Corruptibility, Transparency, and Bureaucratic Institutional Structure*

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31 May, 2005

Abstract

We analyze the role of bureaucratic corruption in the context of infrastructure investment and public service provision by a foreign firm in a developing economy. This type of investment involves a relatively large sunk element, and so the investor may offer a bribe to avoid expropriation, as well as to obtain more favourable terms in the initial contract. We examine these issues for both a centralized and a decentralized bureaucracy, and we consider the role of transparency in each case. Among our results is that, provided there is transparency, domestic welfare and social efficiency may be enhanced by decentralization. The key factor underlying this result is that one bureaucrat in effect may collude with the investor to reduce the payoff of another bureaucrat.

J.E.L. Classification: D73, H54, O12

Keywords: Corruption, Private Provision of Infrastructure, Developing Economy

*Earlier versions of this paper were presented at the ASSA meeting, San Diego, January, 2004; the Centre for the Study of African Economies Conference, Oxford, March, 2004; and the European Economic Association Congress, Madrid, August 2004. Seminar presentations were also made at Brunel and Keele Universities. We are grateful to the participants for their comments. We would especially like to thank the discussant at the ASSA meeting, Sergei Guriev, for his excellent contribution. The paper grew from discussions with Yasmeen Khwaja, to whom we are grateful. We also thank David de Meza, Elisabetta Iossa, Charles Lutyens, James Maw, and Enrico Perotti for helpful advice. The usual disclaimer applies.

1 Introduction

Corruption is one of the most serious economic and political problems in developing countries (see Bardhan, 1997, and Rose-Ackerman, 1999). It gives incentives for bureaucrats and politicians to bias resource allocation decisions to create opportunities for bribery (Shleifer and Vishny, 1998), and agents involved in corruption will tend to expend resources in maintaining secrecy (Shleifer and Vishny, 1993; Nitzan, 1994). Bribery may also be a tax on investment, or the payment of bribes may substitute for the payment of taxes, reducing public service provision, or resulting in further taxation, perhaps with a high excess burden (Goulder *et al*., 1997). More generally, corruption may undermine respect for the law and may feed on itself (Kaufmann *et al.*, 2003). For these reasons, economic growth is generally lower in countries where corruption is greater (Mauro, 1995).

Our aim in this paper is to analyse the impact of corruption on social welfare under different institutional arrangements and different political systems. Our comparison of institutional arrangements relates to whether the government bureaucracy is centralized or decentralized. In the former case, two bureaucrats act as a coalition to maximize their joint payoff, while in the latter, they are independent of one another, with each taking decisions to maximize his or her own payoff. The variation in political system in our model hinges on whether there is 'transparency.' For most of our analysis we assume that the details of the initial deal struck between the investor and the government are public knowledge (we refer to this as transparency), as might be associated with a more democratic tradition. We then amend our results to cover the case in which there is no transparency, as might pertain in more dictatorial structures. The paper analyzes the impact of corruption in a scenario that has been a common feature of developing economies since 1990 – that

of infrastructure investment and public service provision by a foreign firm.[1] This type of investment usually involves a large sunk element, but it is hard for governments to make credible commitments (see Guasch, Laffont and Straub, 2003). Investors are therefore particularly vulnerable to hold-up.

We begin with the benchmark case in which the bureaucrats are 'scrupulous' – refusing to accept any bribes – and go on to consider the case in which they are 'corrupt,' that is, willing to take bribes, the levels of which are determined by bargaining with the investor.[2] Nonetheless, any bureaucrat is free to exercise the 'honest' option, bargaining with the investor in order for any further payments to accrue to the public treasury, rather than the bureaucrat's pocket. The willingness of a bureaucrat to take a bribe depends on whether there is transparency, and also on a parameter representing 'corruptibility', the value of which depends on three factors. The first is how much concern the bureaucrat has for domestic social welfare. Secondly, corruptibility depends on the inefficiency of the domestic tax system – diversion of $1 into the bureaucrat's pocket, rather than the public treasury, will have a greater welfare cost if raising taxes has a larger excess burden. Finally, corruptibility depends on the bureaucratic institutional structure. With decentralization, one bureaucrat does not internalize the concern that the other bureaucrat has for social welfare, and this raises corruptibility relative to the centralized case. However, with decentralization, a bureaucrat does not internalize the effect on the bribe that the other

[1] The critical importance of the provision of infrastructure services for both growth and the alleviation of poverty is emphasized by the World Bank (2004). In the 1990s a shift occurred toward private provision by foreign investors because of the inefficiencies of state provision. Harris (2003) reports that by 2001 infrastructure investment amounting to $755b had flowed into developing and transition countries in nearly 2500 projects.

[2] 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.

bureaucrat is able to negotiate, and this lowers corruptibility relative to the centralized case.

We find, in contrast to Shleifer and Vishny (1993), that neither centralized nor decentralized bureaucracy dominates unambiguously in terms of social welfare. For example, with transparency, the obligation for the government to compensate the investor relatively well, should expropriation occur, tends to favor decentralization; but, if a bureaucrat's (partial) concern for social welfare is primarily for ethical reasons, rather than career concerns, centralization is favored. The relative advantage of these two institutional forms is also shown to depend on the extent of the inefficiency of the tax system.

Moreover, we show that, although corruption is in most circumstances harmful, if there is transparency, and if the bureaucracy is decentralized, there exists a range of parameter values under which both domestic welfare and social efficiency are greater if the bureaucracy is corrupt than if it is scrupulous. This result bears some similarity to the 'grease' hypothesis that, in some situations, bribery can correct for a distortion such as an inefficient regulation, and thus raise social welfare (Leff, 1964; Lui, 1985). However, in our analysis the inefficiency stems not from interference with market mechanisms, but from the market failure associated with the hold-up problem. Nonetheless, we find that, without transparency, decentralized corruption is never better than, and may be worse than, centralized corruption in terms of domestic welfare, and a scrupulous bureaucracy is weakly superior to a centralized bureaucracy. Thus, the potential advantage of decentralized corruption depends on the limits on bureaucratic behavior that derive from transparency.

In Section 2 we set up the model, and in Section 3 we examine the effects of corruption on social welfare for centralized and decentralized corruption, on the

assumption of transparency. In Section 4 we compare these cases, and in Section 5 we consider how our results are affected by an absence of transparency. Section 6 concludes. Proofs are given in an appendix.

2 The Model

2.1 The Project

We consider a project that requires the sinking of a fixed investment at time $t=1$ and yields the provision of a service at time $t=2$. Because of know-how advantages, the investment can only be undertaken by a foreign firm (the 'MNC'). The output of the project either has a large public good element (for example, a port or a road) or is a merit good for which a policy decision has been taken that distribution will be free or at a nominal price (for example, water). Thus, payment of the MNC is made out of public sector funds; this payment is assumed to occur only at $t=2$.

Let K denote the MNC's sunk cost at $t=1$ and let W denote its running cost at $t=2$.[3] Let P denote the payment that the public sector makes to the MNC, and B the total amount that the MNC pays in bribes to bureaucrats. We assume throughout that the MNC is indifferent as to whether any \$1 it pays goes to the public treasury or into a bureaucrat's pocket. Its net profit Π if it sinks the capital and runs the project is therefore

(1) $\Pi = P - K - W - B.$

[3] Throughout, all measures of cost and benefit for each agent are expressed in present value terms. If the period of service provision is split into many sub-periods – so that there are multiple opportunities to expropriate – a sufficient condition for the results of the present paper still to apply is that the initial contract specifies the same price in each sub-period and that all agents apply the same discount rate.

The payment P has a cost of $(1+\theta)P$ to the domestic economy, where $\theta \geq 0$ is an excess burden parameter reflecting the allocative inefficiency of the tax system. We assume that a finance constraint operates on the use of public funds, the maximum feasible expenditure being F. Thus, $P \leq F$. However, we exclude the theoretically trivial case in which the constraint is so tight that it would not allow the MNC to recover costs; that is, we assume that

(2) $F \geq K + W$.

We assume that, to measure domestic welfare, a zero weight is ascribed to the bribe received by a bureaucrat. This may be rationalized in several ways. It may simply be a value judgement, or it may reflect the likelihood that the bureaucrat will save and spend the bribe abroad, yielding little domestic benefit. It may also be a reflection that the bureaucrat has expended resources in rent-seeking, up to the value of the bribe. However, to measure the social surplus of the project, we include the payoffs for all players, including the bureaucrats.

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. Then

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

From (1) and (3), a necessary condition for a project to raise net domestic welfare at the same time as being profitable is that

(4) $U^* \geq P \geq K + W$,

where $U^* \equiv U/(1+\theta)$. To ensure that price P can be set in this range, we assume that $U^* \geq K + W$. The social surplus S from the project is defined to be net domestic welfare plus the MNC's profit, gross of the transfers to bureaucrats in the form of bribes:

(5) $S = U - K - W - \theta P$.

For all P satisfying (4), the project is socially efficient $(S \geq 0)$.

The government and the MNC sign a contract at the beginning of time $t = 1,$ specifying that in return for sinking the investment and running the project the MNC will be paid the amount P^c at $t = 2.$ However, $P,$ the payment actually made, will only equal P^c if the contract is honored, in which case $\Pi = \Pi^c \equiv P^c - B - K - W$ and $N = N^c \equiv U - (1+\theta)P^c.$ If the project is not undertaken $N = \Pi = 0.$

Once the investment has been sunk, the government may renege on the contract, expropriating the asset at $t = 2$ and producing the service itself, or it may renegotiate terms using the threat of expropriation.[4] Thus, contracts are incomplete and the government has residual rights of control over the asset. In the event of expropriation the MNC will not be paid $P^c,$ but we assume that it will be given some compensation C (as specified below). Service provision using the MNC's physical investment is then undertaken by the public sector, but relatively inefficiently, the running costs being $(1+\gamma)W,$ where $\gamma > 0$. The finance constraint implies that

(6) $\quad C + (1+\gamma)W \leq F.$

With expropriation, the project still yields utility $U,$ but, because all revenue is raised through the tax system, the social cost of expropriation is $(1+\theta)[(1+\gamma)W + C].$[5]

If a formula for C were negotiated *ex ante* by the government and the MNC it would not be credible, for the government could expropriate but refuse to pay. However, the project can be understood as fitting into a wider scenario, where the government may want to maintain some international reputation so that other

[4] The 'government' here may be central, regional, or local or it may represent a mayor (see Guasch *et al*., 2003).

[5] We might also have assumed that if the MNC runs the project the quality of provision is lower than U. This would not affect our results significantly.

investors are attracted, and there may be international sanctions if it confiscates with no compensation. We therefore assume that, up to the point at which the finance constraint binds, C is a proportion $\delta \in (0,1)$ of the marginal profit $P^c - W$ that would have been earned by the MNC from running the project (after its investment has been sunk) if the contract had been honored.[6] Thus, using (6), the finance constraint implies the restriction $\delta(P^c - W) + (1+\gamma)W \leq F$. We write $P^c = \overline{P}^c$ for the highest value of P^c satisfying this restriction; that is,

$$\overline{P}^c = \frac{1}{\delta}\left[F - (1 - \delta + \gamma)W\right]. \tag{7}$$

Compensation C is therefore given by

$$\begin{aligned} &C = \delta(P^c - W), \text{ where } 0 < \delta < 1, \text{ for } P^c \leq \overline{P}^c; \\ &C = F \text{ otherwise.} \end{aligned} \tag{8}$$

If the project is expropriated, the respective values of Π and N are

$$\begin{aligned} &\Pi^e = C - K; \\ &N^e = U - (1+\theta)[C + (1+\gamma)W]. \end{aligned} \tag{9}$$

Using (8) and (9), since $\delta < 1$, the MNC would never prefer to have the project expropriated, rather than the contract honored.

2.2 The Bureaucracy

We assume that government decisions are made by public sector 'bureaucrats' who maximize their own payoffs.[7] Bureaucrat 1 deals with the MNC at $t = 1$, bargaining over price P^c, while bureaucrat 2 deals with the MNC at $t = 2$, and so can

[6] Since we shall determine P^c as a function of K, compensation C depends indirectly on K.

[7] We use the term 'bureaucrat' to cover any public sector employee or politician making the relevant decision. Particularly in developing countries with deep social divisions (ethnic-linguistic, religious or rural-urban) bureaucrats tend to have significant discretionary power (De Dios and Ferrer, 2001).

bargain over P and potential expropriation. (We also allow, however, for the possibility that bureaucrats 1 and 2 are the same person.) Bureaucrat 1 may be paid a bribe b_1, while bureaucrat 2 may be paid a bribe b_2, where $b_1 + b_2 = B$. We regard the payment of a bribe by a bureaucrat to the MNC infeasible, so we assume that $b_1, b_2 \geq 0$.

We write the payoff u_i of bureaucrat *i* as

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

Here, α, the weight i places on net domestic welfare, can be given various interpretations. It might reflect an externality resulting from the personal satisfaction felt when contributing to domestic welfare or from the expected feedback on career prospects; or it might represent the extent of an ethical concern by a bureaucrat for doing his or her duty.

We consider three cases. In the first, each bureaucrat i is 'scrupulous;' that is, i would not countenance accepting a bribe $(b_i = 0;\ i = 1,2)$. Thus $u_i = \alpha N$, so that *i* always maximizes N, irrespective of the value of α and of the bureaucratic institutional structure. In the other two cases $0 \leq \alpha < 1$ and each bureaucrat i is 'corrupt,' that is, willing to take a bribe. In these cases the bureaucrats' behavior depends on whether the bureaucracy is 'centralized' or 'decentralized.' With a centralized bureaucracy their behavior is co-ordinated to maximize the joint payoff $u(u_1, u_2)$, which we define below; but with a decentralized bureaucracy the two bureaucrats behave independently, with bureaucrat i maximizing u_i $(i = 1,2)$.

Our rationale for covering the case of a scrupulous bureaucracy is two-fold. First, it is a useful benchmark. Second, we assume that when corrupt bureaucrat *i* negotiates with the MNC, *i* always has the option of behaving honestly, rather than

taking a bribe. Bureaucrat *i* would take up this option if it led to a higher payoff than he or she would obtain with bribery. When the honest option is exercised, u_i reduces to αN, and so i behaves as if he or she were scrupulous. We assume that for each of the players the payoff that would obtain under the honest option is the backstop for any negotiation over bribes that take place. The benchmark case obtains if both bureaucrats choose the honest option.[8]

At $t=1$ the price P^c agreed by bureaucrat 1 and the MNC may or may not become public knowledge. This distinction plays an important role in our analysis. We deal primarily with the case of 'transparency,' that is, where P^c is public knowledge. In this case, bureaucrats are deterred from behaving in a way that can be observed or inferred by outsiders to have an adverse effect on net domestic welfare.[9] In Section 5 we also consider briefly the 'no transparency' case, where P^c does not become public knowledge at $t=1$. This may also be interpreted as a situation in which P^c is public knowledge, but there is no means available of deterring openly undesirable bureaucratic behavior.

Transparency has implications for the decision making of each bureaucrat. We assume that it prevents bureaucrat 1 from agreeing a level of price P^c which, if honored, would yield negative net domestic welfare; i.e., using (3), we assume that $P^c \leq U^*$. Also, when there is transparency, if bureaucrat 2 were to negotiate a bribe with the MNC to raise price above P^c, the nature of this transaction could be inferred

[8] Bribery takes place if, for each participant in a potential bribe transaction, the net payoff is weakly greater than obtains under the honest option. This approach is also taken by Dixit (2004, Ch. 2).

[9] Such behavior may, for example, result in the sacking of bureaucrats, perhaps as a result of domestic protests or through the fear of sanctions by international agencies.

by outsiders, to whom it would be unacceptable.[10] Given transparency, we therefore rule out this form of bribe. Together, these implications imply that $P \leq U^*$: the price *P* actually paid to the MNC cannot exceed the excess-burden adjusted utility of the service provided. Hence, given the upper bound *F* on the finance available for the project, we can define the maximum feasible level of price *P*, with transparency, as $\overline{P}$, where

$$\overline{P} = \min(F, U^*).$$

3 Bureaucratic Corruption and Welfare

3.1 A Scrupulous Bureaucracy

When the bureaucracy is scrupulous, eschewing any potential bribes, each bureaucrat maximizes αN. Consider first what happens at $t = 2$. Here, bureaucrat 2 has control rights, and so may simply exercise the option to expropriate. With expropriation, bureaucrat 2's payoff is αN^e, while (disregarding *K*, as it is already sunk) the MNC's payoff is *C*. Instead, however, because of the inefficiency of public sector provision, there is scope for bureaucrat 2 to negotiate for the service to be run by the MNC, as specified in the initial contract, but in return for an appropriate side-payment to the public treasury. The side-payment emerging from this renegotiation can be thought of as a tax *T*, where the MNC receives the (net-of-tax) price

$$P = P^c - T.$$

Payoffs for bureaucrat 1 and the MNC are then $\alpha[U - (1+\theta)(P^c - T)]$ and $P^c - T - W$, respectively. Given (4), these payoffs are non-negative.

[10] This argument rests on the assumption that the contract at $t = 1$ is price-based. If instead it were cost-based, bureaucrat 2 and the MNC could claim that price was raised at $t = 2$ because costs had risen unexpectedly.

We disregard for now the upper bound $P \le \overline{P}$. With Nash bargaining over T (given P^c), then, using (8) and (9), we obtain[11]

$$(10) \qquad T = (1-\delta)(P^c - W) - \frac{\gamma}{2}W,$$

that is,

$$(10') \quad P = (1-\delta+\frac{\gamma}{2})W + \delta P^c.$$

From (10), the higher is the contract price P^c, the greater will be the tax T; and T is decreasing in running-cost parameters γ and W, and the compensation parameter δ. It is because C depends on P^c that there is a role in the model for P^c, affecting the price P. If an increment were added to P^c above $\overline{P}^c$, compensation would not be affected, so the increment would be superfluous. In the event of expropriation it would add nothing to compensation, so that it would have no effect on the threat points in the bargain at $t = 2$, price P being unaffected. Thus, although P^c is not actually paid, we treat $P^c \le \overline{P}^c$ as a binding constraint.

Consider now the role of the constraint $P \le \overline{P} = \min(F, U^*)$. Using (10'), the price P that emerges from the Nash bargain at $t = 2$ would violate the constraint $P \le F$ if

$$(11) \qquad P^c > \frac{1}{\delta}\left[F - \left(1-\delta+\frac{\gamma}{2}\right)W \right] = \overline{P}^c + \frac{\gamma}{2\delta}W.$$

However, since $P^c \le \overline{P}^c$, (11) never holds. We now assume, temporarily that $P \le U^*$. We shall see below that, for a scrupulous bureaucracy, this assumption is correct, and so the constraint $P \le \overline{P}$ never binds.

[11] Given (4), the payoffs to bureaucrat 2 and the MNC are each $\gamma/2$.

Anticipating the renegotiation that will take place at $t = 2$, with the tax as specified in (10), the initial contract will be determined by bureaucrat 1 and the MNC through Nash bargaining over price P^c. The payoffs in this bargain are $\alpha[U - (1+\theta)P]$ for bureaucrat 1 and $P - K - W$ for the MNC. Using (10'), the solution is found to be[12]

$$(12) \qquad P^c = \frac{1}{2\delta}\left[K + U^* + (2\delta - \gamma - 1)W\right].$$

Substituting (12) into (10'), we obtain our first lemma.

LEMMA 1 *With transparency and a scrupulous bureaucracy,* $P = \tilde{P}$, *where*

$$(13) \qquad P = \left(U^* + K + W\right)/2 \equiv \tilde{P}.$$

Since expropriation does not occur in equilibrium, the size of the compensation parameter δ does not affect $\tilde{P}$; but $\tilde{P}$ is increasing in utility U and decreasing in the cost parameters K, W, and θ. Given that $U^* \geq K + W$, (13) implies that $P \leq U^*$, as we assumed. Finally, note that, when $\tilde{P} = P$, both net domestic welfare N and the social surplus S are non-negative.

3.2 Centralized Bureaucratic Corruption

We now assume that bureaucrats are willing to take bribes. First we consider a bureaucracy that is centralized, its objective function being

$$(14) \qquad u(u_1, u_2) = b_1 + b_2 + \mu\alpha N = b_1 + b_2 + \mu\alpha[U - (1+\theta)(P^c - T)], \text{ where } 1 \leq \mu \leq 2.$$

[12] Using (12), it can be checked that the constraint $P^c \leq \bar{P}^c$ does not bind. For it to bind, the right-hand side of (12) would have to exceed $\bar{P}^c$; that is, using (7), it would be necessary that

Here, if bureaucrat i exercises the honest option $(i=1,2)$, then $b_i=0$; but if bureaucrat 2 negotiates a bribe, then tax $T=0$. The coefficient μ is introduced because of the different interpretations that may be made of the parameter α. If α represents an externality or career benefit to a bureaucrat, then we simply add these benefits, that is, we add u_1 and u_2, so that in (14) $\mu=2$. However, if α represents an ethical concern for doing one's duty, it does not yield a direct personal payoff. To represent this case it would be inappropriate to add u_1 and u_2; rather, we represent it by assuming that $\mu=1$.[13] More generally, the combination of these interpretations is captured by the assumption that $1\le\mu\le 2$.

Before deriving solutions, we define some terms that will play important roles in the analysis. The first is the 'corruptibility' of a bureaucrat, which is the value that he or she puts on receiving \$1 as a bribe, rather than arranging for the \$1 to go into the public treasury as part of the price paid for the service.[14] In the case of bureaucrat 2, he or she places a value of unity on \$1 of bribe, and, from (3) and (14), a value of $-\mu\alpha(1+\theta)$ on a \$1 cut in P. Thus, the corruptibility of bureaucrat 2 when the bureaucracy is centralized is

(15) $\kappa_2^c=1-\mu\alpha(1+\theta).$

The fact that bureaucrat 2 will countenance taking a bribe does not necessarily mean that he or she would accept a bribe (a similar argument applies for bureaucrat 1). Corruptibility must be positive for a bribe to be taken. Bureaucrat 2's corruptibility depends on the weight α that he or she places on domestic welfare, and on the

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$K+U^*+(1+\gamma)W>2F$. From (2) and (6), this condition can never hold.

[13] The case of $\mu=1$ can also be interpreted as bureaucrats 1 and 2 being the same person. See François (2000) for further discussion of the public service ethic.

[14] Note that this relates to the price arranged by the relevant bureaucrat, not to the price that is actually paid.

inefficiency θ of the tax system. We shall see that when the bureaucracy is decentralized the measure of corruptibility changes. Hence, corruptibility also depends on bureaucratic institutional structure.

We also define the 'private benefit' - to the MNC plus the bureaucrat 1 - from a \$1 increment to the initial contract price P^c. When P^c is set \$1 higher at $t=1,$ this has an effect dP/dP^c on the price P paid at $t=2.$ For every \$1 increment to $P,$ the MNC gains unity, but the bureaucracy loses $\mu\alpha(1+\theta).$ Any loss (or gain) to the MNC through a resulting increase in b_2 is offset by the corresponding gain (or loss) to the bureaucracy. The private benefit β_1^c of a \$1 increase in P^c when the bureaucracy is centralized is therefore

$$(16) \qquad \beta_1^c = [1-\mu\alpha(1+\theta)]\frac{dP}{dP^c}.$$

Consider the renegotiation that occurs at $t=2.$ Here, bureaucrat 2 and the MNC negotiate on the basis of the price P^c agreed by bureaucrat 1 and the MNC at $t=1$ - irrespective of whether P^c was determined honestly or through bribery. Suppose first that corruptibility $\kappa_2^c > 0.$ If bureaucrat 2 takes the honest option at $t=2,$ the MNC pays tax $T,$ as given by (10). But since $\kappa_2^c > 0,$ bureaucrat 2 would prefer simply to take this payment as a bribe, rather than allocating it to the treasury. Given this possibility, bureaucrat 2 would never accept a bribe lower than this amount. Conversely, since expropriation would result in no bribe, and domestic welfare *N* would be reduced by expropriation, it would not be credible for bureaucrat 2 to threaten to expropriate if a bribe higher than the right-hand side of (10) were not paid. Thus, for $\kappa_2^c > 0$ the bribe will be equal to the right-hand side of (10):

$$(17) \qquad b_2 = (1-\delta)(P^c - W) - \frac{\gamma}{2}W.$$

However, if corruptibility $\kappa_2^c \leq 0$, bureaucrat 2 will accept the payment by the MNC in the form of a tax, rather than taking it as a bribe.

LEMMA 2 *Assume transparency and consider* $t = 2$ *with a centralized corrupt bureaucracy. The MNC pays the amount* $(1-\delta)(P^c - W) - \gamma W/2$; *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.*

We now examine what happens at $t = 1$. Assume first that $\kappa_2^c > 0$, so that the negotiation that takes place at $t = 2$ results in a bribe, not a tax. Thus $P = P^c$, that is, the price negotiated at $t = 1$ will be the one paid by the MNC to the treasury at $t = 2$.[15] (The relationship between P and P^c specified in equation (10') no longer applies.) 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 $t = 2$. For any $P^c < \overline{P}$, the MNC will gain from an increment to P^c.[16] Although this increment will cause a rise in b_2, from (17), the increase in P will exceed that in b_2. If the bureaucracy also gains, P^c will be raised to $\overline{P}$; but if the bureaucracy loses there will be Nash bargaining over P^c. The payoff to the bureaucracy from this bargain would be $u = \mu\alpha[U - (1+\theta)P^c] + b_2$, and so, using (17), $sign(\partial u / \partial P^c) = sign(\lambda_2 - \delta)$. Hence, if $\kappa_2^c \geq \delta$ then P^c is raised to $\overline{P}$, while if $\kappa_2^c < \delta$ there is Nash bargaining, so that

[15] In addition to the reasons already cited for the bound on *P*, the extent of corruption may be bounded by 'decency constraints' (see Shleifer and Vishny, 1994).

[16] This statement is true provided P^c 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 (17), $P = P^c$, and the fact that $\kappa_2^c > 0$, it is found that $d\Delta / dP^c < 0$. Thus, raising P^c will not make expropriation advantageous to the bureaucracy.

$P^c = \min(\hat{P}, \overline{P})$, where $\hat{P}$ is the interior solution to the bargain (see eq. (A1) in the appendix).

However, bribery at $t = 1$ is also an option. Since a unit price rise at $t = 2$ yields a private benefit β_1^c that has the same sign as corruptibility κ_2^c, which is assumed positive, there is an incentive to raise P^c by bribery as far as possible. Because honesty is the backstop, if $\kappa_2^c \geq \delta$, price P^c is already at its maximum $\overline{P}$ and so there is no scope for bribery. Alternatively, if $\kappa_2^c < \delta$ the solution under honesty at $t = 1$ is $P^c = \min(\hat{P}, F)$. If $\hat{P} \geq \overline{P}$, so that $P^c = \overline{P}$, there is no scope for bribery; while if $\hat{P} < \overline{P}$, so that $P^c = \hat{P}$, a bribe will be paid to raise P^c to $\overline{P}$. The following lemma therefore obtains.

LEMMA 3 *Assume transparency and consider a centralized corrupt bureaucracy with* $\kappa_2^c > 0$. *If* $\kappa_2^c < \delta$ *and* $\hat{P} < \overline{P}$ *the MNC pays a bribe to raise price to* $\overline{P}$; *otherwise* P *is raised to* $\overline{P}$ *through exercise of the honest option.*

We have seen that when $\kappa_2^c \leq 0$ bureaucrat 2 will take the honest option, with tax T paid as specified by (10). If, also, bureaucrat 1 takes the honest option, the solution is the same as when the bureaucracy is scrupulous. Consider, however, the possibility of bribery at $t = 1$. If this occurs $P = P^c$, so that, from (15) and (16), since $\kappa_2^c \leq 0$, a unit price rise at $t = 1$ has a private benefit rise $\beta_1^c \leq 0$, that is, there is no scope for bribery to raise price. Bribery might in principle occur to lower price, but the bribe would then have to be in the form of a payment from the bureaucracy to the

MNC, which we rule out. Hence, bribery does not occur at $t = 1,$ as stated in our next lemma.

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

Our first proposition then follows from Lemmas 2-4.

PROPOSITION 1 *With transparency and a centralized corrupt bureaucracy (i) if* $\kappa_2^c > 0$ *then* $P = \overline{P};$ *but if* $\kappa_2^c \leq 0$ *then* $P = \tilde{P}.$ *Bribery occurs at* $t = 1$ *if* $0 < \kappa_2^c < \delta$ *and* $\hat{P} < \overline{P},$ *but not otherwise. Bribery occurs at* $t = 2$ *if and only if* $\kappa_2^c > 0.$

Given that there is transparency, the price paid by the MNC under a centralized bureaucracy depends on the sign of bureaucratic corruptibility. If corruptibility is positive, the price paid will be at its maximum feasible level; but if corruptibility is non-positive, the price paid will be the same as in the case of a scrupulous bureaucracy. With positive corruptibility, bribery may occur at $t = 1,$ and is sure to occur at $t = 2.$ With non-positive corruptibility, bribery does not occur at either stage.

3.3 Decentralized Bureaucratic Corruption

If the bureaucracy is decentralized, each bureaucrat *i* maximizes u_i without taking into account any effect on the other bureaucrat's payoff. Thus, although a bureaucrat 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 earning \$1 for

the public treasury. In contrast to (15), the corruptibility κ_2^d of bureaucrat 2 is therefore

(18) $\kappa_2^d = 1 - \alpha(1+\theta).$

When P^c is set \$1 higher at $t=1,$ this has an effect dP/dP^c on the price P paid at $t=2.$ For every \$1 increment to $P,$ the MNC gains unity, but bureaucrat 1 loses $\alpha(1+\theta).$ Also, the MNC will make an additional bribe payment db_2/dP^c to bureaucrat 2, which is a cost to the MNC, but, with a decentralized bureaucracy, is not valued by bureaucrat 1. The private benefit from a unit price rise at time t is therefore $\beta_1^d,$ where

(19) $\beta_1^d = [1-\alpha(1+\theta)]\frac{dP}{dP^c} - \frac{db_2}{dP^c}.$

In our framework there are two significant differences between centralized and decentralized bureaucracy. First, when bureaucrat 2 makes decisions in terms of κ_2^d rather than $\kappa_2^c,$ if $\mu > 1$ he or she is putting a smaller weight on treasury receipts. This parallels the Shleifer-Vishny (1993) analysis, causing decentralization to have a negative effect on domestic welfare, relative to centralization. The second difference, however, relates to the private benefit being β_1^d rather than $\beta_1^c.$ When bureaucrat 1 bargains with the MNC under decentralization, he or she will not take into account the effect that a higher price P^c will have on any bribe income b_2 that bureaucrat 2 may earn. This factor favors decentralization.

For renegotiation at $t=2,$ the same considerations apply for decentralized bureaucracy as under centralized bureaucracy, except that bureaucrat 2 now chooses whether to take a bribe by reference to the value of $\kappa_2^d,$ rather than $\kappa_2^c.$ Hence, if

$\kappa_2^d > 0$ there will bribery, where b_2 is given by (17), while if $\kappa_2^d \leq 0$ the MNC pays the same amount, but as a tax T to the treasury.

LEMMA 5 *With transparency and decentralization, Lemma 2 holds, but with* κ_2^c *replaced by* κ_2^d.

Now consider $t = 1,$ and suppose first that $\kappa_2^d > 0,$ so that bribery will occur at $t = 2.$ Then, $P = P^c$ and, from (17), $db_2 / dP^c = 1 - \delta.$ Hence, from (19), the private benefit from the price rise is

(20) $\beta_1^d = 1 - \alpha(1+\theta) - (1-\delta) = \delta - \alpha(1+\theta).$

Comparison of this equation with (16) (with $dP / dP^c = 1$) captures the two effects of decentralization mentioned above. First, if $\mu > 1,$ the term $1 - \alpha(1+\theta)$ in (20) exceeds the corresponding term $1 - \mu\alpha(1+\theta)$ in (16): bureaucrat 1 does not internalize bureaucrat 2's dislike of a price increase (the 'price externality'), so that the incentive to raise P^c under decentralization is greater. Second, the MNC 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^c. What happens at $t = 1$ depends on the relative sizes of these conflicting effects.

Suppose that $\beta_1^d \geq 0$. If bureaucrat 1 takes the honest option, $P^c = \min(P', \overline{P}),$ where P' is the solution to the Nash bargain, $P' = \arg\max_z (z - b_2 - K - W).\{\alpha[U - (1+\theta)z]\},$ in which b_2 is given by (17).[17] Thus,

[17] As in the corresponding analysis for centralized bureaucracy (see note 18), bureaucrat 1 will never choose to expropriate.

(21) $$P' = \frac{1}{2}\left[U^* + \frac{(2\delta - \gamma)W}{2\delta} + \frac{K}{\delta}\right].$$

However, with this honest option as the backstop, since $\beta_1^d \geq 0$ the MNC can bribe bureaucrat 1 to raise P^c from $\min(P', \overline{P})$ to $\overline{P}$. Thus, even if P is not raised to $\overline{P}$ by exercising the honest option, it is nonetheless raised to $\overline{P}$ by bribery.

Now suppose that $\beta_1^d < 0$, still with a positive κ_2^d, so that there will be bribery at $t = 2$. If the honest option is exercised at $t = 1$ then $P = \min(\overline{P}, P')$. Since a \$1 rise in P^c yields a negative private benefit β_1^d, there is no scope to raise P^c through bribery. There is a potential for price reduction through bribery, but this would require that $b_1 < 0$, which we rule out. Bribery therefore does not occur at $t = 1$, and so $P = \min(P', \overline{P})$.

LEMMA 6 *Suppose there is transparency, a corrupt decentralized bureaucracy, and corruptibility* $\kappa_2^d > 0$. *(i) If private benefit* $\beta_1^d > 0$, *then* $P = \overline{P}$; *but there is bribery if and only if* $\overline{P} < P'$. *(ii) If private benefit* $\beta_1^d \leq 0$, *then* $P = \min(P', \overline{P})$, *there being no bribery.*

Finally, if $\kappa_2^d \leq 0$, bureaucrat 2 will bargain honestly. Thus, in (19) $db_2 / dP^c = 0$. If bureaucrat 1 takes the honest option, we have the same solution as with a scrupulous bureaucracy, with $P = \tilde{P}$. From (10'), $dP / dP^c = \delta$, and so, in (19), $sign(\beta_1^d) = sign[1 - \alpha(1 + \theta)] = sign(\kappa_1^d) \leq 0$. Negativity of the private benefit β_1^d rules out the possibility of raising P^c by a positive bribe b_1, while a negative bribe is ruled out by assumption. The honest option is therefore exercised at $t = 1$.

LEMMA 7 *With transparency and a decentralized corrupt bureaucracy, if corruptibility* $\kappa_2^d \leq 0$, *bureaucrat 1 will exercise the honest option.*

Our second proposition draws together the implications of Lemmas 5-7 for price *P*.

PROPOSITION 2 *Suppose there is transparency and a corrupt decentralized bureaucracy. (i) If corruptibility* $\kappa_2^d > 0$, *(a) if private benefit* $\beta_1^d > 0$ *then* $P = \overline{P}$, *which may be achieved through bribery at* $t = 1$, *but (b) if private benefit* $\beta_1^d \leq 0$ *then* $P = \min(P', \overline{P})$, *there being no bribery at* $t = 1$. *(ii) If* $\kappa_2^d \leq 0$, *then* $P = \tilde{P}$. *Bribery occurs at* $t = 2$ *if and only if* $\kappa_2^d > 0$.

Given that there is transparency, the price paid by the MNC under a decentralized bureaucracy depends on the sign of bureaucratic corruptibility and on the sign of the private benefit of a price rise at $t = 1$. With positive corruptibility, if the private benefit is positive, the price paid will be at its maximum feasible level; but if private benefit is non-positive, bargaining will lead to the price paid possibly being lower than this maximum level. With negative corruptibility, the price paid will be the same as in the case of a scrupulous bureaucracy. The only circumstances in which bribery may occur at $t = 1$ are when corruptibility and private benefit are positive. At $t = 2$ there is bribery if corruptibility is positive, but not otherwise.

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 $N = U - (1+\theta)P$. The same rankings apply with respect to social efficiency $S = U - K - W - \theta P$. First, we compare centralized with decentralized bureaucracy, and then consider whether corruption is harmful, that is, we bring a scrupulous bureaucracy into the comparison.

PROPOSITION 3 *Suppose there is transparency and that* $\mu = 1$ *(a bureaucrat's concern for domestic welfare is entirely ethical). If*

(22) $1 > \alpha(1+\theta)$,

and if $P' < \overline{P}$, *decentralization yields a higher level of domestic welfare than centralization does. Otherwise, the two arrangements perform equally.*

This proposition follows directly from Propositions 2 and 3, taking into account (18) and (20). The difference between centralization and decentralization occurs when, with positive corruptibility, centralization results in price P^c being raised to F, and being left there at $t = 2$ (a bribe then being paid). In the corresponding case with decentralization, there is less reason to raise P^c because bureaucrat 1 does not internalize the positive effect this has on bureaucrat 2's bribe income. If (22) holds, and if the upper bound $\overline{P}$ is high enough, this leads to a lower price $P^c (= P)$ in the case of decentralization. In effect, bureaucrat 1 and the MNC are colluding against the interests of bureaucrat 2, and this has a positive welfare effect. [18]

However, when we allow that μ may exceed unity, for example because bureaucrats relate career prospects to domestic welfare, centralization may be

preferred. When $\mu > 1$, it can be seen from (18) and (20) that there is a range of parameter values for which $\kappa_2^d > 0$ but $\kappa_2^c \leq 0$, corruptibility being positive under decentralization, but non-positive under centralization. In this parameter range, if β_1^d, the private benefit of raising P^c under decentralization, is positive, then $P = \overline{P}$. However, under centralization $P = \tilde{P}$. Since $\tilde{P} < \overline{P}$, centralization yields the higher level of welfare. This result is summarized in Proposition 4. Its underlying cause is that, with decentralization, bureaucrat 2 does not internalize the negative effect on bureaucrat 1's payoff of a higher price. Relative to the case of centralization, bureaucrat 1 is therefore more inclined to take a bribe, rather than reduce price by the tax *T*. Using (15), (18) and (20), the proposition specifies the range of parameter values under which this obtains.

PROPOSITION 4 *Suppose there is transparency and that* $\mu > 1$. *If*

(23) $\delta \geq \alpha(1+\theta) \geq 1/\mu$

and $P' < \overline{P}$, *then net domestic welfare is higher under centralization than under decentralization.*

Generally, a high compensation parameter δ favours centralization because it is associated, under decentralization, with a relatively high private benefit from raising price. A low value of the utility function parameter μ ('ethics' being relatively important) favors decentralization because it is associated with a smaller range of values of $\alpha(1+\theta)$ for which decentralization results in positive corruptibility. If $\mu = 1$,

[18] See Tirole (1986, 1992) on general issues relating to collusion in a three-tier principal-agant hierarchy.

higher values of the bureaucrat's care α for domestic welfare and of the inefficiency θ of the tax system tend to favor centralization because they expand the range of values for which corruptibility is negative by more under centralization than under decentralization.

We now bring a scrupulous bureaucracy into the comparison. An immediate implication of our Lemma 1 and Propositions 1 and 2 is that, if $\kappa_2^c \leq 0,$ the behavior of a centralized corrupt bureaucracy is the same as that of a scrupulous bureaucracy, while, if $\kappa_2^c > 0,$ it is the same or worse, in net domestic welfare terms, than that of a scrupulous bureaucracy. The comparison between a decentralized corrupt bureaucracy and a scrupulous bureaucracy is similar, though with κ_2^d replacing $\kappa_2^c,$ except in one important respect. If $\kappa_2^d > 0$ and $\beta_1^d \leq 0,$ then $P = \min(P', \overline{P})$ under decentralized bureaucracy; that is, if $P' < \overline{P}$ then $P = P'.$ Since, with a scrupulous bureaucracy $P = \tilde{P},$ it follows that if $P' < \tilde{P}$ then decentralized corruption is preferable to a scrupulous bureaucracy. Our next proposition uses the formulae for $\tilde{P}$ and P' - (12) and (21) - to restate this result.

PROPOSITION 5 *With transparency, if* $1 > \alpha(1+\theta) \geq \delta$ *and*

(24) $$(1-\delta)K > \frac{\gamma}{2}W,$$

then net domestic welfare is higher under a decentralized corrupt bureaucracy than under a scrupulous one.

This result goes a significant step further than the 'grease hypothesis,' which relates to how, in the presence of bureaucratically-imposed obstacles to efficiency,

bribery can raise welfare – by overcoming these obstacles at least partially. It states that, even without such obstacles, corruption can be beneficial. The rationale for our result, like the grease hypothesis, stems from an inefficiency, but here it is the time-inconsistency associated with the hold-up problem. Comparing the outcomes under a scrupulous bureaucracy and decentralized corruption when $1 > \alpha(1+\theta) \geq \delta,$ in the former case price is negotiated downwards at $t = 2,$ while in the latter it is not. This favors a scrupulous bureaucracy. However, when, with decentralized corruption, negotiations over price take place at $t = 1,$ bureaucrat 1 does not internalize the effect of a price rise on the bribe at $t = 2,$ whereas with a scrupulous bureaucracy it is taken into account that price will be negotiated downwards at $t = 2,$ and this moderates the extent to which bureaucrat 1 bargains for a relatively low price at $t = 1.$ If (24) is satisfied, this difference dominates the comparison between the two cases.

5 Non-Transparency

Our results have been derived on the assumption of transparency, in the sense that the price P^c negotiated at $t = 1$ is common knowledge. Now suppose, however, that P^c is known only to the bureaucracy and the MNC. The upper bound F on government spending will still apply. Also, we assume for now that the price P cannot exceed $U^*,$ though the initial contract price P^c may in principle do so. This widens the bargaining options at $t = 2,$ for now it becomes feasible for bureaucrat 2 and the MNC to bargain over *raising* P above P^c in return for a bribe paid by the MNC to bureaucrat 2. (With transparency, we ruled this possibility out because outsiders could infer the nature of the arrangement.) Let β_2^c and β_2^d denote the respective private benefits at $t = 2$ of a \$1 increase of P above P^c for a centralized and for a

decentralized corrupt bureaucracy. Reasoning as for our derivations of β_1^c and β_1^d, we obtain

(25) $\beta_2^c = 1 - \mu\alpha(1+\theta); \qquad \beta_2^d = 1 - \alpha(1+\theta).$

With centralization, private benefit β_2^c accrues to the two bureaucrats and the MNC; with decentralization private benefit β_2^d accrues to bureaucrat 2 and the MNC.

Consider a centralized corrupt bureaucracy. If $\beta_2^c > 0$ the bureaucracy and the MNC would benefit from raising price P to $\overline{P}$, with an appropriate bribe payment made by the MNC. Similarly, with decentralization, if $\beta_2^d > 0$ price would be raised to F, irrespective of the sign of β_1^d.[19] Consequently, without transparency, there are no cases in which decentralized corruption outperforms either centralized corruption or a scrupulous bureaucracy. Nonetheless, if $\beta_2^c > 0$ a scrupulous bureaucracy is preferable to centralized corruption. These conclusions are summarized in our next proposition.

PROPOSITION 6 *Without transparency, in terms of net domestic welfare, a scrupulous bureaucracy is weakly superior to centralized corruption, which, in turn, is weakly superior to decentralized corruption.*

The potential advantage that decentralized corruption has over other arrangements only exists if there is an implicit control on the behavior of bureaucrats through transparency of agreements that the bureaucrats make on behalf of the public.

[19] When $\beta_2^c < 0$ or $\beta_2^d < 0$ there would be an incentive to reduce P below P^c, but this would require a bribe to be paid to the MNC.

We have assumed throughout that the project is capable of yielding non-negative net domestic welfare ($U^* \geq K + W$) and that the bureaucracy can be deterred from agreeing a price greater than U^*. From (5), this ensures that, even with corrupt bureaucrats, price will be set such that the social surplus *S* is non-negative.[20] With modification of our assumptions, however, corrupt bureaucrats might choose to let 'bad' projects be undertaken.[21] Even if $U^* \geq K + W$, so that the project is potentially able to yield positive values of *N*, there may be nothing to prevent bureaucrats from raising price above U^*, so that $N < 0$. In this case, which may be viewed as representing a deeper level of non-transparency than we have been considering, the upper bound on *P* becomes *F*, rather than U^*, but the ranking in Proposition 6 is unaffected. Alternatively, it may be that $U^* < K + W$, so that the project would be eschewed by a scrupulous bureaucracy, but possibly undertaken by a corrupt one. It would be interesting to analyse further how the (de)centralization of a corrupt bureaucracy affects its behavior in this case.

6 Conclusions

In this paper, we have examined the impact of corruption on social welfare in different institutional and 'political' settings, namely centralization as against decentralization of the bureaucracy, and transparency as against non-transparency of public decisions. Our analysis is formulated in the context of a problem of major

[20] Because $U^* \geq K + W$, a scrupulous bureaucracy will always undertake the project; and since honest behavior is the backstop for a corrupt bureaucrat, such a project would be undertaken when bureaucrats are corrupt.

[21] For example, Enron agreed with the Maharashtra State Energy Board (MSEB) to build the Dabhol power plant, starting in 1995, despite the World Bank declaring the project as not economically viable. Renegotiation occurred the following year, but eventually, the financial burden forced MSEB to scrap the project unilaterally, despite the compensation required. We thank Sergei Guriev for drawing our attention to this case.

concern for many developing economies: the provision, through foreign direct investment, of infrastructure facilities and services. This type of investment has been particularly subject to the hold-up problem, leading to frequent renegotiation of contracts (see Guasch, 2004). We have shown that, although corruption is generally damaging, the ill-effects can sometimes be limited in political environments where the details of the deals struck between investors and bureaucrats are in the public domain. Transparency can act to preclude the most damaging effects of corruption by limiting the set of feasible outcomes to those that are relatively favorable in terms of social welfare. This suggests that a requirement for the full provision of information about the details of investment projects, on its own, can be an important policy tool in limiting the negative effects of corruption on welfare.

Our main focus has been on the impact on social welfare of different institutional arrangements of the bureaucracy. In the literature, a widely-cited analysis by Shleifer and Vishny (1993) finds centralization of the bureaucracy to be advantageous. Shleifer and Vishny show that 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). Our framework is somewhat different and our results are more modulated. With transparency, decentralized bureaucracy can generate the higher social welfare from a given project. This is because, under decentralization, the first bureaucrat does not internalize the bribe externality – the impact of a price rise in the price agreed in the first period on the bribe received by the second bureaucrat. In effect, the first

bureaucrat and the investing firm collude together against the interests of the second bureaucrat, but to the benefit of the community as a whole.[22] However, decentralization has the disadvantage that the first bureaucrat also does not internalize the price externality – the second bureaucrat's dislike of an increase in the price agreed in the first period. Thus, depending on the balance of the two externalities, either centralization or decentralization may yield the higher social welfare. But this conclusion relies on the assumption of transparency, that is, on the discipline that public scrutiny imposes on decision-making. Without transparency, decentralization cannot be advantageous because corrupt behavior by the second bureaucrat at the expense of social welfare cannot be inferred by outsiders, and this behavior neutralizes any socially advantageous behavior by the first bureaucrat.

Our framework also provides an important example of how corruption can actually operate to raise welfare, provided there is transparent public dealing. Our result depends on the bureaucracy being decentralized, and again arises from the failure of the first bureaucrat to internalize the bribe externality**.** This can result not only in decentralized corruption outperforming centralized corruption in terms of social welfare, but also in it outperforming a scrupulous bureaucracy that eschews bribery. Thus, in the presence of the time-inconsistency associated with the hold-up problem, corruption can improve social welfare. This is not to argue that corruption is in general beneficial in developing economies, but, at least when there is a significant degree of transparency in public affairs, corruption can lead to better outcomes than otherwise would have occurred, even in the absence of arbitrary distortions in market processes.

[22] For an alternative approach that emphasizes other costs and benefits decentralization, see Bardhan and Mookherjee (2002). 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

Appendix: Proofs

Lemma 3

The reasoning behind this lemma is sketched out in the text. Here we fill in some of the details. First we derive the price $\hat{P}$ (the honest option being exercised at $t=1$.) Then we establish that when there is bribery at $t=1$, $P^c=\overline{P}$.

Exercising the honest option at $t=1$ would yield the solution to the Nash bargain, $P=\arg\max_z(z-b_2-K-W).\{\mu\alpha[U-(1+\theta)z]+b_2\}$, subject to the constraint $P\le\overline{P}$, where b_2 is given by (17). Thus we obtain

$$\text{(A1)}\quad \hat{P}=\frac{\mu\alpha U}{2(\delta-\kappa_2^c)}+\frac{K}{2\delta}+\left[\frac{1}{2}(2\delta-\gamma)(2\delta-\kappa_2^c)-\delta\right]\frac{W}{2\delta(\delta-\kappa_2^c)}.$$

Now consider $t=1$. Suppose the MNC pays the bureaucracy \$1 for a positive increment ξ to price P^c. The value of ξ, within a range to be specified, may be determined by bargaining; but it is not necessary to consider the bargain explicitly. The bureaucracy gains 1 directly, while the increment to P^c cuts its utility by $\mu\alpha(1+\theta)\xi$; and, from (17), its bribe income rises by $(1-\delta)\xi$. The MNC pays the unit bribe, but gains the price rise ξ; while its bribe payments rise by $(1-\delta)\xi$. Hence, the net benefits are $\Delta_B=1-\mu\alpha(1+\theta)\xi+(1-\delta)\xi$ for the bureaucracy and $\Delta_M=-1+\xi-(1-\delta)\xi=\delta\xi-1$ for the MNC. Both $\Delta_B>0$ and $\Delta_M>0$ if

$$\text{(A2)}\quad \delta>\frac{1}{\xi}>\mu\alpha(1+\theta)-1+\delta.$$

Given that $\kappa_2^c=1-\mu\alpha(1+\theta)>0$, a positive ξ can be chosen to satisfy (A2), and the gain to each player will be greater the more P^c is raised. Thus, $P^c(=P)$ will be raised as far as $\overline{P}$.

Lemma 4

Suppose the MNC pays the bureaucracy \$1 for any positive increment ξ to P^c. The bureaucracy gains 1 directly, but the increment to P^c reduces its utility by $\mu\alpha(1+\theta)\xi$. Also, from (10), T rises by $(1-\delta)\xi$, adding $\mu\alpha(1+\theta)(1-\delta)\xi$ to bureaucratic utility. Hence, the net benefit to the bureaucracy of the \$1 of bribe is $\Delta_B=1-\mu\alpha(1+\theta)\delta\xi$. The MNC 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 $\Delta_M=\delta\xi-1$. Both Δ_B and Δ_M are positive if

$$\text{(A3)}\quad \delta>\frac{1}{\xi}>\mu\alpha(1+\theta)\delta.$$

With $\kappa_2^c\le 0$ (A3) cannot be satisfied by a positive bribe; but a negative bribe is ruled out. Reworking this reasoning for a bribe to reduce price, we find that this too would only work if a negative bribe were permissible.

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corruption; but if vested interests dominate locally, the benefits of the project may be diverted from those with the greatest needs.

Lemma 6

If $\beta_1^d > 0$ then $\kappa_2^d > 0$, so there will be bribery at $t = 2$. When the honest option is exercised at $t = 1$, if the constraint $P \le \overline{P}$ does not bind, then $P = P'$, where $P' = \arg\max_z (z - b_2 - K - W).\{\alpha[U - (1+\theta)z]\}$, b_2 being given by (17). Thus, (21) obtains.

Suppose the MNC pays \$1 to bureaucrat 1 for the price P^c to be raised by the amount $\xi > 0$ above P'. Bureaucrat 1 gains unity, but suffers a loss $\alpha(1+\theta)\xi$ through reduced public funds. Bureaucrat 1 is unconcerned about the effect on b_2. The MNC pays the unit bribe, but gains the price increase ξ. Also, its bribe payments at $t = 2$ rise by $(1-\delta)\xi$. Using the same notation as in Lemma 3, $\Delta_B = [1 - \xi\alpha(1+\theta)]$ and $\Delta_M = \delta\xi - 1$. Necessary and sufficient for both $\Delta_B > 0$ and $\Delta_M > 0$ is that

(A4) $\quad \delta > 1/\xi > \alpha(1+\theta)$.

Given that $\beta_1^d > 0$, a positive ξ can be found to satisfy (A4), so P^c is raised from P' to $\overline{P}$. Allowing for the upper bound $\overline{P}$, Lemma 6 follows.

Lemma 7

Let $\beta_1^d \le 0$. If $\kappa_2^d > 0$ the derivation of the effects of a rise in P^c through a positive bribe paid by the MNC are the same as in Lemma 6, except that, because $\beta_1^d \le 0$, a positive increment ξ cannot satisfy (A4). Alternatively, if the MNC pays a bribe to reduce P^c, the effect on its payoff is $-1 + (1-\delta) < 0$, a one unit loss of revenue, and a fall in b_2. The bribe would therefore have to be negative, which is ruled out.

Let $\kappa_2^d \le 0$; bureaucrat 2 bargains honestly. Suppose P^c is cut by \$1. Bureaucrat 1 gains $\alpha(1+\theta)$ from the rise in treasury funds, but loses $\alpha(1+\theta)(1-\delta)$ from the resulting fall in T: $\Delta_B = \alpha(1+\theta)\delta$. The MNC gains -1 (the price change) plus $1-\delta$ (the fall in the tax): $\Delta_M = -\delta$. Thus, $\Delta_B + \Delta_M = -\delta\kappa_2^d > 0$, but as $\Delta_M < 0$, b_2 would have to be negative, which is ruled out. Bureaucrat 1 is left with the honest option.

Proposition 2

Only one part of this proposition does not follow immediately from the fact that $\tilde{P} \le \overline{P}$. When $\beta_1^d \le 0$, but $\kappa_2^d > 0$, decentralized bureaucracy results in price P'. But, comparing (13) and (21), it is found that $P' > \tilde{P}$.

Proposition 3

Except for the last part, this proposition follows immediately from Lemma 1, and Propositions 1 and 2. The last part is obtained by comparing (13) with (21).

Proposition 4

From (15) and (18), if $\mu = 1$ then $\kappa_2^c = \kappa_2^d$. Putting this in Proposition 1 and comparing with Proposition 2, Proposition 4 follows.

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