

Lemma 3 *If $\kappa_2^c > 0$ a centralized corrupt bureaucracy will set $p = p^C$.*

Proof: see appendix.

When, instead, $\kappa_2^c \leq 0$, bureaucrat 2 will take the honest option, tax T being paid as specified in (14). If bureaucrat 1 were also to take the honest option, the solution would be the same as if the bureaucracy were scrupulous. Consider, however, the possibility of bribery at $t = 1$. From (21) and (23), since $\kappa_2^c \leq 0$, a unit price rise at $t = 1$ would have a negative private benefit β_1^c. Hence, at $t = 1$ a price rise through bribery would not be chosen; and whereas bribery could in principle occur to lower price, b_2 would then have to be negative, which we rule out. Thus, there is no deviation from the honest option.

Lemma 4 *With a centralized corrupt bureaucracy, and $\kappa_2^c \leq 0$, the honest option is taken at $t = 1$.*

Proof: see appendix.

Our second proposition then follows from Lemmas 2-4.

Substituting from (25) into (24), and then setting $p = p^C$, we obtain $\delta u = \delta\{\mu\alpha\{U - (1 + \theta)W] - \gamma W/2\} + [1 - \delta - \mu\alpha(1 + \theta)][F - (1 + \gamma)W]$. Using (4), (12), and (14), it is found that that $u(p^C) > 0$.

Proposition 2 *With a centralized corrupt bureaucracy, if* $\kappa_2^c > 0$ *then* $P = p^C$*, with bribery possibly occurring at* $t = 1$*, and certainly occurring at* $t = 2$*; but if* $\kappa_2^c \leq 0$ *then* $P = P^*$*, and there is no bribery.*

Thus, the price P paid by the investor under a centralized bureaucracy depends on whether the bureaucracy prefers to receive any £1 as a bribe, rather than having the money go to the treasury. If it prefers the bribe, price will reach its maximum feasible level; but if it (weakly) prefers the money to go to the treasury, price will be the same as when the bureaucracy is scrupulous.

Focusing on the case of positive corruptibility κ_2^c, we now consider the sign of N for $P = p^C$. From (3) and (6),

$$N(p^C) = (1+\theta)\{U_\theta - [F - (1-\delta+\gamma)W]/\delta\}, \tag{26}$$

and so we have the following lemma.

Lemma 5 *With a centralized bureaucracy, if* $\kappa_2^c > 0$*,*

$$N \gtreqless 0 \text{ as } F \lesseqgtr \delta U_\theta + (1-\delta+\gamma)W. \tag{27}$$

With positive corruptibility, a centralized bureaucracy drives price P up to the highest feasible level, given F. Price may exceed U_θ, in which case $N < 0$. Thus, unless the available finance F is sufficiently tight, a centralized bureaucracy can

result in a price for which the net impact of the project is detrimental to domestic welfare.

3.2.2 Decentralized Corruption: $t = 1$

Suppose first that $\kappa_2^d > 0$, so that bribery will occur at $t = 2$. Then $P = p$ and, from (25), $db_2/dp = 1 - \delta$. Hence, from (24), the private benefit from the price rise is

$$\beta_1^d = 1 - \alpha(1 + \theta) - (1 - \delta) = \delta - \alpha(1 + \theta) \text{ for } p \leq p^C. \tag{28}$$

Comparison of (28) with (23) (with $dP/dp = 1$) captures the two effects of decentralization, relative to centralization, mentioned above. First, if $\mu > 1$, the term $1 - \alpha(1 + \theta)$ in (28) exceeds the corresponding term $1 - \mu\alpha(1 + \theta)$ in (23): with decentralization, bureaucrat 1 does not internalize bureaucrat 2's dislike of a price rise (the 'price externality'), so the incentive to raise p is greater than under centralization. Second, the investor and bureaucrat 1 do not internalize the effect $1 - \delta$ on bureaucrat 2's bribe income (the 'bribe externality'), and this reduces the incentive to raise p relative to that under centralization. Thus, with decentralization, the incentive to raise p at $t = 1$, compared to that under centralization, depends on the relative sizes of these conflicting effects.

Consider the honest option. This yields the investor profit $\Pi(p) = p - K - W - b_2$, i.e., using (25), $\Pi(p) = \delta p - K - (\delta - \gamma/2)W$; and bureaucrat 1's utility

is $u_1(p) = \alpha N(p)$. A Nash bargain would then yield the price $p = p'$, where

$$p' = \frac{1}{2}\left[U_\theta + \frac{2\delta - \gamma}{2\delta}W + \frac{1}{\delta}K\right]. \tag{29}$$

However, this bargain is not valid for all parameter values (profit or utility may be negative), and we must take into account the constraint $p \leq p^C$.[15] These considerations lead to the next lemma. Here, p_0 denotes the value of p at which, for $\kappa_2^d > 0$ (so that b_2 is given by (25)), $\Pi(p) = 0$, i.e.,

$$p_0 = [K + (\delta - \gamma/2)W]/\delta. \tag{30}$$

Lemma 6 *For a decentralized corrupt bureaucracy with $\kappa_2^d > 0$, the honest option for bureaucrat 1 is the following. (i) If $U_\theta \leq p_0$, the project is not begun. (ii) If $U_\theta > p_0$, then (a) if $N(p^C) < 0$, then $p = p'$; (b) if $N(p^C) \geq 0$ and $p^C > p_0$, then $p = \min(p', p^C)$; (c) if $N(p^C) \geq 0$ and $p^C \leq p_0$, the project is not begun.*

Proof: see appendix.

Part (i) of the lemma describes a situation in which $U_\theta \leq p_0$, i.e., relative to the utility of the project, costs are so great that the investor and bureaucrat 1 do not reach an agreement on price p. Part (ii) relates to when $U_\theta > p_0$, i.e., costs are not prohibitively great. Three cases can then be distinguished, depending on the

[15] As in the corresponding analysis for centralized bureaucracy, for the range of parameter values for which the bargain is valid, bureaucrat 1 will never choose to expropriate.

value of p^C. To relate the results more easily to those for centralization, the lemma is written in terms of the inequality $N(p^C) < (\geq)\ 0$, rather then the equivalent inequality $p^C > (\leq)\ U_\theta$. In case (a), $p^C > U_\theta$ (so that $N(p^C) < 0$), the upper bound on p being too high to have an effect on the bargain between the investor and bureaucrat 1. Hence, $p = p'$. In cases (b) and (c), $p^C \leq U_\theta$ (thus, $N(p^C) \geq 0$), the constraint $p \leq p^C$ potentially playing a role. In case (c) the constraint is so tight that it prevents the investor from making a positive profit, while (b) is an intermediate case, in which the constraint does not preclude an agreement being reached, and so $p = \min(p', p^C)$.

Still assuming that $\kappa_2^d > 0$, we now introduce the possibility that the investor will bribe bureaucrat 1. Suppose first that $\beta_1^d \geq 0$. This implies that, in the absence of a bribe at $t = 1$, $\Pi(p)$ increases more quickly in p than $u_1(p)$ decreases in p. Hence there is a potential for raising p to p^C through bribery. For this case, we must examine the possibility of bribery for each possible outcome of the honest option as described in the various parts of Lemma 6.

In part (i) we have no agreement under the honest option. However, since $\beta_1^d \geq 0$, if $\Pi(p^C) + u_1(p^C) \geq 0$ a bribe will be agreed to start the project with $p = p^C$. But if $\Pi(p^C) + u_1(p^C) < 0$ the project will not start. In part (iia), the honest option results in $p = p'$, at which both players achieve positive payoffs. Since $\beta_1^d \geq 0$, p will be raised to p^C by bribery, with both players thereby raising

their payoffs. In part (iib) the honest option yields $p = \min(p', p^C)$. By the same argument as for part (iia), if $p' < p^C$ will be raised to p^C by bribery, but otherwise it will left unchanged at p^C. In part (iic) the honest option yields no agreement because the constraint $p \leq p^C$ is too tight to allow the investor to gain a positive profit. Since we rule out negative bribes, there is no scope for bribery to change this outcome.

If $\beta_1^d < 0$, there is no scope for bribery to raise p, while a reduction of p through a negative bribe $b_1 < 0$ is ruled out by assumption. The honest option is therefore taken.

We therefore obtain the following lemma.[16]

Lemma 7 *Consider a corrupt decentralized bureaucracy, and suppose corruptibility $\kappa_2^d > 0$. Consider $t = 1$. (i) If private benefit $\beta_1^d \geq 0$, then $p = p^C$ (possibly through bribery) unless either (a) $U_\theta \leq p_0$ and $\Pi(p^C) + u_1(p^C) < 0$, or (b) $U_\theta > p_0 \geq p^C$ and $N(p^C) \geq 0$. In cases (a) and (b) the project is not started. (ii) If private benefit $\beta_1^d < 0$, the honest option obtains as specified in Lemma 6.*

Finally, suppose $\kappa_2^d \leq 0$. Then bureaucrat 2 will exercise the honest option, bargaining to maximize N. Thus, in (24) $db_2/dp = 0$. If bureaucrat 1 takes the honest option, we have the same solution as with a scrupulous bureaucracy; that is, $P = P^*$. But consider the possibility of bribery at $t = 1$. From (15), $dP/dp = \delta$,

[16] Proofs of the existence, or otherwise, of a bribe satisfying both, bureaucrat 1 and the investor are similar to those in Lemmas 3 and 4.

and so, from (24), $sign\beta_1^d = sign[1-\alpha(1+\theta)] = sign\kappa_2^d \leq 0$. Negativity of the private benefit β_1^d rules out the possibility of raising p by a positive bribe b_1. The honest option is therefore exercised at $t=1$. Thus, our last lemma closely parallels Lemma 4.

Lemma 8 *With a decentralized corrupt bureaucracy, if corruptibility $\kappa_2^d \leq 0$, the honest option is taken at $t=1$.*

Taking into account that $\kappa_2^d > \beta_1^d$, these results can be summarized as in our third proposition.

Proposition 3 *Consider a corrupt decentralized bureaucracy. (i) If $\kappa_2^d \leq 0$, there is no bribery, and $P = P^*$. (ii) If $\kappa_2^d > 0 > \beta_1^d$, the honest option is taken at $t=1$, but there is bribery at $t=2$, with results as specified in Lemmas 6 and 7. (iii) If $\kappa_2^d > \beta_1^d \geq 0$, there may be bribery at $t=1$, and there will be bribery at $t=2$; either $P = p^C$ or the project is not started (see Lemma 7).*

4 Types of Bureaucracy and Social Welfare

By examining what happens to the price P, we can rank institutional arrangements with respect to net domestic welfare $N = U - (1+\theta)P$. We begin by comparing centralized corruption with decentralized corruption, and then bring scrupulousness into the comparison.

Suppose first that the bureaucrats' concern for welfare is entirely ethical: $\mu = 1$. Then $\kappa_2^c = \kappa_2^d$, and we denote both of these corruptibility parameters by κ_2. For $\kappa_2 \leq 0$, centralized and decentralized corruption each give the same result as a scrupulous bureaucracy ($P = P^*$), so we focus on what happens when $\kappa_2 > 0$. In this case centralized corruption always results in the project going ahead with $p = p^C$, though $N(p^C)$ may take either sign. With this in mind, we can make the comparison by reference to Table 1, which summarizes the results for decentralization. The final column of the table shows whether centralization, *Cent*, or decentralization, *Dec*, is superior with respect to N. For the case in which decentralization is is weakly superior, the *Dec* is written in parentheses.

[Table 1]

For a non-negative private benefit β_d^1 from a price rise under decentralization there are two rows in the table in which decentralization results in no project. In one of these rows $U_\theta > p_0 \geq p^C$ and $N(p^C) \geq 0$, in which case centralization is superior. In the other, however, it occurs when $U_\theta \leq p_0$ (i.e., when $N(p_0) \leq 0$), and $\alpha\Pi(p^C) + N(p^C) < 0$. Since $\Pi(p^C) \geq 0$, it follows that $N(p^C) < 0$ in this case. Thus, in this second case, centralized corruption results in a negative value of N, while decentralized corruption is preferable because it results in the project not being adopted.

For $\beta_d^1 < 0$, each row of the table yields a different result from $p = p^C$. In the

first of these rows, $U_\theta \leq p_0$, which, with (26), gives

$$N(p^C) \leq \frac{1+\theta}{\delta}\left(K + W - F + \frac{\gamma}{2}W\right). \tag{31}$$

If $K + W - F + \frac{\gamma}{2}W < 0$, $N(p^C) < 0$, in which case, since decentralization results in no project, it is superior. Since $K + W - F \leq 0$, this result is favoured by a large state sector inefficiency parameter γ and by a large excess of finance F over production costs $K + W$.

In the last three rows of the table $\beta_d^1 < 0$ and $U_\theta > p_0$. In the first of these rows, $N(p^C) < 0$, and price is p'. Since this row relates to the case in which $U_\theta < p^C$, we have that $p' < p^C$, and so $N(p') > N(p^C)$. Hence, decentralization is superior to centralization in this case. The following row, with $N(p^C) \geq 0$ and $p_0 < p^C$, gives $P = \min(p^C, p')$, and so decentralization is weakly superior. In the last row, however, with $N(p^C) \geq 0$ and $p_0 \geq p^C$, the project does not start under decentralization and so, since $N(p^C) \geq 0$, centralization is superior.

Combining these conclusions, we obtain the following proposition.

Proposition 4 *Consider a corrupt bureaucracy with $\mu = 1$ and $\kappa_2 > 0$. Centralization is superior to decentralization if and only if $U_\theta > p_0 \geq p^C$ and $N(p^C) \geq 0$. Decentralization is weakly superior to centralization if $N(p^C) < 0$.*

For $\kappa_2 > 0$, centralization always pushes price to the maximum level p^C.

Nonetheless, if centralization yields a non-negative level of welfare $N(p^C)$, whereas under decentralization the investor and bureaucrat 1 do not start the project, centralization is preferable. This can happen because, under decentralization, the investor and bureaucrat do not internalize the bribe externality - the benefit to bureaucrat 2 of the bribe he or she would receive if the project were run. If $N(p^C) < 0$, the project yielding negative net welfare under centralization, decentralization can be superior either because it results in a lower price being paid to the investor, or because it results in the project not being started. The underlying rationale in these cases is again the non-internalization of the bribe externality.

It may be assumed, however, that the bureaucrats' concern for welfare is not entirely ethical ($\mu > 1$), in which case the results above must be amended. Corruptibility κ_2^c under centralization is then less than we have assumed so far in this section, while corruptibility κ_2^d under decentralization is unaffected. Consequently, the range of parameter values for which $P = P^*$ under centralization is extended, whereas the results under decentralization remain the same as in Table 1. Specifically, we obtain the following result.[17]

Proposition 5 *With a corrupt bureaucracy, a sufficient condition for centraliza-*

[17] To obtain this proposition, we suppose that $\kappa_2^d = 1 - \alpha(1+\theta) > 0$, so that decentralization does not result in $P = P^*$, and we raise μ to the level at which $\kappa_2^c = 1 - \mu\alpha(1+\theta) \leq 0$.

tion to be superior to decentralization is that

$$1 > \alpha(1+\theta) \geq 1/\mu. \tag{32}$$

A higher value of μ, ethics being less important, favours centralization because it is associated with a larger range of $\alpha(1+\theta)$-values for which corruptibility is negative under centralization. If $\mu > 1$, higher values of the bureaucrat's care α for domestic welfare and of the inefficiency θ of the tax system tend to favour centralization because they expand further the range of values for which corruptibility is negative under centralization than they do under decentralization. A high compensation parameter δ tends to favour centralization because it is associated, under decentralization, with a relatively high private benefit from raising p.

As a corollary of this analysis, we obtain the ranking of centralized and decentralized corruption relative to scrupulousness.[18]

Corollary 1 *If* $\mu\alpha(1+\theta) > 1$ *centralized corruption yields the same result as scrupulousness; if* $\alpha(1+\theta) > 1$ *decentralized corruption yields the same result as scrupulousness. In all other cases scrupulousness is superior to corruption.*

Proof: see appendix.

[18] If bureaucrats place no weight on net domestic welfare ($\alpha = 0$) then both centralized and decentralized corruption result in price P being set at its maximum feasible level p^C. Hence, scrupulousness is preferable for all parameter values.

For both centralization and decentralization, a range of parameter values exists, as specified in the corollary, in which bureaucrats exercise the honest option, yielding the same result as with scrupulousness. But for all other parameter values corruption either results in a higher price than under scrupulousness, or it results in the project not starting.

5 Conclusions

Literature on the impact of corruption has produced relatively few general propositions or empirical findings. This seems to be because the characteristics of corruption are context specific. In this paper we have addressed the impact of corruption in a particular, empirically relevant, context for many developing economies: the provision, through direct foreign investment, of infrastructure services. We focus on the role of the structure of the economy's bureaucracy, which can be centralized or decentralized.

Our framework applies when foreign firms undertake investments with a significant sunk cost element, therefore being vulnerable to hold-up. Our analysis is formulated our in terms of the 'corruptibility' of bureaucrats under each institutional structure, using as a benchmark the case of a 'scrupulous' bureaucracy. We explain the differences between the results of centralization and decentralization in terms of the non-internalization, in the latter case, of two externalities - the 'bribe

externality' and of the 'price externality.' For Shleifer and Vishny (1993), centralized corruption is always preferable to decentralized corruption. In our framework, however, either a decentralized bureaucracy or a centralized one can be advantageous, depending on parameter values. These two arrangements may differ either in terms of the price that the investor is paid or in terms of whether an agreement is reached to start the project. We find that, in welfare terms, decentralization is favoured, relative to centralization, if, for example, the tax system is less inefficient, bureaucrats are less venal or the compensation for expropriation is relatively ungenerous. Also, if the state is willing to allocate a relatively large amount of funds to the project, this tends to favour decentralization.

Our analysis is not consistent with the 'grease hypothesis,' which postulates that bribery can partially overcome inefficiencies created by government intervention in market processes (Leff, 1964, Lui, 1985). We find that a scrupulous bureaucracy dominates both types of corruption. Since the motivation for a bribe is either to raise the price paid by the public treasury or to divert the proceeds from hold-up away from the public treasury into the pockets of the bureaucracy, bribery is always damaging to domestic welfare.

Appendix: Proofs

Lemma 1 If $P \leq F$ is non-binding, $T = \arg\max_z\{\alpha[U - (1+\theta)(p-z) - N^e]\}(p - z - W - C)$. Using (7) and (8), we obtain (14). Using $P = p - T$, P would exceed F if

$$p > \frac{1}{\delta}\left[F - \left(1 - \delta + \frac{\gamma}{2}\right)W\right] = p^C + \frac{\gamma}{2\delta}W. \tag{a1}$$

However, since $p \leq p^C$, (a1) never holds; i.e., the constraint $P \leq F$ on the Nash bargain at $t = 2$ does not bind.

Lemma 3 The reasoning is outlined in the text; here we confirm that with bribery at $t = 1$, $p = p^C$. Suppose that at $t = 1$ the investor pays a £1 bribe for a positive increment ξ to p. The bureaucracy gains 1 directly, but the increment to p cuts $u(u_1, u_2)$ by $\mu\alpha(1+\theta)\xi$; and, from (25), b_2 rises by $(1-\delta)\xi$. The investor pays the £1 bribe, but gains the price rise ξ, while its payment b_2 rises by $(1-\delta)\xi$. Net benefits are $\Delta_B = 1 - \mu\alpha(1+\theta)\xi + (1-\delta)\xi$ for the bureaucracy and $\Delta_I = -1 + \xi - (1-\delta)\xi = \delta\xi - 1$ for the investor. Both $\Delta_B > 0$ and $\Delta_I > 0$ if

$$\delta > 1/\xi > \mu\alpha(1+\theta) - 1 + \delta. \tag{a2}$$

In the lemma, $\kappa_2^c = 1 - \mu\alpha(1+\theta) > 0$. Hence, a positive ξ can satisfy (a2), each player's gain being greater the more p is raised: $p(= P)$ will be raised to p^C.

Lemma 4 Given that the honest option will be taken at $t = 2$, consider $t = 1$ Suppose the investor pays a £1 bribe for a positive increment ξ to p. The bureaucracy gains 1 directly, but the increment to p reduces $u(u_1, u_2)$ by $\mu\alpha(1+\theta)\xi$. From (14), T rises by $(1-\delta)\xi$, adding $\mu\alpha(1+\theta)(1-\delta)\xi$ to $u(u_1, u_2)$. The net benefit

to the bureaucracy of the £1 of bribe is $\Delta_B = 1 - \mu\alpha(1+\theta)\delta\xi$. The investor loses £1 of bribe, but gains the increment ξ to P. It also loses the increment $(1-\delta)\xi$ to tax T. Its net benefit per £1 of bribe is therefore $\Delta_I = \delta\xi - 1$. Both $\Delta_B > 0$ and $\Delta_I > 0$ if

$$\delta > 1/\xi > \mu\alpha(1+\theta)\delta. \tag{a3}$$

With $\kappa_2^c \leq 0$, (a3) cannot be satisfied by $b_2 \geq 0$; and $b_2 < 0$ is excluded by assumption. Following similar reasoning for a bribe to cut price, this too would only work if $b_2 < 0$.

Lemma 6 From the text, $\Pi(p) = \delta p - K - (\delta - \gamma/2)W$ and $u_1(p) = \alpha N(p)$. Hence, $d\Pi(p)/dp > 0$; $du_1(p)/dp < 0$; $\Pi(0) = -K - W - b_2 < 0$, and $u_1(0) > 0$. Also, $\Pi(p) = 0$ at $p = [K + (\delta - \gamma/2)W]/\delta \equiv p_0$, and $u_1(p) = 0$ at $p = U_\theta$. Hence, if constraint $p \leq p^C$ is ignored, the Nash bargain is valid ($p = p'$) for $U_\theta > p_0$. Now impose $p \leq p^C$. If $p^C > U_\theta$, i.e., if $N(p^C) < 0$, the constraint does not bind. If $p^C \leq U_\theta$, i.e., if $N(p^C) \geq 0$, there are two cases. If $p^C > p_0$, then $p \leq p^C$ may bind, so that $p = \min(p', p^C)$; but if $p^C \leq p_0$, the price constraint prevents agreement.

Corollary 1 Since $p \leq p^C$, and $P^* = p - T$, where $T > 0$, it follows that $P^* < p^C$. The corollary is therefore follows from our propositions, except in one case - when decentralized bureaucracy leads to $P = p'$. But, using (19), (29), and (12), it is found that $p' > P^*$, and so N is higher under scrupulousness.

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Table 1. Decentralized Corruption for $\kappa_2^d > 0$

		P	$signN(P)$	*Dec v Cent*
$\beta_1^d \geq 0$				
$U_\theta \leq p_0$				
	$\alpha\Pi(p^C) + N(p^C) \geq 0$	p^C	?	$=$
	$\alpha\Pi(p^C) + N(p^C) < 0$	no project	..	*Dec*
$U_\theta > p_0$				
	$N(p^C) < 0$	p^C	$-$	$=$
	$N(p^C) \geq 0$ and $p_0 < p^C$	p^C	$+$	$=$
	$N(p^C) \geq 0$ and $p_0 \geq p^C$	no project	..	*Cent*
$\beta_1^d < 0$				
$U_\theta \leq p_0$		no project	..	?
$U_\theta > p_0$				
	$N(p^C) < 0$	p'	?	*Dec*
	$N(p^C) \geq 0$ and $p_0 < p^C$	$\min(p^C, p')$	$+$	*(Dec)*
	$N(p^C) \geq 0$ and $p_0 \geq p^C$	no project	..	*Cent*