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THE DARK SIDE OF INTERNAL CAPITAL MARKETS: DIVISIONAL RENT-SEEKING AND INEFFICIENT INVESTMENT

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1. Introduction

In recent years, it has become almost axiomatic among researchers in finance and strategy that a policy of corporate diversification is value-reducing. A variety of empirical evidence lends support to this view. For example, diversified firms apparently trade at lower stock values than comparable portfolios of specialized firms.[1] Moreover, during the 1980s corporate acquirors systematically dismantled diversified firms with the view that the divisions would be more efficiently run as stand-alone firms.[2]

While it may be clear to most observers that diversification can destroy value, it is much less clear exactly how it does so. One general theme in the literature is that the conglomerate form of organization somehow exacerbates the investment inefficiencies that arise from managerial agency problems. There are two basic ways that this could happen. First, if one believes that managers have a tendency to overinvest out of free cash flow (Jensen 1986, 1993), it might simply be that conglomerates give managers access to more in the way of total resources to play with, and hence lead to more overinvestment.[3] Alternatively, it may be that conglomerates do not on average have more total free cash flow, but that their internal capital markets do a worse job of allocating a given amount of resources than would external capital markets — i.e., they tend to engage in inefficient cross-subsidization, spending relatively too much in some divisions, and too little in others.

This latter hypothesis about inefficient cross-subsidization in internal capital markets has been much discussed. And recent evidence suggests that conglomerates do in fact engage in active resource reallocation, moving funds from one division to another.[4] But, it is far from obvious that any such resource reallocation should be expected to be systematically inefficient, even in a standard agency context. Indeed, Stein (1997), building on Williamson

[1] See, e.g., Lang and Stulz (1994), Berger and Ofek (1995), and Comment and Jarrell (1995).

[2] See Bhagat, Shleifer and Vishny (1990) and Berger and Ofek (1996).

[3] This might occur, if, for example, coinsurance effects allow a conglomerate to borrow more against its assets than a comparable portfolio of specialized firms. However, recent empirical work by Berger and Ofek (1995) finds that in practice, this extra-borrowing effect is of trivial importance.

[4] See Lamont (1997), Shin and Stulz (1996).

(1975), makes exactly the reverse argument. He notes that even if CEOs derive private benefits from control, and hence have a tendency to engage in empire-building overinvestment, there is a presumption that, conditional on the level of investment, any reallocation of resources across divisions will be in the direction of increased efficiency. This is because the CEO's ability to appropriate private benefits should ultimately be roughly in line with the value of the enterprise as a whole. To put it simply, while agency-prone CEOs may want big empires, it also seems reasonable that, holding fixed size, they will want valuable empires.

Of course, one can think of exceptions to this general tendency. For example, there may be "pet" projects that effectively generate disproportionately high private benefits for the CEO.[5] Nonetheless, it remains hard to explain pervasive allocative inefficiencies in internal capital markets simply by appealing to agency problems at the level of the CEO. This is especially true to the extent that the associated cross-subsidies follow a consistent and predictable pattern across firms and industries.

In this regard, many observers have claimed that the cross-subsidies in internal capital markets often tend to be "socialist" in nature — i.e., strong divisions typically wind up subsidizing weak ones. Or said somewhat differently, one of the fundamental failings of the conglomerate form of organization seems to be its inability to put the weakest divisions in the firm on much-needed diets. Unless one is willing to assume that CEOs systematically derive more private benefits from weak divisions — which seems implausible — such a socialist pattern cannot be rationalized simply by appealing to agency problems at the CEO level.

This suggests that in order to develop a satisfactory theory of inefficient cross-subsidies in internal capital markets, one has to go a level deeper in the organization, and explicitly examine the incentives and behavior not only of the CEO, but also of the division managers. That is what we do in this paper. Specifically, we consider a setting where division managers have the ability to engage not only in productive work, but also in wasteful rent-seeking

[5]On a related note, Shleifer and Vishny (1989) argue that CEOs will prefer to invest in industries where they have more personal experience, as this makes them indispensable.

activities. In order to ensure that division managers spend their time usefully, corporate headquarters (i.e., the CEO) must effectively bribe them. It turns out that under certain conditions (though not always), the required bribe is larger for the managers of weaker divisions. The effect that drives this is that the opportunity cost to such managers of taking time away from productive work to engage in rent-seeking is lower, and hence they have a more credible threat to rent-seek.

The rent-seeking behavior we model is in some respects similar to the influence activities studied by Meyer, Milgrom and Roberts (1992), and it has some of the same implications. Their model also predicts that such distortionary behavior will be more of a problem in divisions with poor prospects, and like ours, it suggests that firms may often be better off divesting such divisions. But it is important to note that rent-seeking or influence activities at the level of division managers do not by themselves necessarily generate any inefficiencies in the allocation of *investment spending*.[6] After all, even if headquarters has to bribe rent-seeking division managers, wouldn't it be more efficient for everybody involved if the bribes were paid in cash? Why use directed capital spending as a means of compensation?

Thus while a model with just division-level rent-seeking may in some cases deliver socialist outcomes with respect to cash wages — i.e., managers of weak divisions receiving salaries that seem to be too high relative to those paid to managers of strong divisions — something else must be added if we are to make predictions with respect to capital allocation. This is where the agency problem between headquarters and the outside capital market comes in. We show that although outside investors would prefer that any bribes paid to division managers be paid primarily in cash rather than with distorted capital spending, they have no means to enforce this. For in our setup, the bribing of division managers must be delegated to headquarters. And as an agent, headquarters may not be inclined to pay the

[6]In Meyer, Milgrom and Roberts (1992), there are no investment inefficiencies. The only distortions are the time and effort expended by managers in a fruitless attempt to convince headquarters not to shrink their divisions. Another paper in a similar vein is Rajan and Zingales (1995), which we discuss in more detail below.

bribes in the form that outside investors would prefer. More precisely, we demonstrate that given the nature of the optimal financial contract between outside investors and headquarters, headquarters views it as less personally costly to distort investment in favor of those divisions whose managers require the largest bribes, thereby conserving on cash payments to these managers.

Overall then, the primary novelty of this paper is to build a model with two layers of agency that can speak directly to the question of how some division managers in a conglomerate are able to extract excessively large capital allocations from headquarters. In addition to providing a theoretical rationale for the existence of inefficient cross-subsidies in internal capital markets, the model also enables us to make fairly precise predictions about the directional patterns of such cross-subsidies —i.e., it highlights the circumstances under which there will be a systematic tendency for strong divisions to subsidize weak ones.

The remainder of the paper is organized as follows. Section 2 sets up the building blocks of the model, describing the nature of divisional rent-seeking, investment and the financial contract. Section 3, the heart of the paper, clarifies the conditions under which headquarters will tend to overinvest in divisions with relatively poor assets in place and poor growth opportunities. We check the robustness of the results in Section 4, where we examine the effects of incentive contracts, endogenize some additional variables in the model, and explore alternative formulations of the bargaining game between headquarters and divisional managers. Section 5 discusses some related work, and Section 6 highlights the model's distinctive empirical implications. Section 7 concludes.

2. Model Building Blocks

A. Overview

Our model considers a firm operating with multiple divisions and features three basic agents: division managers, corporate headquarters, and outside investors. Within each division there are both assets already in place and new investment opportunities. Both division managers and headquarters derive private benefits from the assets under their purview. Thus, the manager of a division gets private benefits from the assets of his division only, while headquarters gets private benefits from the assets of all divisions.

Headquarters plays two roles. First, it has the authority to allocate new investment across divisions. Second, headquarters tries to get division managers to spend their time on productive activities rather than on unproductive rent-seeking. As will become clear shortly, this latter task cannot be accomplished by outside investors; rather, if it is to be done, it must be delegated to headquarters.

In order to induce division managers to behave, headquarters must effectively bribe them. Much of the focus of our analysis will be on whether headquarters pays these bribes in cash or instead uses its capital allocation authority to bribe division managers by giving them more capital for investment (and hence more private benefits). However, to facilitate exposition of the model, we begin by assuming that bribes are paid in cash and analyze how these bribes depend on the productivity of the assets in place and other parameters such as managerial human capital. Next, we discuss how new investment is financed, and show that given the nature of the financial contract, there may be incentives for headquarters to pay some bribes with inefficient capital allocations as opposed to cash.

B. Rent-Seeking by Division Managers and the Size of the Bribe

The output of division i's assets in place is $\theta_i H_i^p f(e_i)$, where θ_i is a measure of the productivity of the assets in place, e_i is the productive effort of the manager, H_i^p is a measure of the manager's productive human capital, and $f(.)$ is an increasing, concave function. We assume that a fraction ϕ of this output is nonverifiable and thus can be diverted for the private benefit of either the division manager or headquarters. The remaining output is costlessly verifiable and thus can be assigned to outside investors.

The total pool of private benefits is therefore $\phi\theta_i H_i^p f(e_i)$. One of our key assumptions is that the way these private benefits are split between the division manager and headquarters depends on the amount of effort that the division manager devotes to rent-seeking. Specifically, a division manager's private benefits are given by $\gamma\phi\theta_i H_i^p f(e_i) + H_i^r g(r_i)$, and headquarters' are given by $(1-\gamma)\phi\theta_i H_i^p f(e_i) - H_i^r g(r_i)$, where r_i is the effort devoted to rent-seeking, H_i^r is a measure of the manager's rent-seeking ability, and where the rent-seeking technology $g(.)$ is an increasing concave function. Importantly, the time spent on rent-seeking takes away from productive effort, because division managers face an overall constraint on their time that $e_i + r_i = h$.

Since this formulation is very reduced-form in nature, we should comment briefly on what we have in mind here. The notion that there are private benefits of control is of course a standard one by now; it is meant to capture the idea that because the auditing technology is imperfect, managers can divert either cashflows or various perks to themselves. Somewhat less standard is our idea that the private benefits must be shared among more than one agent in the corporate hierarchy, and more to the point, that the allocation of the spoils depends on actions taken by the agents.

On the one hand, a strict interpretation of the notion of "benefits of control" might suggest that headquarters would get to keep all the private benefits, since it is headquarters that is endowed with formal control rights (in the sense of Grossman and Hart (1986) and Hart and Moore (1990)), and hence can, among other things, threaten to fire the division manager. On the other hand, as emphasized by Aghion and Tirole (1994), there can be a meaningful distinction between formal and real authority, so that if division managers are better informed about their assets than headquarters, they may to some extent have *de facto* control rights, and hence be able to keep some of the private benefits to themselves. In this context, the effort devoted to rent-seeking might be concretely thought of as the effort that division managers spend to keep headquarters in the dark. For example, division managers might spend time actively concealing information — e.g., creating more arcane accounting methods and reporting systems, etc.[7]

Because rent-seeking reduces total output, there is a natural incentive to bribe division managers not to engage in such behavior. We assume that it is impossible for outside investors to write an *ex ante* contract that directly precludes rent-seeking. This is because *ex ante*, rent-seeking can take many forms and it is impossible to adequately describe these in an enforceable contract. Of course, given the *ex ante* noncontractibility of rent-seeking itself, an alternative approach for outside investors would be to put division managers on an incentive contract which pays them wages that are a function of verifiable output. For simplicity, we ignore such incentive contracts for the time being — they will be taken up later. At this point, it suffices to say that optimally designed incentive contracts can at best partially weaken — but not eliminate — division managers' rent-seeking tendencies. Hence, all the results that we will present below continue to hold in a setting where incentive contracts are used, although the effects may be somewhat attenuated.[8]

In contrast, we assume that headquarters does have the ability *ex post* to strike a deal with division managers that precludes them from rent-seeking. This is because *ex post* headquarters is better informed and knows precisely the form that rent-seeking will take. In terms of our previous metaphor of division managers hiding information, we are saying that *ex ante* it is impossible to write a contract specifying all the ways in which managers can hide information. However, *ex post* headquarters may know that it just needs a particular accounting report. Getting division managers to turn over the specific report in

[7]It should also be pointed out that in our formulation, any rent-seeking by division managers is entirely at the expense of headquarters, and does not take money directly out of the pockets of outside investors. (Outside investors would be indirectly hurt by rent-seeking though, because it reduces productive effort and hence verifiable output.) This assumption is not critical. We could alternatively assume that some portion of the rent-seeking comes directly out of investors' pockets–i.e., by assuming that division managers can with some effort hide cashflows from the auditing technology and hence turn verifiable cashflows into unverifiable ones.

[8]Heuristically, in a simple case that we examine below, incentive contracts have the effect of giving division managers a percentage stake in verifiable output. But since verifiable output is proportional to private benefits, adding incentive contracts to the model is roughly isomorphic to raising the parameter γ.

exchange for a bribe is an easier transaction to implement. This distinction between *ex ante* noncontractibility and *ex post* contractibility is exactly that drawn by Grossman and Hart (1986).[9]

Given that headquarters and a division manager have the ability to strike such a deal, the Coase theorem tells us that they will, and it remains only to determine the size of the bribe that must be paid. To do this, note that if no deal is struck, a division manager will go off and rent-seek, with the level of rent-seeking activity given by the first order condition:

$$H_i^r g'(r_i) - \gamma\phi\theta_i H_i^p f'(h - r_i) = 0. \tag{1}$$

On the one hand, rent-seeking increases the manager's share of private benefits; on the other hand, it reduces total private benefits available for rent seeking. Let r_i^n denote the solution to (1) and let $e_i^n = h - r_i^n$ be the productive effort when rent-seeking is r_i^n. In this case, total output is $\theta_i H_i^p f(e_i^n)$, the division manager gets $\gamma\phi\theta_i H_i^p f(e_i^n) + H_i^r g(r_i^n)$, and headquarters gets $(1-\gamma)\phi\theta_i H_i^p f(e_i^n) - H_i^r g(r_i^n)$.

If a deal is struck, there is no rent-seeking, so that total output is given by $\theta_i H_i^p f(h)$, the division manager gets $\gamma\phi\theta_i H_i^p f(h)$, and headquarters gets $(1-\gamma)\phi\theta_i H_i^p f(h)$. For simplicity, we assume that headquarters is able to make a take-it-or-leave-it offer to the division manager.[10] Thus the bribe, B_i, must be just enough to leave the division manager indifferent between rent-seeking and not doing so. Consequently,

$$B_i = H_i^r g(r_i^n) - \gamma\phi\theta_i H_i^p [f(h) - f(e_i^n)]. \tag{2}$$

We can now easily show:

[9] The assumption that rent-seeking is ex post contractible distinguishes our approach from Meyer et. al. (1992) and Rajan and Zingales (1995). In these papers, managerial misbehavior is noncontractible, and hence it persists in equilibrium. We discuss the import of this distinction below.

[10] We also assume that because of the accumulated specific human capital, the current division manager is the only one who can realize any output from the assets in place. Thus, it is not credible for headquarters to threaten to fire the division manager, and such threats play no role in the determination of the bribe.

Proposition 1: (i) Holding fixed the levels of productive and rent-seeking human capital (H_i^p and H_i^r), the bribe B_i is a decreasing function of the productivity of division i's assets in place, θ_i; (ii) Holding fixed the levels of rent-seeking human-capital and the productivity of assets in place (H_i^r and θ_i), the bribe B_i is decreasing function of manager i's productive human capital, H_i^p; (iii) Holding fixed the levels of productive human capital and the productivity of assets in place (H_i^p and θ_i), the bribe B_i is an increasing function of manager i's rent-seeking human capital, H_i^r.

Proof: This follows immediately from differentiating B_i with respect to θ_i, H_i^p, and H_i^r and applying the envelope theorem.

The reasoning behind these results is simple. When the productivity of the assets in place, θ_i, is lower, the manager has a lower opportunity cost of taking time away from productive activities to engage in rent-seeking. Thus, ironically, managers of less valuable assets are bribed more to cooperate. This result is in some ways similar to that in Meyer, Milgrom and Roberts (1992), who argue that managers of divisions with the weakest prospects will spend the most time on influence activities. The same reasoning applies to the manager's productivity parameter, H_i^p. By contrast, managers with high values of H_i^r are more effective rent-seekers and hence would devote more time to such activities. The bribe required to induce them not to rent-seek is therefore higher.

For much of the paper, we will implicitly be discussing the case where there is no difference in rent-seeking ability across division managers, but there is a significant difference in the productivity of the assets in place. As will become clear, this assumption drives the results on socialist capital allocation. However, if there are big differences in rent-seeking human capital — in particular if divisions with high values of θ are run by managers with high rent-seeking ability — the socialism effect can be weakened. In fact, just the opposite of socialism may occur, a sort of exaggerated Darwinism in which the stronger division gets even more than its efficient share of the capital budget. We discuss these implications in more detail in Section 6.

C. New Investment and the Nature of the Financial Contract

In addition to the assets in place, each division can invest in new assets. The financing for these new assets must come from outside investors. The form of the financial contract is very simple. In particular, outside investors have two forms of contractual protection. First, they can specify, $\bar{I}$, the amount of their investment in the firm as a whole which must be converted into physical capital. That is, the act of converting cash into physical capital is verifiable; this is a standard assumption. Second, once physical capital is put into place, it will generate some future verifiable cashflows that outside investors can appropriate. One thing that outside investors cannot do is specify how the total firm-wide physical capital $\bar{I}$ gets split up across divisions — this control right is assumed to reside with headquarters.[11]

Importantly, in this setting, it may be optimal for outside investors to give headquarters a discretionary budget, D, above and beyond $\bar{I}$ — i.e, to turn over to headquarters some additional cash that is not required to be sunk into physical assets. As will become clear, the benefit of this is that headquarters may choose to use this discretionary budget D to pay cash bribes to some division managers, thereby averting wasteful rent-seeking.

For the time being, we will simply analyze the behavior of headquarters and the division managers taking $\bar{I}$ as a fixed parameter, and assuming that D is sufficiently large that headquarters is unconstrained in its bribing decisions — i.e., it always has enough cash to make those bribes it would like to. Once we have solved the model this way, we can both endogenize $\bar{I}$, as well as check whether this approach to setting D is optimal from the

[11]We take this delegation of capital-allocation authority to headquarters to be a defining characteristic of integration. Of course, this raises the question of why there should be integration in the first place, i.e., why headquarters should be given this authority. We do not model the benefits of integration here, but rather just focus on its consequences. One reason that integration might be beneficial is that headquarters has better information about divisional investment opportunities than do outside investors. See Stein (1997) for a rationale along these lines.

perspective of outside investors.

We denote the physical investment allocated to division i by I_i, and the resulting output by $k(I_i)$, where $k(.)$ is an increasing concave function. As with assets in place, a fraction ϕ of the new investment's output is nonverifiable, and is split between division managers and headquarters. We assume that the total take by division manager i is $\gamma\phi k(I_i)$, with headquarters keeping $(1-\gamma)\phi k(I_i)$. Thus, we assume that rent-seeking activities only affect the division of spoils from assets in place; this is merely a simplification. Also, note that we are initially assuming that the productivity parameters θ_i and H_i^p do not affect new investment. This is unrealistic but facilitates the analysis. We will return to discuss the case where the productivity of assets in place and new investments is correlated.

3. The Form of the Bribe: Overinvestment vs. Cash

A. Only One Rent-Seeking Division

To begin to understand the forces at work in the model, it is useful to consider a case where there are two divisions, 1 and 2, but where only division manager 1 actively seeks rents. In this situation, headquarters need only bribe division manager 1, and the only question is whether the bribe takes the form of cash or extra physical investment.

We formulate this problem by supposing that headquarters can offer division manager 1 a package $\{b_1, I_1\}$, where b_1 is the cash component of the package and I_1 is the promised investment. Again, this offer is take-it-or-leave-it, so that if it is turned down, each party will go off and optimize on its own. First, consider what happens if no deal is struck. Headquarters will have no incentive to do anything but the first-best level of investment. Therefore, the level of investment if no deal is struck, I_1^n, is just $\bar{I}/2$, since investment is equally productive in the two divisions. Thus, given that he rent-seeks manager 1's payoff in this case is:

$$\gamma\phi[\theta_1 H_1^p f(e_1^n) + k(I_1^n)] + H_1^r g(r_1^n) \tag{3}$$

where e_1^n and r_1^n are the levels defined in equation (1).

Now, consider what happens if a deal is struck. In this case, headquarters is bound by the promised package, $\{b_1, I_1\}$, and the manager does not rent-seek. Thus, the manager gets:

$$\gamma\phi[\theta_1 H_1^p f(h) + k(I_1)] + b_1 \tag{4}$$

In order to prevent rent-seeking the value of (4) must be at least as great as that of (3). Given that headquarters has all the bargaining power, it will set the two exactly equal. This condition, which we call the bribery constraint, can be written as:

$$b_1 + \gamma\phi[k(I_1) - k(\bar{I}/2)] = B_1 \tag{5}$$

where B_1 is defined in equation (2).

Intuitively, (5) tells us that the required bribe B_1 can be paid in one of two ways — either with cash (i.e., $b_1 > 0$) *or* with overinvestment in division 1 relative to the first-best allocation (i.e., $I_1 > \bar{I}/2$). It is worth noting that even though division-manager 1 derives private benefits from levels of investment below $\bar{I}/2$, such levels of investment are of no use in bribing him. This is because he can count on at least $\bar{I}/2$ even if he does not cooperate. Thus, bribery with physical investment requires *overinvestment.*

Headquarters maximizes its rents from the new investment less any cash bribes:

$$(1-\gamma)\phi\sum_i k(I_i) - b_1 \tag{6}$$

subject to the bribery constraint (5), as well as the constraints that $I_1 + I_2 = \bar{I}$ and $b_1 \geq 0$.

We establish the following proposition:

Proposition 2: Headquarters always invests more in division 1 than in division 2, i.e., $I_1 > \bar{I}/2$. For smaller values of B_1 such that (5) can be satisfied with $b_1 = 0$ and $\frac{k'(I_1)}{k'(\bar{I}-I_1)} > 1-\gamma$, there is no cash bribe and only the indicated amount of overinvestment. If

B_1 is so large that this cannot be accomplished, then I_1 is set so that $\frac{k'(I_1)}{k'(I-I_1)} = 1 - \gamma$, and the remainder of the bribe is paid in cash.

Proof: See the appendix.

Figure 1 illustrates the results of the proposition, plotting I_1 as a function of B_1. For smaller values of B_1, the bribe is all in the form of overinvestment and therefore I_1 increases with B_1. Eventually, we hit a point where investment is so distorted that headquarters is unwilling to distort it further and begins to use cash to pay for further increases in B_1.

According to the proposition, the maximum level of investment distortion is given by the equation $\frac{k'(I_1)}{k'(I-I_1)} = 1 - \gamma$, and therefore can be quite large. In particular, when γ is close to one, so that headquarters' share of private benefits is small, headquarters will — when confronted with a large value of B_1 — allocate virtually all of the capital budget to division 1 before resorting to a cash bribe.

The intuition behind this result is simple. Given the financial contract, when headquarters pays a cash bribe, it views this as coming dollar-for-dollar out of its own pocket. This is because outside investors have no contractual mechanism to repossess any money left over in the discretionary budget — at the margin, the discretionary budget "belongs" to headquarters. In contrast, if headquarters pays the bribe by steering extra investment funds to division 1, it does not bear all of the efficiency costs of misallocating the capital. Indeed, when γ is close to one, headquarters bears virtually none of these costs and as a result will substantially overinvest in division 1.

The root of the problem is that the bribing of division managers must be done by an agent (i.e. headquarters) rather than by the principal (i.e. outside investors). Again, this is because the principal does not observe enough about the specific nature of the rent-seeking to deal with it directly. And when bribing is delegated to an agent, there is no guarantee that this agent will pay the bribe in a form that the principal would like.

To see the pure effects of this delegation, suppose that everything in the model is exactly the same, except that in choosing the form of the bribe, headquarters maximizes the payoffs to outside investors rather than to itself — i.e., it maximizes $(1-\phi)\sum_i k(I_i) - b_1$ instead of $(1-\gamma)\phi\sum_i k(I_i) - b_1$. It is easy to show that in this case the maximum investment distortion is given by $\frac{k'(I_1)}{k'(I-I_1)} = \frac{1-\phi}{1-\phi(1-\gamma)}$. If one makes the reasonable assumption that private benefits are relatively small compared to verifiable cash flows, so that ϕ is close to zero, this implies that the maximum distortion is much smaller when headquarters acts on behalf of outside investors. In other words, bribes are now paid predominantly in cash. Figure 2 illustrates the distinction between the cases where headquarters acts in this benevolent fashion rather than in its own private interests.[12]

B. Two Rent-Seeking Divisions

So far, we have only analyzed the case in which there is one rent-seeking division that needs to be bribed. We started with this case to illustrate as simply as possible the agency effect that can lead headquarters to bribe a division manager with overinvestment rather than with cash. However, by examining the bribing of only the division-1 manager, we have ignored the possibility that the resulting underinvestment in division 2 might make it more costly to bribe the manager of that division. In this sub-section, we ask whether headquarters would still choose to overinvest in one division when both divisional managers can rent-seek, and hence both have to be bribed.

Thus, we assume that both divisional managers receive private benefits from investment allocated to their division and that both can try to get more of divisional private benefits through rent-seeking. Now, headquarters offers both managers packages of cash and investment, $\{b_i, I_i\}$, $i = 1, 2$, to induce them not to rent-seek.

[12] Note that even outside investors might react to rent-seeking by raising division 1's investment above that of division 2. But this is capturing nothing more than the fact that in our model, a small increase in investment may at the margin be an efficient way of paying a bribe to division manager 1. When outside investors have to share some surplus with division managers, they care both about the fraction of the output they can appropriate $(1-\phi)k(I)$, *and* the share of the output that managers can appropriate, $\phi k(I)$. Thus, investment tends to increase in that division relative to one where there is no rent-seeking.

As before, we assume that headquarters makes take-it-or-leave-it offers to divisional managers. We now further assume that these offers are made simultaneously.[13] We are looking for a solution in which both managers accept the offers and do not rent-seek. To determine whether a manager accepts the offer, we must first determine the manager's payoff should he turn it down. Thus, suppose manager 1 turns down the offer — deviates from an equilibrium in which both managers accept the offers. Manager 1 gets no cash bribe, but headquarters must now determine how much investment to allocate to division 1.

Assuming that headquarters cannot renege on its offer to division 2 and reduce its investment allocation, the allocation to division 1, I_1^n can be no more than $\bar{I} - I_2 = I_1$, the initially proposed investment allocation to division 1. In fact, if headquarters had initially proposed to underinvest in division 1 and overinvest in division 2, I_1^n will be equal to the initial offer, $I_1 < \bar{I}/2$, since this is the best feasible allocation for headquarters given its commitment to overinvest in division 2. If, however, headquarters had initially proposed to overinvest in division 1 and underinvest in division 2, it will now choose to reduce division 1's allocation to $\bar{I}/2$ and increase division 2's allocation $\bar{I}/2$. Thus, if division manager 1 turns down the offer, its capital allocation is $\min(\bar{I}/2, I_1)$.

It is now possible to write down the bribery constraints for the two divisions that ensure that neither of them rent-seeks.

$$b_1 + \gamma\phi[k(I_1) - k(\min(\bar{I}/2, I_1))] \geq B_1, \tag{7}$$

$$b_2 + \gamma\phi[k(I_2) - k(\min(\bar{I}/2, I_2))] \geq B_2, \tag{8}$$

These bribery constraints are similar to the bribery constraint when there is only one rent-seeking division (5) with one difference. In the case of one rent-seeking division, if headquarters offers to underinvest in the division, the manager knows that he will get an investment allocation of $\bar{I}/2$ if he turns down the offer. Underinvestment in the division

[13]Thus we disregard bargaining games where headquarters approaches the two division managers sequentially. This variant of the model is discussed in Section 4.C. below.

is not credible because it is ex-post sub-optimal. However, in the case of two rent-seeking divisions, underinvestment *is* credible because headquarters has committed to overinvest in the other division.

Headquarters maximizes:

$$\sum_i [(1-\gamma)\phi k(I_i) - b_i] \tag{9}$$

subject to the above bribery constraints, (7) and (8), as well as the constraints that $I_1 + I_2 = \bar{I}$ and $b_i \geq 0$.

The following proposition states one of the main results of the paper.

Proposition 3: (i) Investment across the two divisions is never equal; headquarters underinvests in one division and overinvests in the other division. (ii) Without loss of generality suppose that $B_1 > B_2$. Let I_2^b be the value of I_2 that satisfies the bribery constraint (8) with $b_2 = 0$. If I_2^b is such that $\frac{k'(I_2^b)}{k'(\bar{I}-I_2^b)} > 1-\gamma$, then headquarters overinvests in division 1 and underinvests in division 2; $I_1 > \bar{I}/2 > I_2$.

Proof: See the appendix.

The bottom line is that even when *both* divisions can rent-seek, investment is distorted away from the symmetric outcome. Moreover, for a wide range of parameter values, we can unambiguously pin down the direction of the distortion — the added investment goes to the division requiring the higher bribe B. If the only difference between the divisions is the productivity of the assets in place, this implies that the overinvestment goes to the weaker division (Proposition 1). If, however, the more productive division also is run by a manager with more rent-seeking ability, the overinvestment may (but need not) end up going to this division.

The reasoning behind the proposition that the higher-B division gets more of the capital budget is a bit subtle. As suggested above, there is more to it than simply the idea that headquarters is an agent and hence may prefer to pay bribes with capital expenditures rather than cash. With two rent-seeking divisions, one also has to explain why moving capital expenditures (say) from division 2 to division 1 saves headquarters any cash at all — i.e., why it relaxes the bribery constraint in division 1 more than it tightens the bribery constraint in division 2.

The answer to this latter question is apparent from equations (7) and (8). Note the important asymmetry: when headquarters offers a division manager a package with overinvestment, further increases in the level of investment *reduce* the cash component of the bribe that is required. In contrast, when headquarters offers a division manager a package with underinvestment, further decreases in the level of investment *do not increase* the cash component of the bribe that is required. This asymmetry is a direct outcome of the bargaining game between headquarters and the division managers. Changes in investment only affect the cash component of the bribe at the margin in an overinvestment scenario because it is only in this case that headquarters can credibly say that it will cut investment if a deal is not struck with the division manager. When headquarters proposes to underinvest in a division, it has no credible threat to further cut investment if no deal is struck, so only cash bribes have any value in eliminating rent-seeking.

The asymmetry in the bribery constraints implies that headquarters will always prefer to distort investment away from the symmetric outcome. Given this logic, it is then easy to see why the investment is typically steered towards the division with the higher B: if we are in a region where headquarters views tilting the capital budget as cheaper on the margin than using cash — i.e., if the marginal shadow cost to headquarters of tilting the capital budget is less than one — it will prefer to use the cheaper method to pay the bigger bribe.

As the proposition indicates, we lose the ability to pin down which division gets the overinvestment in the extreme case when both Bs become very large, so that satisfying (8) with $b_2 = 0$ implies $\frac{k'(I_2^b)}{k'(\bar{I}-I_2^b)} < 1-\gamma$. This is because if both Bs are big enough, headquarters will be unwilling to distort investment enough to pay either of them off entirely with capital expenditures. Thus, in this case, while there is the maximal distortion in capital expenditures, some cash is used at the margin in *both* divisions. Consequently, the marginal shadow cost to headquarters of bribing either division is one, and it is a matter of indifference which division gets the extra capital expenditures. Note, however, that if one thinks of γ as close to one, so that headquarters' share of the private benefits is small, it is unlikely that this extreme solution will obtain.

Proposition 3 addresses the case where the investment opportunities facing the two divisions are identical. This simplifies the analysis somewhat by making equal-sized investment allocations the efficient benchmark. But it is more empirically realistic to think that a division whose assets-in-place are relatively unproductive will also have less attractive investment prospects. In light of this motivation, we can generalize the model as follows. Let the total proceeds from new investment in division i now be given by $(1 + \alpha\theta_i)k(I_i)$, where $\alpha \geq 0$ is a parameter that measures the extent to which shocks to assets-in-place also carry over to new investment opportunities.[14] In this case, the efficient investment benchmark is no longer given by $I_1 = I_2$, but rather by the values I_1^* and I_2^* that satisfy: $(1 + \alpha\theta_1)k'(I_1^*) = (1 + \alpha\theta_2)k'(I_2^*)$.

Although things become more complicated in this case, we are able to show:

Proposition 4: (i) Investment across the two divisions is never efficient; headquarters underinvests in one division and overinvests in the other relative to the benchmark values of I_1^* and I_2^*. (ii) Suppose $B_1 > B_2$, and denote by I_1^b and I_2^b the values of investment that satisfy the bribery constraints (7) and (8), with $b_1 = 0$ and $b_2 = 0$, respectively. The following two conditions are sufficient to ensure that the overinvestment is in division 1 — i.e., that $I_1 > I_1^*$:

[14]For notational simplicity we drop H_i^p from the productivity shock of *new* investment. This assumption does not color our conclusions.

$$\frac{(1+\alpha\theta_2)k'(I_2^b)}{(1+\alpha_1\theta_1)k'(\bar{I}-I_2^b)} > 1-\gamma$$

and

$$(I_1^b - I_1^*)\left[(1+\alpha\theta_1)k'(I_1^b) - (1-\gamma)(1+\alpha\theta_2)k'(\bar{I}-I_1^b)\right] > (I_2^b - I_2^*)\left[\gamma(1+\alpha\theta_1)k'(I_1^*)\right].$$

Proof: See the appendix.

The first sufficient condition in Proposition 4 is identical to that in Proposition 3, except that it has been generalized to incorporate $\alpha > 0$. The second condition is new, and arises out of the fact that investment opportunities are no longer the same in the two divisions. Hence Proposition 4 is in some sense weaker than Proposition 3. Note, however, that the second condition will be satisfied if *any* of the following criteria are met: (i) B_1 is small, so that the amount of overinvestment required $(I_1^b - I_1^*)$ is small in the sense that $k'(I_1^b) \approx k'(I_1^*)$; (ii) B_1 is substantially larger than B_2, so that $(I_1^b - I_1^*)$ is substantially larger than $(I_2^b - I_2^*)$; or (iii) γ is close to one.

Proposition 4 is of particular interest because it speaks directly to the issue of socialism in capital budgeting practice. Consider a case where $\theta_1 < \theta_2$. If $\alpha > 0$, efficient capital allocation would imply $I_2^* > I_1^*$ — i.e., the more productive division 2 should get more capital. But since $\theta_1 < \theta_2$ also implies $B_1 > B_2$ (as long as $H_1^r = H_2^r$) headquarters will tend to tilt the capital budget away from the efficient point, and in the direction of the weaker division 1. Thus there is a tendency for the actual allocation of capital to be more equal than it should be from an efficiency perspective.

This tendency is mitigated or even reversed if $H_2^r > H_1^r$; that is, if the division with the more productive assets in place also has a manager with more rent-seeking ability. In this case, B_2 may end up being larger than B_1. This would imply that division 2, the better division, would end up getting more than the efficient share of the capital budget, an excessively Darwinistic outcome.

4. Loose Ends

A. Incentive Contracts for Division Managers

As mentioned in Section 2.B, an alternative approach to dealing with the problem of rent-seeking by division managers is to have outside investors put them on incentive contracts. Since we are assuming that some portion of output is verifiable, it should be feasible to write contracts based on the output from assets in place. Such contracts would implicitly reward productive effort, and therefore deter rent-seeking.

To simplify the analysis of incentive contracts, it is convenient to consider a case where output can take on only two values ex post. This can be easily done with a minor reinterpretation of our notation. For division i, let $f(e_i)$ now denote the probability that the assets in place yield a successful outcome, in which case expected output is $\theta_i H_i^p$. With probability $1 - f(e_i)$, assets in place yield zero. Thus expected output is $\theta_i H_i^p f(e_i)$ as before. Everything else — in terms of shares of private benefits, etc. — remains exactly as before.

In this simple case, an incentive contract is completely described by the wages paid to the manager in the successful and unsuccessful states. We assume limited liability, so the wage can never be less than zero. As is typically the case in these models, the limited liability constraint is binding in the unsuccessful state, so that the wage in this state is exactly zero. Thus all that is left to determine is the wage to division manager i in the successful state, which we denote by w_i.

For a fixed value of w_i, the division manager's total expected income is now $(w_i + \gamma\phi\theta_i H_i^p) f(e_i) + H_i^r g(r_i)$. This implies that if no deal is struck with headquarters, and the division manager goes off and rent-seeks, his rent-seeking activity now satisfies the following modified version of equation (1):

$$H_i^r g'(r_i) - (w_i + \gamma\phi\theta_i H_i^p) f'(h - r_i) = 0 \quad (10)$$

Two observations follow from (10). First, a non-zero incentive payment has exactly the same effect as an increase in the division manager's private-benefit-appropriation parameter γ — it gives him a percentage stake in expected output, and thereby deters unproductive rent-seeking. Second, however, it is impossible for outside investors to completely stop rent-seeking with just a finite incentive payment. Thus while incentive contracts may be useful, they cannot be expected to eliminate the investment distortions that arise when headquarters intervenes and tries to deal with rent-seeking itself.

The precise nature of the investment distortions — in terms of both the magnitude and which division gets favored — continues to depend on the configuration of the B_is, just as before. That is, Propositions 3 and 4 still hold exactly as stated. All that is changed is that the value of B_i now depends not only on the exogenous parameters θ_i, H_i^p, and H_i^r, but also on the endogenously chosen w_i. Specifically, we have this modification of equation (2):

$$B_i = H_i^r g(r_i^n) - (w_i + \gamma\phi\theta_i H_i^p)[f(h) - f(e_i^n)]. \quad (11)$$

where r_i^n is now given by the new first-order condition (10).

The heart of our previous results was that divisions with high values of B tend to get favored in capital budgeting. It turns out that this basic idea carries over even when we allow for headquarters to set the w_is in an optimal fashion. More precisely, we can make the following statement:

Proposition 5: Suppose that in the absence of incentive contracts, $B_1 > B_2$. If it can be unambiguously shown that there is overinvestment in division 1 *without* incentive contracts (i.e., the sufficient conditions in either Proposition 3 or 4 apply), then (i) there is still overinvestment in division 1 with optimally designed incentive contracts, although the magnitude of the overinvestment may be attenuated; (ii) $w_1 \geq 0$ and $w_2 = 0$.

Proof: See the appendix.

The bottom line of the proposition is that any time there was overinvestment in a given division without incentive contracts, there will still be overinvestment in that division with incentive contracts. Thus, our key results continue to apply. This is not to say, however, that incentive contracts have no value. Indeed, a positive incentive payment may be given to the high-B division so as to reduce the amount of overinvestment needed to bribe its manager.

Interestingly, no incentive payment is ever made to the low-B division, which receives a cash bribe. The reason is that from the perspective of outside investors, a cash bribe is the most efficient way of preventing rent-seeking: headquarters can make the cash bribe directly contingent on the rent-seeking behavior of the division manager, whereas incentive contracts can only indirectly discourage rent-seeking. In other words, outside investors get more bang for their buck by allocating to headquarters the discretionary funds for a cash bribe as opposed to setting up an incentive contract for low-B managers.

B. The Choice of $\bar{I}$ and D

To this point, we have been treating the amount of total firm-wide physical investment $\bar{I}$ as a fixed parameter. We have also been assuming that outside investors give headquarters a discretionary budget D that enables them to pay all the cash bribes they would like. The next step is to ask what values of $\bar{I}$ and D emerge from *ex ante* optimization on the part of outside investors.

Consider the optimal choice of D first. The method of analysis is as follows. First, solve the model under the assumption that headquarters is unconstrained in its bribing decisions. This implies an amount of cash that is needed to pay any b_1 or b_2. Now ask whether outside investors can gain by reducing D below $b_1 + b_2$. (Clearly, they will never wish to give headquarters more than $b_1 + b_2$).

To fix ideas, suppose that $B_1 > B_2$. Suppose further that we are in the "non-extreme" case from Proposition 3, with $b_2 = B_2$, and $b_1 = 0$, so that division 1's manager is bribed entirely with overinvestment. If outside investors cut D below B_2, headquarters will be unable to strike a deal with division 2's manager, so he will rent-seek. The cost of this rent-seeking to outside investors is $(1-\phi)H_2^p[f(h) - f(e_2^n)]$. Thus outside investors' decision will turn on a simple comparison of this value to B_2. Clearly, as long as $H_2^r g(r_2^n)$ is small relative to $H_2^p[f(h) - f(e_2^n)]$, it will be preferable for outside investors to preserve the discretionary budget.

But the most important point for our purposes is that no matter what happens to D, the investment outcome is the same in this case. Think of headquarters' problem if it has no cash. It can no longer strike a deal with both divisions. But it can still strike a deal with one division, by using overinvestment. If it is forced to choose, it will certainly prefer to mollify division 1's manager. After all, it is division 1's manager who will take more rents away from headquarters if he is not dealt with; this is why $B_1 > B_2$ in the first place.

This sort of reasoning gives us:

Proposition 6: Suppose $B_1 > B_2$. If it can be unambiguously shown that there is overinvestment in division 1 (i.e., the sufficient conditions in either Proposition 3 or 4 apply) when headquarters is not cash-constrained in its bribing decisions, then there is still overinvestment in division 1 no matter what value of D outside investors choose.

Proposition 6 is analogous to Proposition 5. Put simply, it says that our earlier results about the pattern of investment can never be overturned by allowing outside investors to choose an optimal value of D less than that which would be required to pay all cash bribes.

The optimal choice of $\bar{I}$ is much less interesting for our purposes, in the sense that it does not interact in any meaningful way with any of our previous results. Everything we have derived thus far holds for any value of $\bar{I}$. Nonetheless, for completeness it is worth discussing the determination of $\bar{I}$. In the best of all possible worlds in which outside investors were also managers and there was no rent-seeking, they would choose a level of investment in each division I^{**}, satisfying $k'(I^{**}) = 1$. However, since outside investors must delegate the job of running the company to managers, they receive at most $\phi k(I_i) < k(I_i)$ of the payoff from investment. So there is an underinvestment effect even without any possibility of rent-seeking. This effect carries over to our model with rent-seeking. Thus, the optimal $\bar{I}$ with two divisions will be less than the first-best, $2I^{**}$. Moreover, given that $\bar{I}$ is inefficiently allocated across divisions, this will further reduce the chosen $\bar{I}$.

C. Sequential Bargaining with Division Managers

In the current formulation of the model, headquarters makes simultaneous take-it-or-leave-it offers to both division managers. However, one can obviously imagine alternative bargaining mechanisms. For example, headquarters could deal with the divisions sequentially. To get an idea of how this might work, it is useful to return the simple "non-extreme" case considered in Proposition 3, where the investment opportunities facing the two divisions are symmetric, and where the bribe paid to the higher-B division 1 is all in the form of capital expenditures. Recall that in this case, with simultaneous offers, investment in division 1 satisfies:

$$B_1 = \gamma\phi[k(I_1) - k(\bar{I}/2)]. \tag{12}$$

To make things even more transparent in what follows, we will focus on a situation where the Bs are sufficiently small that we can use the following sort of linear approximation:

$$B_1 \approx \gamma\phi k'(\bar{I}/2)(I_1 - \bar{I}/2), \tag{13}$$

or, equivalently

$$I_1 \approx \frac{\bar{I}}{2} + \frac{B_1}{\gamma\phi k'(\bar{I}/2)}. \tag{14}$$

As was emphasized earlier, in order to bribe division 1's manager with capital expenditures, in this setup there needs to be *overinvestment relative to the efficient level* of $\bar{I}/2$.

The larger B_1, the larger is the indicated overinvestment. Again, this is because, given the simultaneously outstanding offer to division 2, headquarters cannot credibly threaten to reduce the investment below $\bar{I}/2$ if manager 1 does not make a deal.

Things change when headquarters approaches the two divisions sequentially. Suppose it approaches division 1 first, and makes the following speech: "If you turn down my offer, I will go off and negotiate with division 2. Moreover, since you are out of the picture, I will prefer to strike a deal that involves some level of overinvestment with division 2 as opposed to just a cash bribe. Hence I have a credible threat to underinvest *ex post* in your division if we cannot reach an agreement."

More precisely, if headquarters and division manager 1 do not make a deal, the *ex post* rational thing for headquarters to do is to strike an all capital-expenditure deal with division-manager 2 that satisfies:

$$I_2 \approx \frac{\bar{I}}{2} + \frac{B_2}{\gamma\phi k'(\bar{I}/2)} \tag{15}$$

This implies that if division-manager 1 does not agree to a deal, his capital allocation will be only $\bar{I} - I_2 \approx \bar{I}/2 - B_2/(\gamma\phi k'(\bar{I}/2))$, which is obviously less than $\bar{I}/2$. Hence the level of investment that headquarters needs to offer division manager 1 to get him to accept a deal in a sequential-bargaining setting is reduced. Specifically, denoting this new level of investment by I_1^s we have:

$$I_1^s \approx \frac{\bar{I}}{2} + \frac{B_1 - B_2}{\gamma\phi k'(\bar{I}/2)}. \tag{16}$$

Thus, our basic qualitative result still holds — there is still overinvestment in division 1 relative to the benchmark of $\bar{I}/2$, since $B_1 > B_2$.[15] But interestingly, the magnitude of this overinvestment is attenuated — it now depends not on the absolute value of B_1, but rather on the *difference* between B_1 and B_2.

[15] In this setting, it is still straightforward to argue — along the same lines as above — that headquarters will prefer to use overinvestment for the higher-B division, and cash for the lower-B division. That is, it will approach the higher-B division first in a sequential setting.

Which specification of the bargaining mechanism makes more sense? It is hard to say. On the one hand, we think that the result embodied in equation (16) — that significant investment distortions only arise to the extent that there are *differences* in the Bs across divisions — is intuitively appealing. On the other hand, it should be recognized that the sequential bargaining mechanism places a much greater informational burden on division managers than does the simultaneous mechanism. With the simultaneous mechanism, all division manager i needs to know to evaluate an offer is his own B_i (and the efficient level of investment $\bar{I}/2$). In contrast, with the sequential mechanism, the first division manager also needs to know the B of the second division manager. For example, headquarters may claim that the second division manager has a relatively high value of B_2 — say because the second manager has a high value of H_2^r — in an attempt to con the first division manager into accepting a deal with only a modest amount of overinvestment. If the first division manager cannot figure out whether this claim is true or not, the sequential mechanism will not work as we have described.

5. Related Work

This paper is related to several other recent works. We have already noted the piece by Meyer, Milgrom and Roberts (1992). Another paper with some similar features is Rajan and Zingales (1995). Their model of "power struggles" is in many ways quite close to our rendition of rent-seeking — subunits in a firm can choose to devote their efforts either to production (increasing the size of the overall pie) or power grabbing (increasing their share of the pie). In the same spirit as both Meyer et al and us, they argue that subunits with poor prospects will be most inclined to be power-grabbers. Thus a common implication of all three papers is that it may be inefficient for conglomerates to hold on to weak divisions; divestiture would increase value.

Where the models differ is with respect to their implications for the manifestation of the inefficiency. In both Meyer et. al. and Rajan and Zingales, the rent-seeking activities under consideration are *noncontractible*. This means that it is impossible for headquarters to structure any sort of deal — in cash or otherwise — to stop the bad behavior. Consequently, the deadweight costs that arise in these models are literally just the wasted time and energy spent on influence and power-grabbing activities; the are no distortions in capital expenditures.

In contrast, in our model, rent-seeking is *ex post contractible*, so a deal can be (and typically is) struck to eliminate it. At first glance, it would seem that making the rent-seeking activity contractible as in our model would enhance efficiency. And indeed, this would be the case if it were the *principal* (i.e. investors) who made the deal with division managers. But, when it is an *agent* who makes the deal, we obtain the ironic conclusion that *the ability to make a deal can dramatically reduce efficiency.* In other words, investors may be much better off in a world where division managers spend some time rent-seeking, but where capital is allocated efficiently, rather than in our setting, where the reverse outcome is obtained.

In our focus on the question of cash vs. capital as a reward for managers, we are much closer to Rotemberg (1993). In his model, managers are paid off in part with the right to make irreversible investment decisions, because this is a way for headquarters to commit not to renege on a long-term compensation package — cash salaries can always be cut in the future, but an irreversible investment that gives a manager large private benefits cannot be taken away. However, in Rotemberg's framework, such a grant of power to division managers is profit-maximizing; when headquarters allocates power, there is no agency problem, and it acts purely in the best interests of outside investors. Thus Rotemberg has nothing to say, e.g., about why a conglomerate might ever wish to divest particular divisions.[16]

[16]See also Prendergast and Stole (1996) who provide a number of other reaons why intra-firm transactions might *optimally* be done in a non-monetary fashion.

6. Empirical Implications

The main comparative static that emerges from the model is that high-B divisions — those that would get the most from rent-seeking — end up getting more than their efficient share of the capital budget. Thus, the empirical implications of the model hinge on being able to identfy high and low B divisions.

Recall from Proposition 1 that the rent-seeking model implies that, all else equal, the managers of divisions with less valuable assets in place have higher Bs – they are more willing to rent-seek since their opportunity cost of doing so is lower. Thus, the model predicts a kind of "socialist" cross-subsidization in which the divisions with the least valuable assets in place get more than their efficient share of the capital budget.

To to see whether socialist cross-subsidization exists on average, one could examine whether the divisions in a conglomerate with the least valuable assets in place (i.e., those in the lowest-Q or least profitable industries) have systematically higher capital expenditures than comparable stand-alone firms in the same industry.[17] To further make the case that such cross-subsidization is value destroying, one could also check whether those conglomerates where cross-subsidization is particularly acute according to this sort of metric are more likely to: i) trade at a steep "conglomerate discount," (in the sense of Lang and Stulz (1994) and Berger and Ofek (1995)); and ii) ultimately be taken over and broken up.[18]

One important caveat, however, is that these simple empirical predictions may be difficult to detect in the data to the extent that there is a selection effect whereby more talented managers get to manage high-Q divisions. Better managers may also be more effective rent-seekers; in modelling terms this amounts to saying that θ may be correlated with H^r.[19]

[17]Shin and Stulz (1996) present related evidence which is suggestive of inefficient cross-subsidies to low-Q divisions.

[18]Berger and Ofek (1996) demonstrate that higher conglomerate discounts are in fact associated with a greater likelihood of takeover and bustup; however, they do not link these phenomena to divisional investment patterns.

[19]In a slightly different bargaining model, one could probably reach a similar conclusion by assuming that

In order to make clean inferences, one would ideally like to disentangle the extent to which a given division's performance is related to exogenous technological factors (like θ), as opposed to human-capital-related variables (like H_i^p and H_i^r). One advantage of measuring a division's productivity by the Q of its industry *peers* is that this measure is less likely to contain information about the human capital of the individual division managers. Indeed, one can go a step further and try to control for manager-specific human capital directly, perhaps by looking at the extent to which a division *outperforms* its industry. This suggests running a regression with the industry-adjusted capital expenditures of any division i in a conglomerate as the dependent variable and the following four explanatory variables: 1) the performance of the industry to which division i belongs; 2) the perfomance of the industries to which the other divisions in the conglomerate (call them collectively division j) belong; 3) the performance of division i *relative* to its industry; 4) the performance of division j relative to its industry.

In such a regression, we would predict a negative coefficient on 1) and a positive coefficient on 2), to the extent that these variables are giving us clean measures of θ_i and θ_j, respectively. The predictions for 3) and 4) are much less clear cut, because strong relative-to-industry performance is potentially associated with high values of *both* H_i^p and H_i^r, which have opposing effects in our model.[20]

In addition to these predictions, our analysis of incentive contracts highlights the relationship between internal capital allocation and managerial compensation. Specifically, Proposition 5 implies that there should be higher-powered incentive contracts (i.e., a steeper pay-for-performance schedule) in a firm's higher-B divisions, where overinvestment is po-

more talened managers have better outside options and hence can hold up headquarters for a greater share of the rents.

[20]Note that if a firm is liquidity constrained and is allocating capital efficiently, then one would expect to see a positive relationship between industry adjusted capital expenditures and divisional performance as measured by 1) and 3) and a negative relationship between industry adjusted capital expenditures and the other divisions' performance as measured by 3) and 4). This effect would make it harder to find the socialism effect in which we are mainly interested.

tentially more of a problem. While this strikes us as an interesting possibility, a couple of caveats are in order. For one, despite the fact that we predict higher-powered incentives in high-B divisions, we also simultaneously predict a higher *level* of cash compensation in low-B divisions; these two effects may be hard to disentangle in the data. Also, even if one can isolate pure pay-for-performance, one must be careful (as above) in associating high values of B with low values of observable productivity measures like Q. For example, it is plausible that the marginal product of managerial talent is higher in high-Q divisions. If this is the case, one might expect a countervailing tendency toward higher-powered incentives in these high-Q divisions as a device to screen out less talented managers.

7. Conclusions

Although we have couched our model in terms of corporate headquarters allocating capital to divisions, we believe it captures a more general and broadly applicable point about how organizations work. In its most basic form, our key insight is that when any agent i inside an organization wishes to get any other agent j to do something, he will likely try to pay for this not with cash, but rather by directing to agent j an extra share of the resources over which he (i) has allocative authority. Our model has considered an especially simple case where it is exogenously assumed that headquarters (i.e., the CEO) is the only one with any meaningful authority to allocate resources. But in reality, a wide range of agents throughout any organization have some authority to allocate resources, and non-monetary exchanges are pervasive.

Because these non-monetary exchanges are typically inefficient in our framework, a potentially important element of organizational design centers on how spreading or concentrating the power to make resource-allocation decisions affects efficiency. To see the sorts of issues that might arise, consider an example of a business school faculty that must make decisions in two different areas: 1) it must choose which new faculty to recruit; and 2) it must assign existing faculty to teaching particular courses. Now compare two organizational design options. In the first case, a single individual is given the authority to make both decisions. In the latter, two separate people are put in change of recruiting and course staffing.

On the one hand, the latter, two-headed option might well offer the advantage of specialized expertise in decision making — in other words, if somebody is responsible for just recruiting and nothing else, he is more likely to become more informed about the candidates. On the other hand, dividing up the authority in this way could conceivably increase the scope for inefficient "favor-trading." For example, the course-staffing chair might give a particularly light teaching load to the recruiting chair in exchange for being allowed to hire his favorite candidate. It might be interesting to model these sorts of tradeoffs more explicitly, and to draw out their implications for organizational design.

Appendix

Proof of Proposition 2: The Lagrangian expression for this optimization problem can be written:

$$L = (1-\gamma)\phi[k(I_1) + k(\bar{I} - I_1)] - b_1 + \lambda\{b_1 + \gamma\phi[k(I_1) - k(\bar{I}/2)] - B_1\}. \qquad (17)$$

Note that we have imposed the constraint $I_1 + I_2 = \bar{I}$.

Differentiating (17) with respect to b_1 and I_1 we have the following first-order conditions:

$$\frac{\partial L}{\partial b_1} = -1 + \lambda \leq 0. \qquad (18)$$

$$\frac{\partial L}{\partial I_1} = (1-\gamma)\phi[k'(I_1) - k'(\bar{I} - I_1)] + \lambda\gamma\phi k'(I_1) \leq 0. \qquad (19)$$

There are two cases to distinguish. In the first, the inequality (18) is strict — i.e. $\lambda < 1$, which implies that $b_1 = 0$. Given the standard assumption that $k'(0) = \infty$, $I_1 > 0$ and (19) holds with equality. Thus, after some rearranging, (19) implies that λ is less than one (and hence $b_1 = 0$), provided

$$\frac{k'(I_1^b)}{k'(\bar{I} - I_1^b)} > 1 - \gamma. \qquad (20)$$

where I_1^b is the value of I_1 that satisfies the bribery constraint (5) with equality when $b_1 = 0$. From (5) it follows that I_1^b is increasing in B_1. Given the concavity of $k(.)$, the left-hand-side of (20) is decreasing in I_1^b and it is equal to 1 at $B_1 = 0$. Thus, (20) is satisfied at $B_1 = 0$ and for all $B_1 > 0$ but less than $\bar{B}_1$ where $\bar{B}_1$ satisfies $\frac{k'(I_1)}{k'(\bar{I}-I_1)} = 1-\gamma$ and $\gamma\phi[k(I_1) - k(\bar{I}/2)] = \bar{B}_1$ simultaneously.

In the second case, (20) is violated, so that $b_1 > 0$ at an optimum and $\lambda = 1$. I_1 therefore satisfies the first-order condition (19) which is equivalent to

$$\frac{k'(I_1)}{k'(\bar{I} - I_1)} = 1 - \gamma. \qquad (21)$$

Given this I_1, b_1 is the value that satisfies the bribery constraint (5) with equality.

Proof of Proposition 3: The optimal package maximizes (9) subject to the two bribery constraints (7) and (8), the constraints that $b_i \geq 0$, and $I_1 + I_2 = \bar{I}$. Let λ_1 be the Lagrange multiplier on division-1's bribery constraint (7), and let λ_2 be the Lagrange multiplier on division-2's bribery constraint (8). The first-order conditions for a maximum are:

$$\frac{\partial L}{\partial b_1} = -1 + \lambda_1 \leq 0 \qquad (22)$$

$$\frac{\partial L}{\partial b_2} = -1 + \lambda_2 \leq 0 \tag{23}$$

$$\frac{\partial L}{\partial I_1} = (1-\gamma)\phi[k'(I_1) - k'(I_2)] + \lambda_1\gamma\phi[k'(I_1)(1-U(I_1))] - \lambda_2[k'(I_2)(1-U(I_2))] \leq 0 \tag{24}$$

where

$$U(I_i) = \begin{cases} 1 & \text{if } I_i < \bar{I}/2 \text{ (underinvestment in division i)} \\ 0 & \text{if } I_i \geq \bar{I}/2 \text{ (overinvestment in division i)} \end{cases} \tag{25}$$

(i) To see that I_1 does not equal I_2 at an optimum, suppose to the contrary that it does. In this case $b_i = B_i$ to satisfy both bribery constraints. Consider the following perturbation: increase I_1 by a small amount ϵ and reduce I_2 by an equal amount. Now reduce b_1 by $\delta = \gamma\phi[k(\bar{I}/2+\epsilon) - k(\bar{I}/2)]$ so that division-1's bribery constraint continues to be satisfied. Note that division 2's bribery constraint is still satisfied despite the lower level of investment. Headquarters distorts investment slightly away from the first best, thereby losing

$$(1-\gamma)\phi\{[k(\bar{I}/2) - k(\bar{I}/2-\epsilon)] - [k(\bar{I}/2+\epsilon) - k(\bar{I}/2)]\}.$$

On the other hand, it saves $\gamma\phi[k(\bar{I}_2+\epsilon) - k(\bar{I}/2)]$ in cash bribes. Thus, the net effect of the perturbation is proportional to

$$[k(\bar{I}/2+\epsilon) - k(\bar{I}/2)] - (1-\gamma)[k(\bar{I}/2) - k(\bar{I}/2-\epsilon)] \tag{26}$$

At $\epsilon = 0$, (26) is zero. But, an infinitesimal increase in ϵ raises the first term by $k'(\bar{I}/2)$ while lowering the second term by $(1-\gamma)k'(\bar{I}/2)$, the net effect of which is positive. Thus, there exists an $\epsilon > 0$ which raises headquarters' expected payoff.

(ii) Without loss of generality, suppose that $B_1 > B_2$. We want to show that $I_1 > \bar{I}/2 > I_2$. Suppose to the contrary that $I_2 > I_1$. Also suppose that $b_2 = 0$, i.e., that the bribe to division 2 is paid all in overinvestment and not in cash. Let I_2^b, be the value of I_2 that solves the division-2 bribery constraint (8) with equality and $b_2 = 0$. This will be optimal given overinvestment in division 2 provided that $\lambda_2 < 1$, which from (23) and (24) will be the case provided that

$$\frac{k'(I_2^b)}{k'(\bar{I} - I_2^b)} > 1 - \gamma. \tag{27}$$

In this case $b_1 = B_1$.

We now show that there exists an alternative package that results in higher expected payoffs to headquarters. First, reduce division 1's cash bribe to $B_1 - B_2$, giving B_2 in cash to division 2. (This leaves total cash bribes unchanged). Now switch investment levels of the two divisions, i.e., give division 1 investment of I_2^b and give division 2 investment of $\bar{I} - I_2^b$.

It is easy to see that both bribery constraints continue to be satisfied and that headquarters is made neither better nor worse off by this change.

Now increase I_1 by an infinitesimal amount, ϵ and reduce I_2 by the same amount. To keep division 1's bribery constraint unchanged, reduce the cash bribe by $\gamma\phi k'(I_1)$. Note that division 2's bribery constraint is unaffected by the reduction in I_2 so that its bribe need not be increased. The net effect on headquarters' payoff is

$$\gamma\phi k'(I_1) + (1-\gamma)\phi[k'(I_1) - k'(I_2)]$$

which can be rewritten as

$$\phi\{k'(I_2^b) - (1-\gamma)k'(\bar{I} - I_2^b)\} \tag{28}$$

given that we have set $I_1 = I_2^b$ and $I_2 = \bar{I} - I_2^b$. Since we have already assumed that $\frac{k'(I_2^b)}{k'(\bar{I}-I_2^b)} > 1-\gamma$ (to ensure that only cash bribes for division 2 are optimal), (28) is positive. Thus, overinvesting in division 2 is not optimal if the above condition is met. The optimal solution is to overinvest in division 1.

Proof of Proposition 4: Suppose, without loss of generality that $B_1 > B_2$. We will argue by contradiction. Suppose that it is division 2 that gets the overinvestment. Moreover, suppose that *all* of division 2's bribe is paid in the form of overinvestment. In order for this to be optimal, it must be that:

$$\frac{(1+\alpha\theta_2)k'(I_2^b)}{(1+\alpha\theta_1)k'(\bar{I} - I_2^b)} > 1-\gamma. \tag{29}$$

This condition follows from the first-order conditions for b_2 and I_2. It is analogous to the one in Proposition 3 when the divisions have identical investment opportunities.

Under this contract,

$$B_2 = \gamma\phi(1+\alpha\theta_2)[k(I_2^b) - k(I_2^*)] \tag{30}$$

and $B_1 = b_1$. In this case, headquarters receives expected payoffs of

$$(1-\gamma)\phi[(1+\alpha\theta_2)k(I_2^b) + (1+\alpha\theta_1)k(\bar{I} - I_2^b)] - B_1. \tag{31}$$

We will now demonstrate that in certain circumstances it is possible to increase headquarters' expected payoff by moving to a new solution where division 1 is paid off entirely with overinvestment. Under the proposed switch

$$B_1 = \gamma\phi(1+\alpha\theta_1)[k(I_1^b) - k(I_1^*)] \tag{32}$$

and $B_2 = b_2$. Headquarters' expected payoff is

$$(1-\gamma)\phi[(1+\alpha\theta_2)k(\bar{I}-I_1^b)+(1+\alpha\theta_1)k(I_1^b)]-B_2. \quad (33)$$

The difference in the payoff to headquarters is proportional to

$$\begin{aligned} Z \equiv\ & (1+\alpha\theta_1)\left[k(I_1^b)-k(I_1^*)+(1-\gamma)[k(I_1^*)-k(\bar{I}-I_2^b)]\right] \\ & -(1+\alpha\theta_2)\left[k(I_2^b)-k(I_2^*)+(1-\gamma)[k(I_2^*)-k(\bar{I}-I_1^b)]\right]. \end{aligned} \quad (34)$$

For the proposed switch to increase headquarters' payoff, Z must be strictly positive. Using first-order Taylor series approximations, we can show that

$$\begin{aligned} Z >\ & (1+\alpha\theta_1)[k'(I_1^b)(I_1^b-I_1^*)+(1-\gamma)[k'(I_1^*)(I_2^b-I_2^*)]] \\ & -(1+\alpha\theta_2)[k'(I_2^*)(I_2^b-I_2^*)+(1-\gamma)[k(\bar{I}-I_1^b)(I_1^b-I_1^*)]] \\ =\ & (I_1^b-I_1^*)[(1+\alpha\theta_1)k'(I_1^b)-(1-\gamma)(1+\alpha\theta_2)k'(\bar{I}-I_1^b)] \\ & -(I_2^b-I_2^*)[(1+\alpha\theta_2)k'(I_2^*)-(1-\gamma)(1+\alpha\theta_1)k'(I_1^*)]. \end{aligned} \quad (35)$$

Thus, a sufficient condition for the proposed switch to increase headquarters' payoff is for (35) to be positive, or rearranging, if

$$(I_1^b-I_1^*)[(1+\alpha\theta_1)k'(I_1^b)-(1-\gamma)(1+\alpha\theta_2)k'(\bar{I}-I_1^b)] > (I_2^b-I_2^*)[\gamma(1+\alpha\theta_1)k'(I_1^*)]. \quad (36)$$

Proof of Proposition 5: Let $B_i(w_i)$ denote the value of B for division i given an incentive wage of w_i. Suppose $B_1(0) > B_2(0)$. And, suppose that at $w_i = 0$ it is optimal to overinvest in division 1 — $I_1 = I_1^b$ with no cash bribe ($b_1 = 0$) — and to underinvest in division 2 with $b_2 = B_2$. One can show that even with incentive contracts, headquarters will continue to prefer to overinvest in division 1.

First, we show that it never pays to set $w_i > 0$ for a division i that is underinvesting. The potential benefit of increasing w_i is that it lowers B_i: from (11) and the envelope theorem it follows that

$$\frac{dB_i(w_i)}{dw_i} = -[f(h)-f(e_i^n)] < 0. \quad (37)$$

Thus, the cash bribe b_i is lowered which helps outside investors since this reduces the discretionary budget, D, by that amount. However, an increase in w_i raises incentive payments by $f(h)$ (given that there is no rent-seeking in equilibrium). So the net effect of increasing the w_i of an underinvesting division is $-f(e_i^n) < 0$.

Thus, if $B_1(0) > B_2(0)$, the only way that $B_1(w_1)$ could be less than $B_2(w_2)$ is if $w_1 > w_2$. But in the case that $B_1(w_1) < B_2(w_2)$ we have shown that w_1 would have to equal zero, since division 1 would be underinvesting. This is a contradiction. As a result, $B_1(w_1) \geq B_2(w_2)$ and $w_2 = 0$ at an optimum. Since $B_1(w_1) \leq B_1(0)$, the conditions of Propositions 3 and 4 that outline the conditions under which $I_1 = I_1^b$ and $b_2 = B_2$ continue to be met. Thus, headquarters will continue to overinvest in division 1 and underinvest in division 2.

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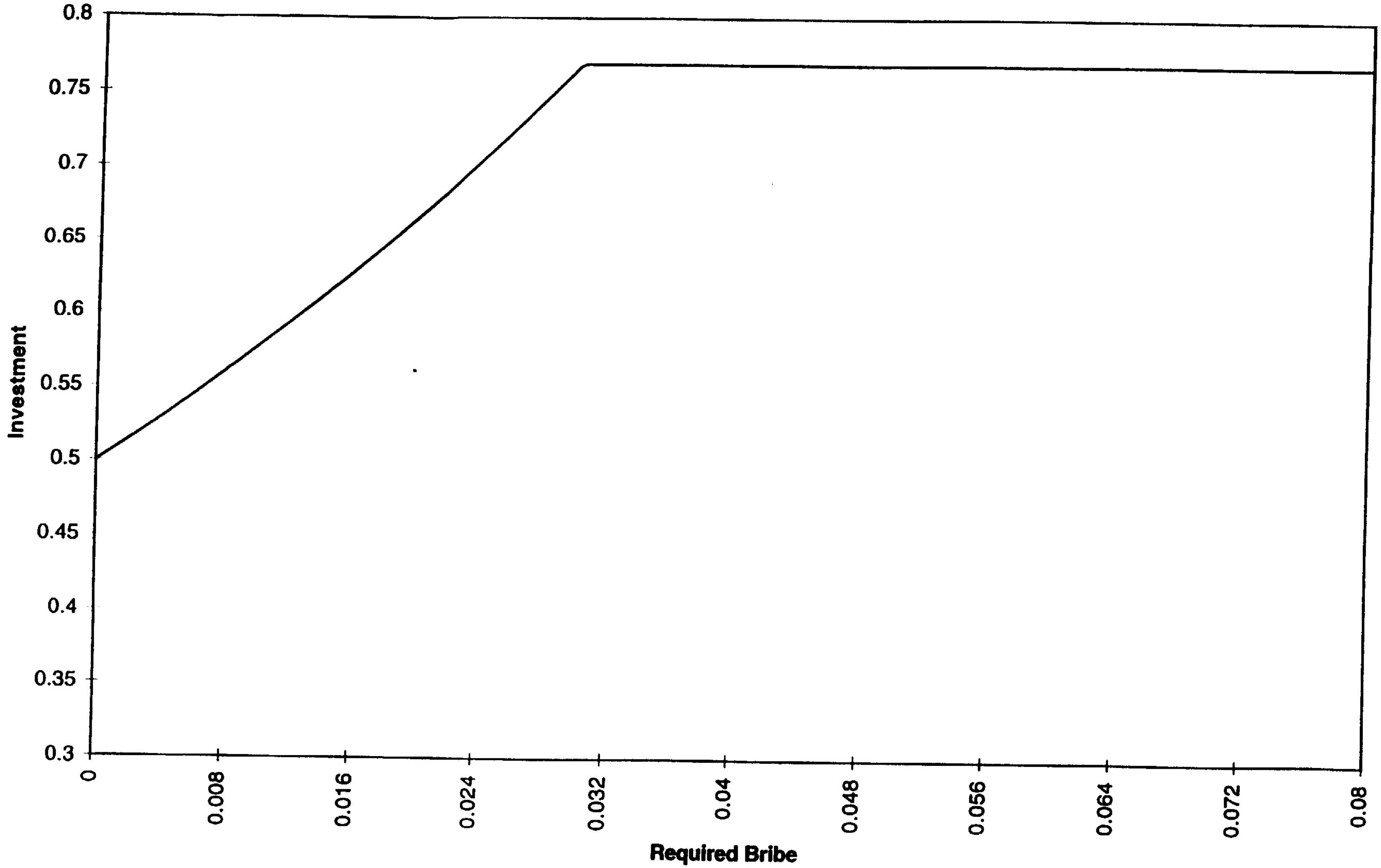
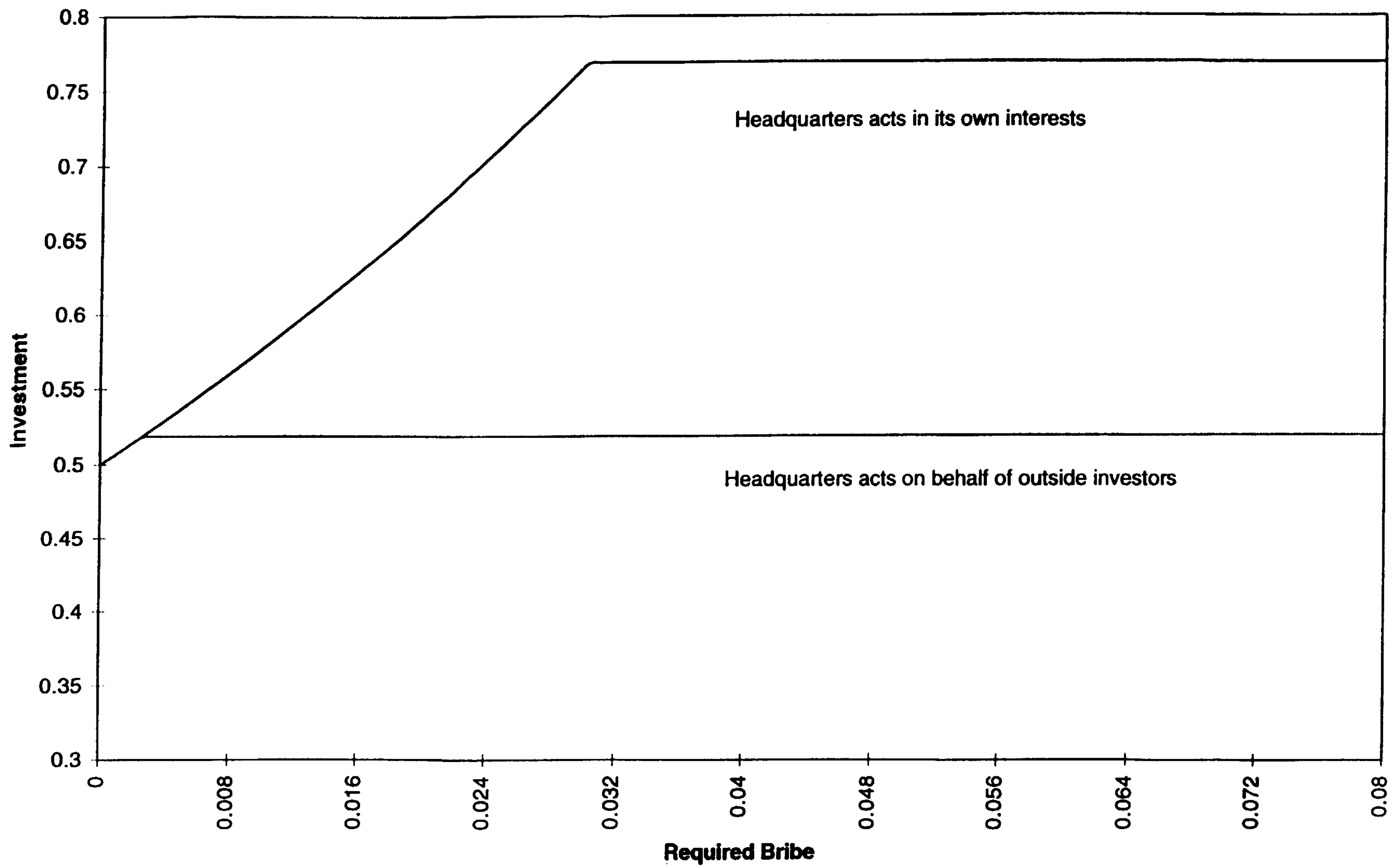
Figure 1: Investment as a Function of the Required Bribe



Note: In this example, the parameters are set as follows: $\bar{I} = 1$; $k(I) = \log I$; $\gamma = .7$; $\phi = .1$.

Figure 2: The Effect of Delegating Bribing Decision to an Agent



Note: In this example, the parameters are set as follows: $\bar{I} = 1$; $k(I) = \log I$; $\gamma = .7$; $\phi = .1$.