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On the Value of Influence Activities for Capital Budgeting

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Abstract

While the literature typically focuses on the "dark side" of influence activities, this paper highlights potential benefits. In particular, I show that a capital budgeting procedure in which the division manager is required to fight for funds i) controls his tendency to exaggerate project prospects and ii) motivates him to acquire productive information. Consequently, and in contrast to what has frequently been argued, lobbying activities may improve the efficiency of capital allocation. Moreover, I characterize the trade off between motivating a high level of information-acquisition and motivating a proper use of the acquired information.

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1 Introduction

There is an extensive literature that focuses on the dark side of influence activities.[1] Inefficiencies arise because division managers waste time and effort in an attempt to influence headquarters for their own benefit (Milgrom 1988; Milgrom and Roberts 1990; Meyer, Milgrom and Roberts 1992). Managers may take actions that establish qualifications for a key job or improve their bargaining power but do not contribute to firm value (Milgrom and Roberts 1988; Shleifer and Vishny 1989). Particularly recent research on internal capital markets stresses the negative consequences of influence activities for capital budgeting. There is widespread concern that rent seeking behavior leads to a misallocation of funds among divisions (Rajan, Servaes and Zingales 2000; Scharfstein and Stein 2000; Wulf 2000)[2].

In contrast to this literature, the focus of my paper is on potential benefits of influence activities. I show that lobbying for capital may not necessarily result in a distorted capital allocation. Rather it may help to improve the efficiency of capital allocation. Previous research typically emphasizes the costs influence activities impose on headquarters. However, fighting for capital may also be costly to division managers (e.g., effort costs).[3] My focus on the managers' influence effort costs leads to a new point of view. In particular, I show that the *willingness* of managers to engage in privately costly influence activities reveals valuable information. For this reason, influence activities may be valuable to the firm even when they are completely unproductive.

I model the desire for capital by assuming that division managers enjoy private benefits of control. These benefits increase with the value of the assets under control, i.e., with the capital allocated and the quality of the project under consideration (Har-

[1] Influence activities are activities undertaken by managers to increase their power, resources under control or compensation. Alternative expressions are rent- or power-seeking.

[2] See also Stein (2001) for an overview.

[3] Influence activities that are costly to managers are assumed, e.g., in Meyer, Milgrom and Roberts (1992), Bagwell and Zechner (1993) and Wulf (2000).

ris and Raviv 1996, 1998; Stein 1997). One well known implication of this assumption is that division managers will not voluntarily disclose unfavorable information, e.g., low project quality. Instead, they tend to make a report that results in the highest capital allocation in order to maximize their private benefits.

In this context, I show that a capital budgeting procedure, which involves influence activities, controls the manager's empire-building preferences. To fix the idea, consider a capital budgeting procedure in which the amount of capital allocated to the manager is an increasing function of the level of influence exerted by the manager. Obviously, this procedure counteracts the manager's tendency to exaggerate capital requirements (i.e., the project quality) because higher capital allocations involve higher levels of influence effort. From the manager's point of view, it is worthwhile to fight for a high capital allocation only if the benefits associated with this capital allocation exceed the personal cost of fighting. Since the manager's benefits are correlated with the project's profits, the influence level chosen by the manager reveals the project quality.[4] As a result, the net present value maximizing capital allocation can be achieved.

In addition, I show that a capital budgeting procedure that requires the manager to fight for funds motivates him to exert research effort to acquire information about the project. The manager's research incentives arise from his wish to be able to base his influence decision on more accurate information about project prospects. Intuitively, the manager wants to avoid to fight for a project that is of low quality because such a project involves only low benefits of control. However, motivational problems exist with respect to both the acquisition and exploitation of the manager's information. I show that these control problems interact and characterize the trade off between motivating a high level of information-acquisition and motivating a proper use of the acquired information. This trade off results in ex post over- or underinvestment.

The positive incentive effects offer a new rationale for (unproductive) influence

[4]More precisely, this result holds because it is assumed that the manager benefits more from a capital allocation increase when the quality of the project is high than when it is low (i.e., the single crossing property holds). This assumption is satisfied, for example, if the empire benefits are a linear function of cross profits.

activities.[5] Headquarters should not ignore or even punish attempts at influence but rather stimulate these activities to elicit private information or to motivate information-acquisition.[6] Interestingly, these results may rationalize observed capital budgeting practices. Ross (1986) observed that "If division management wanted to, they could increase this capital allocation by making a good case for it. But this would require a major effort and would use up some of the division's "credit" with corporate headquarters." (p. 18).

The analysis in this paper has two interesting implications. First, a centralized capital budgeting procedure is preferred to a decentralized approach: The authority over investment funds gives headquarters the (valuable) power to impose influence activities on the manager. This result differs from previous arguments, where having discretion over capital funds is considered as being problematic because it makes headquarters vulnerable to wasteful influence activities (Scharfstein and Stein 2000). Moreover, this result sheds more light on the empirical finding that in general the capital budgeting process is centralized in firms (Scapens and Sale 1981; Stanley and Block 1984). Second, influence activities may substitute for wage payments to create incentives and, thus, may reduce the expected wage costs. Interestingly, when compensation payments can be based on the report only (because realized profits are not verifiable), influence activities can provide exactly the same incentives as compensation payments.

[5] In previous articles, the economic rationale for wasteful influence activities is that managers try to manipulate information to increase their benefits (Milgrom and Roberts 1988; Meyer, Milgrom and Roberts 1992) or to strengthen their bargaining position (Shleifer and Vishny 1989). In my paper, influence activities neither distort signals nor do they strengthen the bargaining position.

[6] Note that the model can also be applied to other relationships such as an entrepreneur and a (relatively) uninformed bank or a potential student and a business school. Banks may have an interest in complicating the lending process (e.g., by requiring detailed business plans) in order to attract only managers that are really convinced of their new investment idea. In the same way business schools may require elaborate letters of application in order to attract only students that are convinced of their abilities and/or to urge them to think twice about whether they really want to join the school prior to applying (and not after being accepted).

As already mentioned, there is a large literature on the costs of unproductive influence activities. But only a few papers discuss the potential value of these activities. Lobbying for capital may come in different guises. Making elaborate presentations in meetings or submitting project proposals that include financial analyses are two examples. These activities may be valuable because some hard (i.e., verifiable) information is produced (Rotemberg and Saloner 1995) or because expending effort on additional documentation "hardens" information that would otherwise be soft (Stein 2002).[7] In contrast, I do not assume that influence activities directly generate information. Rather, I show that the manager's willingness to engage in influence activities may do so.

Apart from the influence activities literature, my paper is also related to several recent studies on capital budgeting. Harris and Raviv (1996, 1998) and Bernardo, Cai and Luo (2001) consider models in which the division manager is initially informed about the project quality and enjoys empire benefits.[8] While Harris and Raviv (1996, 1998) analyze the incentive impact of internal auditing procedures, Bernardo, Cai and Luo (2001) study the role of compensation in controlling the manager's empire-building preferences. The current paper contributes to this literature by emphasizing the role of influence activities to counteract the manager's tendency to overstate project prospects. Studies that investigate how to motivate the manager to acquire costly information include Lambert (1986) and Stein (2002). Lambert (1986) shows that headquarters optimally induces over- or underinvestment in a risky project in order to decrease the expected wage cost of motivating the manager to become informed. In contrast to Lambert (1986), in my paper the manager chooses a probability of obtaining information at a personal cost that is increasing in the probability. The advantage of inducing an ex post inefficient investment decision based on the

[7] In these papers, however, the manager engages too much (from headquarters' point of view) in generating hard information.

[8] See also Harris, Kriebel and Raviv (1982), Antle and Eppen (1985), Arya, Glover and Young (1996) and Antle and Fellingham (1997) for models in which the manager prefers larger capital allocations to smaller ones.

acquired information is that it increases the ex ante probability of acquiring information. Stein (2002) shows that the division manager has greater incentives to gather (soft) information about projects when the authority over investment decisions rests with him rather than with headquarters.[9] In the current paper, the reverse is true: Information-acquisition is motivated by imposing influence activities on the manager which requires headquarters to have the authority over the capital allocation. Other papers that deal with information-acquisition are, e.g., Demski and Sappington (1987), Prendergast (1993), Lewis and Sappington (1997), Cremer, Khalil and Rochet (1998) and Laux (2001). None of these papers, however, studies the role of influence activities (or other activities) in motivating the manager to gather information.

The remainder of this paper is organized as follows. The basic model is developed in section 2. In Section 3, I discuss some implications of the main results and the robustness of the model.

2 A Capital Budgeting Model

2.1 Basic Structure

Consider a decentralized firm with two parties, headquarters and the division manager. Headquarters acts in the interest of owners and the division manager maximizes his own utility. I assume that the manager has no private wealth and that he can leave the firm at any time. All parties are risk-neutral and only one period is considered. The risk-free rate of return and manager's reservation utility is normalized to zero.

The division manager proposes a new project. The project's gross profits, $x(I, \theta)$, depend on the project quality, $\theta \in \left[\underline{\theta}, \overline{\theta}\right]$, and the investment level, I. Headquarters is uninformed about the quality θ but it is commonly known that θ follows a distribution function F with positive density f. The gross profits are increasing in the project

[9] In Stein (2002), the division manager enjoys empire benefits and faces two investment projects. Given a fixed capital budget, the manager is motivated to acquire information about the quality of the projects in order to be able to allocate the scarce capital efficiently between the two projects.

quality and increasing and strictly concave in the investment level. Thus, given the quality, there exists a unique capital input, $I^n(\theta)$, that maximizes net present value (NPV); $V(I,\theta) = x(I,\theta) - I$. Moreover, I assume that the marginal product of capital is increasing in the quality, i.e., $\frac{\partial^2 x(I,\theta)}{\partial I \partial \theta} > 0$. This implies that the NPV maximizing level of investment, $I^n(\theta)$, is increasing in θ.

The manager is personally interested in the investment decision because he enjoys private benefits of control, $b(I,\theta) > 0$, if the project is realized. These benefits are increasing in the project quality and in the investment level.[10] Moreover, I assume that the manager benefits more from a capital investment increase when the project quality is high than when it is low, i.e., $\frac{\partial^2 b(I,\theta)}{\partial I \partial \theta} > 0$.[11] This is the case, for example, when the benefits of control are a linear function of cross profits.

The manager is able to engage in influence activities. The level of influence effort exerted by the manager is denoted by c. For simplicity, assume that the disutility of exerting influence c is simply c. Moreover, I assume that the level of influence effort c is observable by headquarters. While this is an extreme assumption, it does not seem to be too unrealistic, since headquarters is in a position to "invent", if necessary, a suitable influence activity that satisfies this condition. (See also the discussion in section 3.3.) It is reasonable to assume, however, that the level of influence c is not verifiable. Hence, headquarters cannot design an enforceable contract that specifies the influence effort the manager has to incur. The manager will only engage in influence activities if he knows that this results in a preferred investment decision. In order to concentrate solely on the incentive impacts of influence activities, I assume that: i) influence activities are completely unproductive, in the sense that they do not produce any valuable outcome or generate verifiable information; ii) influence activities neither destroy value nor keep the manager from doing his regular job. To sum up, i) and ii) imply that influence activities do not directly affect the value of the

[10] This is a common assumption in the literature that deals with empire building (Harris and Raviv 1996, 1998; Bernardo, Cai and Luo 2001; Stein 1997, 2002).

[11] This assumption is referred to as the single crossing property because it makes sure that the manager's indifference curves can only cross once.

firm. In section 3.4, I show that these two assumptions are not crucial for the main results.

Finally, the manager has preferences that are linear and additively separable into the private benefits of control, $b(I,\theta)$, the influence effort, c, the research effort, e, (introduced in section 2.3) and the wage payment, w, (introduced in section 3.2) of the form: $b(I,\theta) - c - e + w$.

2.2 Eliciting Private Information

In this section I assume that the manager is perfectly informed about the project quality θ.[12] This information is, of course, valuable to headquarters because it wants to allocate more capital to higher quality projects. However, the manager's empire-building preferences generate a conflict of interest between the two parties. The manager will not voluntarily disclose bad information (low θ) to headquarters but rather tends to announce the quality that results in the highest capital allocation. Headquarters must therefore install an incentive device that motivates the manager to report the true quality. One frequently described disciplining device is a wage contract: To keep the manager from always overstating project prospects, the compensation paid to the manager must decrease with reported quality.[13] Interestingly, there exists another way to control the manager's empire-building preferences. Headquarters can simply require the manager to engage in influence activities prior to the investment.

Consider a message-contingent mechanism where the manager is asked to send a report $\widehat{\theta}$. Headquarters responds to the message $\widehat{\theta}$ according to a prespecified scheme $\langle I(\widehat{\theta}), c(\widehat{\theta})\rangle$ where $I(\widehat{\theta})$ is the capital amount approved for the project and $c(\widehat{\theta})$ is the level of influence the manager has to exert. In other words, headquarters announces that it will allocate the amount $I(\widehat{\theta})$ if the manager reports $\widehat{\theta}$ and exerts influence $c(\widehat{\theta})$. The following proposition provides the main result of this section:

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[12] Due to the limited liability assumption it does not matter whether the manager receives the private information prior or after signing the contract.

[13] See Bernardo, Cai and Luo (2001).

Proposition 1 *The required influence effort controls the manager's empire-building preferences. The optimal mechanism, given by*

$$\begin{aligned} c^*(\theta) &= b\left(I^*(\theta),\theta\right) - \int_{\underline{\theta}}^{\theta} \frac{\partial b(I^*(\tau),\tau)}{\partial \tau} d\tau - b(I^*(\underline{\theta}),\underline{\theta}), \\ I^*(\theta) &= I^n(\theta), \end{aligned}$$

induces truth-telling, guarantees that the manager participates and ensures that the NPV is maximized for every project quality.

Proof: See the Appendix.

The need to exert influence $c^*(\theta)$ prior to the capital allocation $I^*(\theta)$ imposes discipline on the manager. The influence level $c^*(\theta)$ is increasing in the reported quality and, thereby, counteracts the manager's tendency to overstate project prospects.[14] More precisely, the manager does not find it advantageous to exaggerate the quality because the added burden of influencing offsets the added empire benefits associated with an increase in I. On the other hand, the manager will not understate the project quality. The screening of project qualities is possible because the manager is more eager to fight for funds when the project's profitability is high than when it is low.[15] In the optimal scheme $I^*(\theta)$ equals the NPV maximizing level of investment, $I^n(\theta)$. This has two reasons: First, influence activities do not directly affect the value of the firm.[16] Second, headquarters cannot internalize the manager's private benefits of control because the manager is not wealthy and influence activities are unproductive. Consequently, headquarters considers the financial returns of the investment only. Note that the investment level $I^n(\theta)$ is optimal not only ex ante but also ex post, i.e., after the manager has revealed the private information.

The optimal mechanism discussed so far can be nicely reinterpreted. Note that the message in the optimal mechanism can be replaced by the influence decision

[14] Note that $\frac{dc^*(\theta)}{d\theta} = \frac{\partial b(I^*(\theta),\theta)}{\partial I}\frac{dI^*(\theta)}{d\theta} + \frac{\partial b(I^*(\theta),\theta)}{\partial \theta} - \frac{\partial b(I^*(\theta),\theta)}{\partial \theta} \geq 0$.

[15] Remember, the single crossing property, $\frac{\partial^2 b(I,\theta)}{\partial I \partial \theta} > 0$, holds.

[16] See section 3.4 for a discussion of the optimal investment level $I^*(\theta)$ when influence activities directly increase or decrease the value of the firm.

made by the manager.[17] Instead of reporting the message, the manager directly chooses the level of influence. The reinterpreted capital budgeting procedure is as follows: Headquarters initially imposes the spending limit $I^*(\underline{\theta}) \geq 0$ on the manager. That is, the manager is free to invest in the project up to this level. The spending limit is flexible, however, in the sense that the manager can increase it if he chooses to influence. More precisely, if the manager exerts influence $c^*(\theta)$ where $\theta > \underline{\theta}$, headquarters increases the spending limit to the level $I^*(\theta)$. As already mentioned, the manager finds it advantageous to choose a high level of influence only if the project is of high quality. Hence, a capital budgeting procedure in which the capital allocation is increasing in the level of influence activities results in a desirable outcome - from the headquarters' point of view.

Finally, it is interesting to note that the manager cannot exploit his private information and, therefore, does not capture informational rents. Rather, the opposite is true: The unobservability involves "informational costs" to the manager as he is required to engage in influence activities. The manager would be better off if the information were observable by headquarters or, equivalently, if the manager could "harden" the information and credibly pass it on to headquarters. Then there would be no need to impose influence activities on the manager in order to screen the private information.

2.3 Motivating Information-Acquisition

In contrast to the previous section, I now assume that there is no initial information asymmetry between headquarters and the manager. Rather, there is a difference in their ability to acquire information. If the division manager exerts research effort e, he uncovers the project quality θ with probability $p(e) \in [0, 1)$. That is, the manager becomes perfectly informed about the quality with probability p and remains

[17] The level of influence effort exerted by the manager and the message are equivalent means of communication because there is a one to one correspondence between them.

uninformed with probability $(1-p)$.[18] The probability function $p(e)$ is increasing and concave, i.e., $p'(e) > 0$, $p''(e) < 0$. For simplicity, I assume that the disutility of exerting research effort e is simply e. Headquarters, on the other hand, is not able to gather information and does not observe the manager's effort level e.

In this section, I show that headquarters can motivate the manager to exert research effort by imposing influence activities on him. To concentrate on this intention, the model is simplified by assuming that there are only two possible investment levels: $I = 0$ (no investment) or $I = I^o > 0$ (investment). To avoid a trivial solution, I assume that there exists a cutoff value, θ^z (z stands for zero NPV), with the properties $\underline{\theta} < \theta^z < \overline{\theta}$ and $V(I^o, \theta^z) = 0$. Hence, the project has positive NPV if $\theta > \theta^z$ and negative NPV if $\theta < \theta^z$. For simplicity, define $V(\theta) \equiv V(I^o, \theta)$ and $b(\theta) \equiv b(I^o, \theta)$.

As in the previous section, headquarters announces a scheme $\langle I(\widehat{\theta}), c(\widehat{\theta})\rangle$. Note that $c(r) = c(t)$ must hold if $I(r) = I(t)$ for all $r \neq t$. The manager will never send the message r when the message t results in the same investment decision and requires a lower influence level. As there are only two different investment levels, there are at most two different levels of influence activities. Moreover, $c(r) = 0$ must hold if $I(r) = 0$: The manager will not exert influence effort when this results in a project rejection. As in the previous section, the message in the contract can be replaced by the influence decision made by the manager. These considerations imply that it is sufficient to consider the following simple capital budgeting procedure: Headquarters announces that it will approve the project if and only if the manager engages in a certain level of influence activities, given by c_A (A for approval). The remainder of this section is organized as follows: First, the manager's behavior is analyzed given headquarters' approval rule. Second, headquarters' choice of the optimal value of c_A is analyzed under the assumption that headquarters is able to commit to this project approval rule.[19]

[18] The way the information acquisition process is modeled is similar to, e.g., Aghion and Tirole (1997) and Stein (2002).

[19] The assumption that headquarters can commit to a prespecified scheme is common in the capital budgeting literature. See Antle and Eppen (1985), Antle and Fellingham (1997), Harris and Raviv

The Manager's Problem: The project approval rule induces the following behavior:

Proposition 2 *Given that the manager knows θ, he chooses to influence if and only if $c_A < b(\theta)$. Given that the manager does not know θ, he chooses to influence if and only if $c_A < E[b(\theta)]$. The manager exerts research effort ex ante. His optimal effort level e^* is given by*

$$\begin{aligned} p'(e^*) &= \frac{1}{\int_{\underline{\theta}}^{\theta_t} (c_A - b(\theta))\, f(\theta)\, d\theta} \text{ if } c_A < E[b(\theta)] \text{ and} \\ p'(e^*) &= \frac{1}{\int_{\theta_t}^{\overline{\theta}} (b(\theta) - c_A)\, f(\theta)\, d\theta} \text{ if } c_A > E[b(\theta)] \\ \text{with } \theta_t &= b^{-1}(c_A). \end{aligned}$$

Assume that the manager has successfully uncovered the project quality. The informed manager chooses a cutoff value denoted by θ_t (t stands for threshold) such that he exerts influence c_A if and only if the quality is higher than θ_t. To determine the optimal cutoff value, the manager has to solve the problem

$$\max_{\theta_t} \int_{\theta_t}^{\overline{\theta}} (b(\theta) - c_A)\, f(\theta)\, d\theta.$$

The first order condition on θ_t is given by $c_A = b(\theta_t)$. The manager finds it profitable to engage in influence activities if the benefits associated with the project, $b(\theta)$, exceed the influence effort cost c_A. The cutoff value $\theta_t(c_A)$ is an increasing function of c_A. (For notational convenience, the dependency of θ_t on c_A is dropped hereafter.) If, on the other hand, the manager is uninformed, he finds it profitable to exert influence c_A if the expected private benefits, $E[b(\theta)]$, exceed c_A.

More interestingly, the approval rule motivates the manager to exert research effort. The reasoning behind this result is as follows: Since the manager must engage in influence activities to get the project approved, he faces an investment decision. This investment has a well known expense, namely c_A, but an uncertain return, namely $b(\theta)$. Hence, the manager wants to acquire information about the project quality in order to find out whether this investment is worthwhile. The advantage of being

(1996, 1998) and Bernardo, Cai and Luo (2001).

informed is that the manager is then able to base his influence decision on the project quality.[20] To motivate information-gathering, c_A must lie in the range $(b(\underline{\theta}), b(\overline{\theta}))$. Otherwise, the manager would always choose to influence (if $c_A \leq b(\underline{\theta})$) or would always forgo the project (if $c_A \geq b(\overline{\theta})$) without making an effort to become informed.

To derive the manager's optimal research effort level e^* it is necessary to distinguish between the two cases $c_A < E[b(\theta)]$ and $c_A > E[b(\theta)]$. Assume first that $c_A < E[b(\theta)]$. In this situation the manager chooses to influence if he does not know the quality. The manager's choice of the optimal effort level e^* is the solution to the problem

$$\max_e p(e) \left[\int_{\theta_t}^{\overline{\theta}} [b(\theta) - c_A] f(\theta) \, d\theta \right] + (1 - p(e)) [E[b(\theta)] - c_A] - e,$$

where the first (second) term in square brackets is the a priori expected utility of the manager if he is informed (uninformed). Differentiating with respect to e and rearranging yields:

$$p'(e) = \frac{1}{\int_{\underline{\theta}}^{\theta_t} (c_A - b(\theta)) f(\theta) \, d\theta}. \tag{1}$$

Note that the optimal effort level e^* is increasing in c_A.[21] Remember, if the quality is lower than θ_t, the informed manager chooses not to influence. The advantage of being informed is therefore that the informed manager avoids a loss of $(c_A - b(\theta))$ if $\theta < \theta_t$. In other words, the informed manager avoids to fight for a project that is only of low quality. The denominator of (1) represents the a priori advantage of being informed. If c_A increases, the potential loss increases. Consequently, the manager finds it more advantageous to become informed and exerts more research effort.

Assume now that $c_A > E[b(\theta)]$. In this situation, the manager will forfeit the project if he does not know the project quality. The manager solves the problem

$$\max_e p(e) \left[\int_{\theta_t}^{\overline{\theta}} [b(\theta) - c_A] f(\theta) \, d\theta \right] - e.$$

[20] Note that this result holds even in the absence of private benefits of control. In such a situation the manager must be reimbursed for his effort e. Since the manager is protected by limited liability wage payments have a similar effect as private benefits of control.

[21] $\frac{de}{dc_A} = \frac{dp'(e)}{dc_A} / p''(e) = -\frac{(p'(e))^2}{p''(e)} F(\theta_t) > 0.$

(Note that the manager receives a utility of zero if he forfeits the project.) Differentiating with respect to e and rearranging yields:

$$p'(e) = \frac{1}{\int_{\theta_t}^{\overline{\theta}} (b(\theta) - c_A) f(\theta) d\theta}. \tag{2}$$

This time, the optimal effort level e^* is decreasing in c_A.[22] The advantage of being informed is that the informed manager enjoys a utility of $(b(\theta) - c_A)$ if $\theta > \theta_t$ whereas the uninformed manager forgoes the project. The denominator of (2) represents the a priori advantage of being informed. Clearly, if c_A increases, the potential reward of being informed decreases and the manager exerts less research effort.

From this analysis it follows that the strongest research incentives are provided if headquarters chooses $c_A = E[b(\theta)]$. The manager is then indifferent to influencing headquarters if he is uninformed.

Headquarters' Problem: Headquarters' problem is to determine the optimal value of c_A. Headquarters pursues three goals: It wants to motivate the manager i) to exert a high level of research effort, ii) to make a proper investment decision if he has successfully acquired information and iii) to make a proper investment decision if he has not.[23] It is helpful to ignore headquarters' objective iii) for now in order to concentrate solely on i) and ii). I will come back to objective iii) later.

It is already clear that the manager's motivation to gather information is maximized if headquarters chooses $c_A = E[b(\theta)]$. However, given that the manager has successfully uncovered the quality, the optimal level of c_A equals $b(\theta^z)$. This level ensures that the informed manager exerts influence c_A if and only if the project's NPV is positive. Obviously, the two control problems interact if $E[b(\theta)] \neq b(\theta^z)$. Hence, headquarters trades off the benefits of a high probability of acquiring information with the benefits of a proper use of the acquired information. This trade off results in the following proposition:

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[22] $\frac{de}{dc_A} = \frac{dp'(e)}{dc_A} / p''(e) = \frac{\left(p'(e)\right)^2}{p''(e)}(1 - F(\theta_t)) < 0.$

[23] Note that the manager actually makes the investment decision as the project is automatically approved if he exerts influence c_A.

Proposition 3 *Let θ^* be the cutoff value of an informed manager in the optimal solution.*

If $b(\theta^z) = E[b(\theta)]$, *then* $\theta^* = \theta^z$.

If $b(\theta^z) < E[b(\theta)]$, *then* $\theta^* > \theta^z$.

If $b(\theta^z) > E[b(\theta)]$, *then* $\theta^* < \theta^z$.

Proof: See the Appendix.

If $b(\theta^z) = E[b(\theta)]$, the optimal level of c_A is $c_A^* = b(\theta^z)$. In this situation headquarters achieves the best possible outcome: The manager has strong research incentives and makes a proper investment decision based on the acquired information.

Suppose now that $b(\theta^z) < E[b(\theta)]$. Again, if headquarters chooses $c_A = b(\theta^z)$, the informed manager pursues the optimal investment policy. The drawback of $c_A = b(\theta^z)$, however, is that the probability that the manager becomes informed is relatively low. Hence, in order to strengthen the manager's research incentives, headquarters increases c_A. Note that $E[b(\theta)]$ represents an upper limit because the manager's research effort decreases again if this threshold level is passed (see the previous section). Therefore, the optimal c_A^* lies in the range $(b(\theta^z), E[b(\theta)]]$. Since $c_A^* > b(\theta^z)$ implies $\theta^* > \theta^z$, there are qualities $\theta \in (\theta^z, \theta^*)$ for which the informed manager chooses not to influence even though the NPV is positive. In other words, the informed manager forgoes positive NPV projects. To sum up: Headquarters optimally induces ex post underinvestment in order to strengthen the manager's ex ante incentives to acquire information.

A similar line of reasoning can be used to explain why the optimal c_A^* lies in the range $[E[b(\theta)], b(\theta^z))$ if $b(\theta^z) > E[b(\theta)]$. Since $c_A^* < b(\theta^z)$ implies $\theta^* < \theta^z$, there are now qualities $\theta \in (\theta^*, \theta^z)$ for which the informed manager exerts influence c_A even though the NPV is negative. Hence, headquarters optimally induces ex post overinvestment in order to increase the manager's ex ante incentives to acquire information. The optimal solution is therefore characterized by ex post under- or overinvestment.

I now return to the third objective, namely the wish that the manager makes a proper investment decision if he is uninformed. This goal is always satisfied given the optimal c_A^* that results from the two other goals if the manager's private benefits

are a linear function of gross profits.[24] Otherwise, an additional conflict of interest emerges if $c_A < E[b(\theta)]$ ($c_A > E[b(\theta)]$) and the expected NPV is negative (positive). Then, the uninformed manager chooses to influence (not to influence) even though this is not desired by headquarters. This additional problem does not change the results discussed so far. The only difference is that headquarters may optimally choose $c_A = E[b(\theta)]$ not only to strengthen ex ante research incentives but to rule out a conflict of interest if the manager is uninformed ex post.

3 Discussion

3.1 Centralized versus Decentralized Capital Budgeting

In the previous section, a centralized capital budgeting procedure was considered, where the authority over the investment decision rests with headquarters. The role of headquarters is to observe the level of influence and to react to it according to a prespecified scheme. Even though headquarters has formal authority, the better informed manager has real authority over the investment decision as he is able to successfully influence headquarters.[25] An obvious question is therefore whether formal authority can be passed to the manager without loss of performance. In other words, is it possible to replace the discussed centralized approach with a decentralized approach, where the manager has not only real but also formal authority over investment decisions? The answer is no: If the manager has formal authority over the use of funds, he no longer has any reason to engage in influence activities. The advantage of a centralized capital budgeting is therefore that headquarters has the valuable power

[24] To see this assume that $b(\theta) = \beta x(\theta)$ with $\beta > 0$. If $b(\theta^z) < E[b(\theta)]$, then $x(\theta^z) < E[x(\theta)]$ which implies that the expected NPV is positive. Since c_A^* lies in the range $(b(\theta^z), E[b(\theta)]]$, the manager chooses to influence if he is uninformed. Hence, there is no additional problem in this situation. Similarly, if $b(\theta^z) > E[b(\theta)]$, then the expected NPV is negative and the manager will choose not to influence if he is uninformed.

[25] Aghion and Tirole (1997) were the first who distinguished between formal and real authority. There, as in the current paper, the party who is better informed has real authority.

to impose costly influence activities on the manager.[26] Hence, a centralized capital budgeting procedure is preferred to a decentralized approach. As already mentioned in the Introduction, this result differs from previous arguments, where the authority over the resources is considered as being problematic because it makes headquarters vulnerable to wasteful influence activities. This difference arises from the fact that in the current model influence activities are used as an incentive device (which makes them valuable), whereas in previous studies these activities have been posited as being wasteful.

3.2 Monetary Incentives

In the agency literature, incentives are usually provided by means of compensation payments. An interesting question is therefore whether the influence activity scheme is capable of providing all of the incentives that a wage contract can provide? The answer is given in the following proposition.

Proposition 4 *Influence activities can perfectly replicate all incentives generated by compensation payments if realized profits are not verifiable.*

Proof: See the Appendix.

If profits are not verifiable (and therefore not contractible) wage payments can only be based on the report.[27] Both the influence effort and compensation payments are then perfect substitutes in the incentive constraints. To make this point clear, consider the second variation of the model in which the manager must be motivated to

[26] If there are two divisions (or more) and capital is scarce, both divisions may struggle for capital even when there is no higher authority. In this situation, however, it is not clear how this conflict is resolved and how much capital is awarded to each division relative to their respective lobbying efforts. (In Inderst, Müller and Wärneryd (2002), for example, the allocation of rents (capital) is determined by a contest success function.) Consequently, the positive incentive effects of influence activities can only be exploited if headquarters controls the capital allocation process.

[27] The assumption that profits are not verifiable is frequently made in the financial contracting literature (e.g., Bolton and Scharfstein 1990).

gather information. If $c_A = 0$, the division manager should receive a positive payment, say w_n, if he rejects the project.[28] Otherwise, he would always propose the project without making an effort to become informed since he has nothing to lose. Note that w_n and c_A are perfect substitutes in the incentive constraints: If the manager wants to realize the project he has to incur either the "costs" of forfeiting the wage w_n or the effort cost c_A. Starting with a situation in which $w_n > 0$ and $c_A = 0$, incentives are not changed if headquarters reduces w_n and increases c_A by the same amount. Hence, headquarters can simultaneously impose effort cost on the manager *and* reduce the expected wage payment. Clearly, if influence activities do not impose costs on headquarters, as I have assumed so far, headquarters strictly prefers to use lobbying activities as an incentive device instead of wage payments. That is $w_n = 0$ holds in the optimum.

If profits are verifiable, the advantage of influence activities is not reduced. However, in this situation the advantage of wage payments is increased because they can be based on the outcome. Hence, wage payments may play a role in the optimal capital budgeting procedure because they can be used to strengthen the incentives that are already provided by influence activities.

3.3 Effort Cost and Observability

Influence activities are assumed to be privately costly to the manager and observable by headquarters. Note that these properties are necessary conditions for influence activities to be influential since it is assumed that lobbying does not directly change the manager's position (e.g., does not manipulate information or improve the manager's outside option). When the manager enjoys engaging in lobbying activities, headquarters would no longer react to these activities. Remember, it is the willingness of the manager to engage in undesired activities that provides additional information. The same is true for the observability. Headquarters must be able to observe, or at least

[28] See Lambert (1986) and Laux (2001).

deduce, the influence effort level exerted by the manager.[29] Otherwise, these activities pass by without causing headquarters to take any action. My paper therefore predicts that unproductive influence activities in firms (that do not directly change the manager's position) must be costly to the manager and observable to some extent. As already mentioned in the Introduction, Ross noted that "If division management wanted to, they could increase this capital allocation by making a good case for it. But this would require a major effort and would use up some of the division's "credit" with corporate headquarters."(p. 18). This remark highlights two points: first, activities that influence headquarters impose effort costs (or other costs) on the manager; and second, these costs are indeed observable, otherwise Ross would not have noticed them.

3.4 Detrimental or Productive Influence Activities

So far, I have assumed that influence activities do not directly affect the value of the firm. They neither impose costs on the firm nor do they produce a valuable outcome. The assumption is not necessary to achieve the main results, namely that influence activities induce truth-telling and motivate information-acquisition. However, the optimal investment strategies are, of course, sensitive to this assumption. In order to discuss changes in the optimal solution, consider the first variation of the model in which the manager is initially endowed with private information.

Suppose that the value of the firm is reduced by γc with $\gamma > 0$. For example, the influence activities keep the manager from pursuing productive jobs. To find the optimal investment level $I^*(\theta)$, headquarters trades off the benefits of maximizing NPV with the costs of inducing truth-telling. In other words, headquarters will optimally deviate from the NPV maximizing level of investment, $I^n(\theta)$, in order to limit the

[29] It is not necessary to assume that the level of influence is perfectly observable as is done in this paper. Suppose, for example, that the influence effort is a linear function of the (observable) time, t, spent on influence activities such that $c = gt$, where $g \in \{g_L, g_H\}$ and $g_L < g_H$. In this situation, headquarters can screen both types in standard fashion (which is of course costly to headquarters) and influence activities may remain valuable to the firm.

influence activities required to keep the manager honest.[30]

Suppose that influence activities are productive such that the value of the firm is raised by γc. If the project quality were observable, headquarters could (perfectly) internalize the manager's empire benefits by choosing $c^*(\theta) = b(I^*(\theta), \theta)$ where $I^*(\theta)$ is given by $\frac{\partial V(I^*(\theta),\theta)}{\partial I} + \gamma \frac{\partial b(I^*(\theta),\theta)}{\partial I} = 0$. Since the quality is not observable, however, headquarters cannot extract all private benefits and the manager receives an information rent, as is common in adverse selection models.[31]

Appendix

Proof of Proposition 1

Given the report $\widehat{\theta}$ and the the actual quality θ, the manager's utility takes the following form:

$$U(\widehat{\theta}, \theta) = b\left(I\left(\widehat{\theta}\right), \theta\right) - c\left(\widehat{\theta}\right).$$

Let $U(\theta) \equiv U(\theta, \theta)$. Headquarters problem is given by:

$$\max_{c(\theta), I(\theta)} \int_{\underline{\theta}}^{\overline{\theta}} V(I(\theta), \theta) f(\theta) d\theta$$

subject to

$$U(\theta) \geq U(\widehat{\theta}, \theta) \quad \forall\ \theta, \widehat{\theta}, \tag{3}$$

$$U(\theta) \geq 0 \quad \forall\ \theta. \tag{4}$$

[30] It is technically difficult to determine the optimal capital allocation $I^*(\theta)$ because the manager receives the utility $U(\underline{\theta}) = b(I(\underline{\theta}), \underline{\theta})$ if the project quality is $\underline{\theta}$. This does not allow the use of standard techniques to solve the adverse selection problem. However, in a setting with only two possible qualities, $\theta \in \{\underline{\theta}, \overline{\theta}\}$ with $\overline{\theta} > \underline{\theta}$, it can be shown that $I^*(\underline{\theta}) > I^n(\underline{\theta})$ and $I^*(\overline{\theta}) < I^n(\overline{\theta})$. The intuition behind this result is as follows: If the capital allocation for the low and the high quality do not deviate much, the additional benefits associated with cheating are low. Thus, the required level of influence that keeps the manager from cheating is low, too.

[31] It can be shown that $I^*(\theta)$ is given by

$$\frac{\partial V(I^*(\theta), \theta)}{\partial I} + \gamma \frac{\partial b(I^*(\theta), \theta)}{\partial I} - \gamma \frac{\partial^2 b(I^*(\theta), \theta)}{\partial \theta \partial I} \frac{1 - F(\theta)}{f(\theta)} = 0,$$

if $I^*(\theta)$ is nondecreasing.

Constraint (3) is the truth-telling constraint and ensures that the manager reports the true θ. Constraint (4) is the participation constraint and ensures that the manager receives his reservation utility for every project quality.

For a truthful report it must be that the following first- and second-order necessary conditions hold (Salanié 1998):

$$\frac{\partial U(\theta)}{\partial \widehat{\theta}} = \frac{\partial b\left(I\left(\theta\right),\theta\right)}{\partial I}\frac{dI(\theta)}{d\theta} - \frac{dc(\theta)}{d\theta} = 0, \tag{5}$$

$$\frac{\partial^2 U(\theta)}{\partial \widehat{\theta}^2} = \frac{\partial^2 b\left(I\left(\theta\right),\theta\right)}{\partial I^2}\left(\frac{dI(\theta)}{d\theta}\right)^2 + \frac{\partial b\left(I\left(\theta\right),\theta\right)}{\partial I}\frac{d^2 I(\theta)}{d\theta^2} - \frac{d^2 c(\theta)}{d\theta^2} \leq 0 \qquad \forall\theta. \tag{6}$$

Differentiating (5) with respect to θ yields:

$$\frac{\partial^2 b\left(I\left(\theta\right),\theta\right)}{\partial I^2}\left(\frac{dI(\theta)}{d\theta}\right)^2 + \frac{\partial^2 b\left(I\left(\theta\right),\theta\right)}{\partial I \partial\theta}\frac{dI(\theta)}{d\theta} + \frac{\partial b\left(I\left(\theta\right),\theta\right)}{\partial I}\frac{d^2 I(\theta)}{d\theta^2} - \frac{d^2 c(\theta)}{d\theta^2} = 0.$$

By substituting this into (6), the first- and second-order necessary conditions can be written as:

$$\frac{\partial b\left(I\left(\theta\right),\theta\right)}{\partial I}\frac{dI(\theta)}{d\theta} - \frac{dc(\theta)}{d\theta} = 0, \tag{7}$$

$$\frac{\partial^2 b\left(I\left(\theta\right),\theta\right)}{\partial I \partial\theta}\frac{dI(\theta)}{d\theta} \geq 0 \qquad \forall\theta. \tag{8}$$

Since it is assumed that $\frac{\partial^2 b(I(\theta),\theta)}{\partial I \partial\theta} > 0$, (8) simplifies to $\frac{dI(\theta)}{d\theta} \geq 0$.

(7) implies that

$$\frac{dU(\theta)}{d\theta} = \frac{\partial b(I(\theta),\theta)}{\partial\theta}.$$

Integrating yields:

$$\int_{\underline{\theta}}^{\theta} \frac{dU(\tau)}{d\theta}d\tau = \int_{\underline{\theta}}^{\theta} \frac{\partial b(I(\tau),\tau)}{\partial\tau}d\tau$$

$$U(\theta) = \int_{\underline{\theta}}^{\theta} \frac{\partial b(I(\tau),\tau)}{\partial\tau}d\tau + U(\underline{\theta}).$$

$U(\theta) = b(I(\theta),\theta) - c(\theta)$ implies

$$c^*(\theta) = b\left(I(\theta),\theta\right) - \int_{\underline{\theta}}^{\theta} \frac{\partial b(I(\tau),\tau)}{\partial\tau}d\tau - U(\underline{\theta}).$$

Participation is ensured if $U(\underline{\theta}) \geq 0$. Since c must be nonnegative, it follows that $U(\underline{\theta}) \in [0, b\left(I(\underline{\theta}),\underline{\theta}\right)]$. Therefore, a mechanism $\langle I(\theta), c(\theta)\rangle$ induces truth-telling and

ensures participation if

$$c^*(\theta) = b\left(I(\theta),\theta\right) - \int_{\underline{\theta}}^{\theta} \frac{\partial b(I(\tau),\tau)}{\partial \tau} d\tau - U(\underline{\theta}) \quad \text{with } U(\underline{\theta}) \in [0, b(I(\underline{\theta}),\underline{\theta})]\,,$$
$$\text{and } I(\theta) \text{ is nondecreasing.}$$

Finally, as c is not present in the target function, the optimal $I^*(\theta)$ is the NPV maximizing level of investment, which is nondecreasing in the quality.

Proof of Proposition 3

Headquarters' choice of the optimal level of c_A is the solution to the following problem:

$$\max_{c_A} p\left(e\right) \int_{\theta_t}^{\overline{\theta}} V(\theta) f(\theta) d\theta + \left(1 - p\left(e\right)\right) E\left[V(\theta)\right] \cdot y \tag{9}$$

subject to

$$e \text{ solves } \max_{\widetilde{e}} p\left(\widetilde{e}\right) \left[\int_{\theta_t}^{\overline{\theta}} \left(b(\theta) - c_A\right) f\left(\theta\right) d\theta - \left(E\left[b(\theta)\right] - c_A\right) \cdot y \right] - \widetilde{e}, \tag{10}$$

$$\theta_t \text{ solves } \max_{\widetilde{\theta}_m} \int_{\widetilde{\theta}_m}^{\overline{\theta}} \left(b(\theta) - c_A\right) f\left(\theta\right) d\theta \Rightarrow \theta_t = b^{-1}(c_A), \tag{11}$$

$$y \text{ solves } \max_{\widetilde{y}} \left[E\left[b(\theta)\right] - c_A\right] \widetilde{y} \text{ with } y \in \{0,1\}. \tag{12}$$

Headquarters' objective is to maximize the expected net present value, subject to the constraints that the manager chooses his optimal research effort level e (10) and makes his optimal influence decision if he is informed (11) and if he is uninformed (12). Note that y stands for the optimal influence decision of an uninformed manager. The uninformed manager chooses $y = 1$ if it is optimal for him to influence headquarters and $y = 0$, otherwise.

Suppose that $c_A < E\left[b(\theta)\right]$. This implies that the manager chooses to influence if he is uninformed, i.e., $y = 1$. Inserting $y = 1$ in (9) and differentiating with respect to c_A gives (the dependencies of θ_t on c_A and of e on c_A and θ_t are dropped)

$$p'(e)\frac{de}{dc_A} \int_{\theta_t}^{\overline{\theta}} V(\theta) f(\theta) d\theta + p\left(e\right) \left(-V\left(\theta_t\right) f\left(\theta_t\right) \frac{d\theta_m}{dc_A} \right) - p'(e)\frac{de}{dc_A} E\left[V(\theta)\right].$$

Simplifying yields:

$$-p'(e)\frac{de}{dc_A}\int_{\underline{\theta}}^{\theta_t} V(\theta)f(\theta)d\theta - p(e)V(\theta_t)f\left(\theta_t\right)\frac{d\theta_m}{dc_A}. \tag{13}$$

Note that $\frac{de}{dc_A} = \frac{dp'(e)}{dc_A}/p''(e) = -\frac{p'(e)^2}{p''(e)}F(\theta_t) > 0$ (see (1)), $\int_{\underline{\theta}}^{\theta_t} V(\theta)f(\theta)d\theta < 0$ for all $\theta_t \leq \theta^z$, $V\left(\theta_t\right) \leq 0$ for all $\theta_t \leq \theta^z$, and $\frac{d\theta_m}{dc_A} > 0$. From this it follows that (13) is positive if $c_A \leq b(\theta^z)$ because then $\theta_t \leq \theta^z$. This implies that $c_A < E\left[b(\theta)\right]$ and $c_A \leq b(\theta^z)$ is never optimal.

Suppose that $c_A > E\left[b(\theta)\right]$. Then the manager chooses not to influence if he is uninformed, i.e., $y = 0$. Inserting $y = 0$ in (9) and differentiating with respect to c_A gives

$$p'(e)\frac{de}{dc_A}\int_{\theta_t}^{\overline{\theta}} V(\theta)f(\theta)d\theta - p(e)V\left(\theta_t\right)f\left(\theta_t\right)\frac{d\theta_m}{dc_A}. \tag{14}$$

Note that $\frac{de}{dc_A} = \frac{dp'(e)}{dc_A}/p''(e) = \frac{p'(e)^2}{p''(e)}(1 - F(\theta_t)) < 0$ (see (2)), $\int_{\theta_t}^{\overline{\theta}} V(\theta)f(\theta)d\theta > 0$ for all $\theta_t \geq \theta^z$, $V\left(\theta_t\right) \geq 0$ for all $\theta_t \geq \theta^z$ and $\frac{d\theta_m}{dc_A} > 0$. From this it follows that (14) is negative if $c_A \geq b(\theta^z)$ because then $\theta_t \geq \theta^z$. This implies that $c_A > E\left[b(\theta)\right]$ and $c_A \geq b(\theta^z)$ is never optimal.

These considerations imply that if $b(\theta^z) = E\left[b(\theta)\right]$ then $c_A^* = b(\theta^z)$ and $\theta_t^* = \theta^z$. If $b(\theta^z) < E\left[b(\theta)\right]$ then $c_A^* \in (b(\theta^z), E\left[b(\theta)\right]]$ and $\theta_t^* > \theta^z$. If $b(\theta^z) > E\left[b(\theta)\right]$ then $c_A^* \in \left[E\left[b(\theta)\right], b(\theta^z)\right)$ and $\theta_t^* < \theta^z$.

Proof of Proposition 4

In the following it is shown that compensation payments and influence activities are perfect substitutes in the incentive constraints if wage payments depend on the report only.

Consider the first variation of the model (Section 2.2). Let $w(\widehat{\theta})$ be the wage if the manager reports $\widehat{\theta}$. Given the report $\widehat{\theta}$ and the actual quality θ, the manager's utility is given by:

$$U(\widehat{\theta}, \theta) = b\left(I\left(\widehat{\theta}\right), \theta\right) - c\left(\widehat{\theta}\right) + w(\widehat{\theta}).$$

In similar manner to the proof of Proposition 1, it can be shown that the first- and

second-order conditions for truth-telling are given by:

$$\begin{aligned}(c(\theta)-c(\underline{\theta}))+(w(\underline{\theta})-w(\theta)) &= b\left(I(\theta),\theta\right)-\int_{\underline{\theta}}^{\theta}\frac{\partial b(I(\tau),\tau)}{\partial\tau}d\tau-b(I(\underline{\theta}),\underline{\theta}),\\ &\quad I(\theta)\text{ is nondecreasing.}\end{aligned}$$

Obviously, $(c(\theta)-c(\underline{\theta}))$ and $(w(\underline{\theta})-w(\theta))$ are perfect substitutes in the truth-telling constraint.

Consider the second variation of the model (Section 2.3). The project is realized if and only if the manager exerts influence c_A. If the manager forgoes the project, he receives the wage payment w_n (n for no investment) and if the project is realized he receives the wage w_i (i for investment). The set of constraints are given by:

$$e\text{ solves}\max_{\widetilde{e}}p\left(\widetilde{e}\right)\left[\begin{array}{c}\int_{\theta_t}^{\overline{\theta}}\left(b(\theta)-c_A+w_i\right)f(\theta)d\theta+\int_{\underline{\theta}}^{\theta_t}w_nf(\theta)d\theta-\\ -\left(E\left[b(\theta)\right]-c_A+w_i\right)\cdot y-w_n(1-y)\end{array}\right]-\widetilde{e},$$

$$\theta_t\text{ solves }\max_{\widetilde{\theta}_m}\int_{\widetilde{\theta}_m}^{\overline{\theta}}\left(b(\theta)-c_A+w_i\right)f(\theta)d\theta+\int_{\underline{\theta}}^{\widetilde{\theta}_m}w_n\Rightarrow\theta_t=b^{-1}(w_n-w_i+c_A),$$

$$y\text{ solves }\max_{\widetilde{y}}\left[E\left[b(\theta)\right]-w_n+w_i-c_A\right]\widetilde{y}\ \text{ with }y\in\{0,1\}.$$

Suppose that it is optimal for the manager to influence when he is uninformed, i.e., $y=1$. The first order condition on e is then given by:

$$p'(e)=\frac{1}{\int_{\underline{\theta}}^{\theta_t}\left(w_n-w_i+c_A-b(\theta)\right)f(\theta)d\theta}.$$

Suppose that $y=0$, the first order condition on e is given by:

$$p'(e)=\frac{1}{\int_{\theta_t}^{\overline{\theta}}\left(b(\theta)-w_n+w_i-c_A\right)f(\theta)d\theta}.$$

Headquarters optimally chooses $w_i=0$. Obviously, w_n and c_A are perfect substitutes in the incentive constraints.

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