Incentives in Internal Capital Markets: Capital Constraints, Competition, and Investment Opportunities[1]

Roman Inderst[2]
University College London

Christian Laux[3]
University of Mannheim

First Version: January 2000
Current Version: May 2001

[1]We are grateful to comments by Martin Hellwig, Christian Leuz, Holger Müller and seminar participants at the University of Mannheim, the University of Vienna, and the CEPR Conference "The Firm and Its Stakeholders: The Evolving Role of Corporate Finance" (Courmayeur 2001)

[2]University College London, Gower Street, London WC1E 6BT, UK. Email: r.inderst@ucl.ac.uk

[3]Department of Economics, University of Mannheim, D-68131 Mannheim, Germany. Email: laux@econ.uni-mannheim.de

Abstract

This paper considers the effect of competition for scarce corporate financial resources on managers' incentives to generate profitable investment opportunities. Competition is only unambiguously beneficial if projects are symmetric. If divisions differ in their cash endowments or their growth potential, integration may reduce incentives for some managers, which may lower total firm value. Moreover, relaxing capital constraints, e.g., by integrating a cash cow project, may reduce incentives.

We treat two different scenarios where contracts can either only specify monetary incentives or additionally the allocation of funds. While distorted capital allocations increase managers' incentives, they only survive renegotiations in integrated firms

JEL Classifications: G31, G34, J33

Keywords: capital allocation, conglomerate discount

1 Introduction

The present paper analyzes the effect of competition for scarce corporate financial resources on managers' incentives to generate profitable investment opportunities. Projects are endowed with financial resources, e.g., cash flow from assets in place. When projects are incorporated separately, no reallocation of capital between different projects is possible. If, however, projects are incorporated jointly, a capital reallocation is possible and (division) managers who derive a private benefit from increased investments under their control, compete for financial resources.

Intuition suggests that competition for resources increases managers' incentives. This is, however, not correct in general. Integration only unambiguously increases incentives if divisions are symmetric with respect to the profitability of their investment alternatives and their cash endowment. In this case integration increases the sensitivity of the capital allocation to the investment opportunities' profitability. If divisions are asymmetric with respect to their initial endowment or the profitability of their investment opportunities, the effect on division managers' incentives differ. The net effect may be a reduction of total expected profits when combining projects. This is so even though integration allows for an improved capital allocation ("winner picking"). Moreover, a relaxation of the resource constraint (e.g., due to the integration of a cash cow division that only generates cash but has no profitable investment opportunities on its own) may decrease the sensitivity. The negative effect on incentives may again more than compensate the advantage of being able to carry out profitable investment opportunities on a larger scale. That is, a binding capital constraint may be beneficial for investors as it increases competition between managers.

We focus on the incentive effect of (ex post) optimal capital allocation. Any (ex ante) promises to allocate resources in a way which is not ex-post optimal are not credible. While it is surely difficult in practice to precisely pre-commit funds, our perspective is rather extreme as the combination of a well-designed budgeting system with reputational concerns may give firms some commitment power. We therefore consider also the opposite extreme where contracting on the allocation of funds is possible. Contracting may be advantageous for several reasons. First, increasing the capital allocation sensitivity to the productivity of investment opportunities increases managers' incentives, and at the margin it is optimal for investors to substitute investment capital for wages. Second, it may be optimal to bias the capital allocation towards one of the projects in order to take into account different incentive effects for different managers. However, if these capital allocations are not ex post optimal, they may be renegotiated. The analysis of renegotiations reveals another advantage of integration. When projects are incorporated separately, there is no credible commitment to invest less than optimal (or possible). In contrast, when projects are integrated, such a distortion will be possible because the capital demand of the other division places a limit on renegotiation.

Our analysis relates to the growing literature on the costs and benefits of an internal capital market. The main benefit of an internal capital allocation is seen in the possibility of an improved capital allocation when external financing is associated with higher agency costs than internal financing.[1] However, the very fact that residual rights of control over the firms assets reside with headquarters rather than with division managers and that capital can be reallocated between divisions may give rise to new agency problems between division managers and headquarters. For example, giving up discretion over the use of funds in an internal capital market may reduce division managers' initiative to search for investment opportunities and to generate funds.[2] In addition, division managers may engage in inefficient activities to increase their rent. As a result, headquarters may no longer allocate funds efficiently.[3] These costs of integration have to be traded off against the benefit of an improved capital allocation.[4]

Our paper starts from the premise that there is an effort incentive problem and that managers exert effort to increase the amount of capital invested in their unit. In this setting the only effect of integration is that division managers effectively compete for capital allocations with other division managers. Interestingly, the effect of competition on managers' incentives may be positive as well as negative depending on the characteristics of the units that are combined. Hence, the same incentive conflict that may result in a conglomerate premium above and beyond the mere benefit of an improved capital allocation may also be the source of a conglomerate discount.

[1] See, in particular, Williamson (1975), Donaldson (1984), Thakor (1990), Stein (1997), and Matsusaka and Nanda (2000).

[2] See Gertner, Scharfstein, and Stein (1995) and Aghion and Tirole (1997) on the first point and Brusco and Panunzi (2000) and Gautier and Heider (2000) on the second.

[3] See Meyer et al. (1992), Rajan et al. (2000), Scharfstein and Stein (2000), and Wulf (2000a).

[4] This line of research was motivated by a lage empirical literature that argues that internal capital allocations are distorted and that conglomerates trade at a discount on average. See, for example, Lang and Stulz (1994), Berger and Ofek (1995), Comment and Jarrell (1995), Servaes (1996), and Lins and Servaes (1999) on the diversifcation discount, and Lamont (1997), Scharfstein (1998), Shin and Stulz (1998), and Rajan et al. (2000) on evidence for inefficient cross-subsidization in internal capital markets. However, recent empirical research casts doubt on the presumed causality, that the diversification discount and cross-subsidizations are a consequence of an internal capital market. See, for instance, Campa and Kedia (1999), Hyland (1999), Chevalier (2000), and Graham et al. (2000).

Incentives and total firm value may decrease if units differ in their endowments and investment opportunities. This result resembles the one by Rajan et al. (2000). There, however, managers engage in inefficient rent seeking activities and the diversity of investment opportunities at the time of the capital allocation is negative.[5] In contrast, in our paper diversity at the time of the managers' effort decision may reduce incentives. Since Tobin's q captures both, present as well as future investment opportunities' quality, their finding that diversity increases the conglomerate discount, is also consistent with our paper. Also, in their paper the advantage of combining similar units stems from the reallocation of capital alone. In our paper there is the additional advantage of increasing incentives. Evidence for the negative effect of diversity on the size of the discount is also found by Lamont and Polk (2000).

While beyond the scope of the present model, it is interesting to note that firm value maximization in a dynamic setting may imply that intertemporal changes in a unit's cash flow and investment opportunities result in divesting certain divisions and merging with other firms.[6] Most of the literature explains the value creation of spin-offs either by an increased focus on core competencies or by a better alignment of incentives between shareholders and managers.[7] Schoar (2000) interprets her finding that the integration of newly acquired unit seems to reduce the efficiency of incumbent plants to a "new toy" effect, where attention and resources are devoted to the new acquisition at an inefficiently high level. Our paper carves out another aspect, namely, the effect of competition on manager's incentives to generate profitable investment opportunities. This may provide a rationale for why competition may indeed be detrimental to the development of a particular division, as suggested by the following business press quote from Rato (2000): "The cardiovascular unit was the one in which Baxter did the fewest acquisitions as the business competed for money with other divisions...The new status of the cardiovascular business as a stand-alone company will mean

[5] Note that while capital distortions towards the less profitable project due to rent seeking and influence activities surely reduces incentives resulting from integration in our model, the empirical evidence does not suggest that cross-subsidization is so strong that incentives disappear, i.e., that the capital allocation sensitivity decreases under integration. For example, in Shin and Stulz (1998), which is typically quoted as providing evidence for cross-subsidization of smaller segments, such subsidization is no longer found if the largest segment has itself good growth opportunities.

[6] To the extent that these organizational changes are costly, a diversification discount is compatible with firm value maximization: a firm may trade at a discount until the discount becomes so large that it is worthwhile to carry out the canges.

[7] Daley et al. (1997) test for these two hypotheses. On asset sales and spin-offs to create focus see also the special issue of the Journal of Financial Economics, 1995. Nanda and Narazanan (1999) contains a detailed list of alternative motives for divestitures.

greater opportunities for R&D".[8]

The paper that is closest to ours is Stein (2000). He analyzes how integration affects incentives to acquire privately costly information. By acquiring information, headquarters and division managers can make more informed decisions. Importantly, in contrast to our paper, Stein only considers the symmetric case and does not allow for monetary incentives. Instead, Stein shows that integration reduces division managers' incentives to generate information when this information is soft. The reason is that information cannot be used as a means to receive more funds. Rather headquarters may take funds away and therefore division managers, who benefit from maximizing their divisions' profits, have less incentives to become informed.

Moreover, we explicitly model the coexistence of incentives arising from monetary compensation and capital allocation. Our paper highlights that wage payments and capital allocation are substitutes in creating incentives to exert effort. This result differs from previous arguments, where cash and capital were used to deal with influence activities (Scharfstein and Stein, 2000). Wulf (2000b) finds evidence that when the wage sensitivity to *firm* performance increases, the capital allocation to a division is less responsive to its realized profits. She argues that this may reflect a reduced need to rely on a division's profits as a (noisy) proxy for its investment opportunities' profitability and that one may rely more on manager recommendations. The reason is that managers' incentives to engage in influence activities are reduced when a higher proportion of their compensation depends on firm performance. Our paper predicts that when the capital allocation responsiveness to the quality of investment opportunities increases, compensation based on division performance is less important.

As repeatedly argued, it is central for our argument that division managers compete for limited resources, implying that capital allocations depend on relative performance even though projects are uncorrelated. This distinguishes our paper from those were integration is beneficial as correlation allows headquarters to design less costly mechanisms which induce managers to reveal their private information or which allow for better risk-sharing (see recently Berkovitch et al. (2000) and Maskin et al. (2000)). Finally, the idea that managers of one firm are in competition with each other is, of course, not new to the literature. Indeed, it is exploited heavily in the tournament literature where managers compete for promotion.[9]

The remainder of the paper is organized as follows. Section 2 lays out the model. The

[8] See also Krishnaswami and Subramaniam (1999), who show, amongst other things, that firms with higher growth opportunities are more likely to engage in spin-offs. They explain their findings with an informational theory.

[9] See Lazear and Rosen (1981) and Milbourn et al. (1999) for a recent example.

incentive effect of the capital allocation when projects are carried out on a stand-alone basis are discussed in Section 3, while Section 4 considers integration. Section 5 compares these two situations and discusses costs and benefits of integration. While joint incorporation is always optimal when symmetric projects are combined, combining two projects may reduce incentives when projects are asymmetric. Section 6 introduces contracting on allocations. Under joint incorporation contracts prove to be beneficial even when they may be renegotiated. Section 7 concludes.

2 The Model

2.1 Outline

We want to analyze the effect of investors' (headquarters') capital allocation decision on managers' incentives to increase the profitability of investment opportunities. Consider a set $I = \{1, 2, ...n\}$ of "projects". (Throughout most of the paper we assume that $n \leq 2$). Each project is managed by a (division) manager who has no personal funds of his own and whose reservation utility is zero. All parties are risk neutral and the risk-free rate of return is normalized to be zero.

Each project i has an initial endowment of resources, X_i, that can be invested. The initial endowment consists primarily of the project's cash flow, which is generated by the project's assets in place. However, it may also include excess funds that were not jet invested and any potential borrowing from outside. The quantity of these resources is assumed to be limited because external capital markets are imperfect (see below).[10] When projects are incorporated jointly, headquarters can reallocate resources from one project to the other. In contrast, when projects are incorporated separately, no reallocation of funds is possible.

Each project opens up investment opportunities. The profitability of the investment opportunities depends on the manager's effort, which he exerts to search for profitable investment opportunities and for ways to increase their profitability. Headquarters observes the investment opportunities' profitability and allocates funds so as to maximize the firm's (present) value subject to the resource constraint. Funds that are not invested in the firm's investment opportunities (real assets) can be invested in financial assets, yielding the risk-free rate of return, zero.

A project's investment opportunities can be ranked according their profitability. If an

[10]Note, however, that one of the results of our paper is that it may actually be optimal for the investor to limit the amount of resources.

amount K is invested in project i's investment opportunities, they yield a net present value $Y_i(K,t)$, which depends on the project's type $t_i \in T = \{g, b\}$ ("good" or "bad"). It is assumed that projects' types are uncorrelated and observable prior to making the investment decision. A project's type reflects the manager's success in finding investment opportunities and increasing their profitability in the following sense: (1) A project's net present value is higher if it is of type g than if it is of type b for all (relevant) levels of investment. (2) The probability of a project's type is determined by the manager's effort level. Both points are now made precise:

With respect to a project's investment opportunities, we make the following assumption:

(A.1) *$Y_i(K,t)$ is differentiable in K; $y_i(K,t) \equiv \frac{\partial Y_i(K,t)}{\partial K}$ is continuous, strictly decreasing in K, and $y_i(K,g) > y_i(K,b)$ for all $i \in I$ and K.*

Note that $y_i(K,t)$ is the marginal net present value of an investment in project i if it is of type t. For future reference it is useful to define

$$K_i^*(t) \equiv argmax_K \left[Y_i(K,t)\right] > 0,$$

which is the investment level that maximizes the net present value of project i's investment opportunities given type t if the capital constraint is not binding. $K_i^*(t)$ is assumed to be finite and is determined by the first order condition $y_i(K_i^*(t), t) = 0$. Clearly, (A.1) implies $K_i^*(g) > K_i^*(b)$.

In order to economize on case distinctions, it is assumed that no project has sufficient cash to always finance all of its profitable investment opportunities:

(A.2) $X_i < K_i^*(g)$.

A manager may exert either high or low effort $e \in \left\{e^l, e^h\right\}$. Project i will be of the good type with probability p_i^h if manager i exerts high effort. Given low effort, the respective probability is p_i^l, with $0 < p_i^l < p_i^h < 1$ for all $i \in I$. High effort is unobservable and involves a disutility $c_i > 0$, while low effort is costless.

Managers choose their effort level so as to maximize their utility. It is assumed that they derive a private benefit of control from investments under their supervision, which is linear in the amount of resources allocated to their project and denoted by αK_i, with $\alpha > 0$.[11]

[11] It is a standard assumption that managers derive benefits from resources under their control. One way to justify this is to assume that they are able to transform part of this into perquisites.

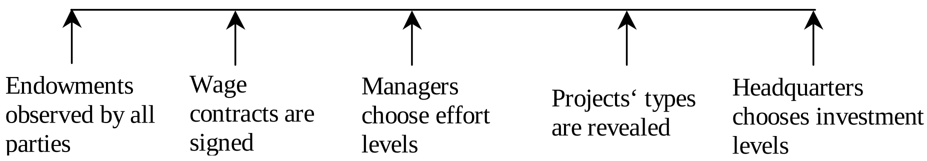

Figure 1: Sequence of Events.

It is assumed that headquarters always provides monetary incentives to assure that managers exert high effort.[12] In general, an incentive system pays a reward based on some measure of a manager's success, e.g., the number of patents of his division or future profits, which are assumed to be verifiable. For ease of exposition, it is assumed that the wage contract can be directly contingent on the project's type: $w_i^\phi(t)$ for $t \in T$, where $\phi = S$ when projects are incorporated separately and $\phi = M$ when projects are incorporated jointly (integration).[13] Because of the managers' limited wealth, the wage must not be negative and $w_i^\phi(t) \geq 0$.

To summarize, the sequence of events is presented in Figure 1.

The paper focuses on the case where headquarters cannot commit ex ante to a specific (state contingent) capital allocation. Rather, the allocation is chosen at the time the decision is made. The impossibility to commit funds to future investment alternatives rests on two problems: First, in a more complex environment than the one considered in the present paper it is hardly possible to specify in advance the ex ante optimal capital allocations for all possible contingencies.[14] Second, it is certainly next to impossible to rule out all ways by which capital could be (re-)allocated even without the consent of division managers, e.g., via transfer prices or the allocation of overhead costs. However, one may argue that reputational concerns together with fixed budgeting rules may substitute for (binding) contracts in some way. For that reason we also analyze the case where the allocation of funds is contractible (Section 6).

[12] This is optimal if the expected increase in the net present value exceeds expected wage costs.

[13] In general, the contract chosen for project manager i could depend on the types of all projects. However, it is straightforward to show that the assumed independence of types allows us to restrict consideration to wage contracts that are contingent only on the manager's own project.

[14] The problem to commit funds to future investment alternatives (growth options) is also underlying the underinvestment problem discussed by Myers (1977), who provides several reasons as to why it is difficult to contract on future investment levels.

2.2 On headquarters' incentives

Headquarters presumed incentives and the assumption that the firm is financially constrained warrant further discussion.

Clearly, headquarters' capital allocation is identical to the one that owners would choose. One straightforward interpretation therefore is that the firm's owners have a strong influence as, for example, in family run businesses, which are widespread in Continental Europe. Alternatively, one may view it as a modelling assumption, which allows to analyze a potential conflict within the firm without having to deal with multiple layers of agencies. For the setting where headquarters acts in owners' interest, Myers and Majluf (1984) provide a theoretical justification for why there may be a wedge between the costs of internal and external financing, which may effectively constrain the amount of funds which headquarters takes on.[15]

An alternative view is that headquarters pursues its own interests and derives a private benefit that is increasing in the value of the assets under control. For example, as Scharfstein and Stein (2000) argue, "although agency-prone CEOs may want big empires it also seems reasonable that, holding size fixed, they will want valuable empires" (p. 2538). They and Stein (1997, 2000) assume that headquarters invests all funds in *real* assets and therefore an overinvestment problem may occur. If the capital constraint is binding, however, headquarters' "private benefits coincide perfectly with shareholders' objective of maximizing the firm's net profit" (Stein, 2000, p. 9).

For headquarters to indeed be willing to overinvest, it is crucial that headquarters associates higher private benefits with profits from real assets than from financial assets and that headquarters is inpatient (in an intertemporal setting). Otherwise headquarters may rather invest funds in financial assets with a NPV of zero instead of carry out projects with a negative net present value.[16] This behavior can be interpreted as resulting from an extreme weakness of investors in a public corporation: headquarters has full discretion over resources and therefore does not want to waste them.[17] In this case a capital constraint arises because headquarters is reluctant to access the capital market for a fear of loss of con-

[15] See Thakor (1990) for a detailed discussion along these lines.

[16] Division managers are interested in the level of (real) investments in their division and willing to sink funds because they have no discretion over the cash flow they generate. Their valuation of allocated funds can also be endogenized by assuming that they can substitute resources with own effort (in the subsequent period).

[17] See Hellwig (2000, 2001) for an extensive discussion of managers' incentives and possible investment distortions. It is argued there that a separation of ownership and control is not sufficient for a conflict of interest between management and outside investors to give rise to an agency problem.

trol. Also, investors may be reluctant to provide new funds when headquarters tries to avoid (re-)payment to investors. In addition, it is interesting to note that—as argued below—a capital constraint may be in the interest of owners even when they can force headquarters to repay funds.

Clearly, headquarters may derive an overproportionally high private benefit from carrying out some "pet" projects. Headquarters would therefore be willing to deviate from maximizing the total output of the firm. To the extent that these pet projects are carried out independently of the quality of the other investment opportunities, the situation in the present paper can be interpreted as the residual allocation problem. That is, the projects' endowment is the amount of resources that is left after headquarters has carried out its pet projects.

3 Separate Incorporation

We first consider the case where projects are incorporated separately. The important characteristic of the stand-alone case is that no transfer of funds between projects is possible.

After observing the project's type, t_i, headquarters chooses the investment level, $K_i(t)$, in order to maximize $Y_i(K,t)$ subject to the resource constraint, $K_i(t) \leq X_i$. Given t_i and X_i, the optimal investment level is

$$K_i(t) = \min\left\{K_i^*(t_i), X_i\right\}.$$

The project manager anticipates this allocation when choosing his effort level and exerts high effort if

$$w_i^S(g) - w_i^S(b) + \alpha[K_i(g) - K_i(b)] \geq d_i.$$

with $d_i \equiv c_i/(p_i^h - p_i^l)$.

Headquarters chooses the wage structure to induce high effort at minimal costs. Because of limited liability (wealth) it is optimal to set $w_i^S(b) = 0$ and

$$w_i^S(g) = \max\left\{0, d_i - \alpha[K_i(g) - K_i(b)]\right\}.$$

Note that a manager's incentive to exert effort stems from two sources: the sensitivity of the wage payment to the project's type, $w_i^S(g) - w_i^S(b)$, and—through its effect on the manager's private benefit—the sensitivity of the capital allocation to the project's type, $K_i(g) - K_i(b)$. Clearly, the wage sensitivity and the capital allocation sensitivity are substitutes. The higher the capital allocation sensitivity, the higher are the incentives stemming from the manager's private benefit of control, and the lower is the necessary wage payment when $w_i^S(g) > 0$. To abstract from tedious case distinctions, we will assume throughout the paper that each manager's incentive constraint is binding so that a positive wage payment is necessary.[18] Hence,

$$w_i^S(g) = d_i - \alpha[K_i(g) - K_i(b)]. \tag{1}$$

The capital allocation sensitivity is exogenous at the time the wage contract is signed.[19] It results from headquarters' choice of the investment level in the two states and depends on $y_i(K, g)$, $y_i(K, b)$, and X_i.

When a project is carried out on a stand alone basis, the capital allocation sensitivity is weakly increasing in X_i: It is zero if the resource constraint is always binding ($X_i \leq K_i^*(b)$) so that $K_i(g) = K_i(b) = X_i$. For intermediate levels of X_i the constraint is only binding in the good state ($K_i^*(b) < X_i < K_i^*(g)$). In this case the capital allocation sensitivity is $X_i - K_i^*(b)$ and increasing in X_i. The sensitivity is maximal and given by $K_i^*(g) - K_i^*(b)$ if the resource constraint never binds. A capital constraint therefore has two negative effects: First, it restricts the level of profitable investments. Second, it reduces the capital allocation sensitivity, which reduces incentives stemming from the capital allocation, and therefore necessitates a higher wage payment. This will be strikingly different under integration, where tightening the capital constraint may increase the capital allocation sensitivity and therefore result in higher incentives.

4 Joint Incorporation: Competition for Corporate Financial Resources

In this section we consider the case where two projects are incorporated jointly (integration). The distinguishing feature of joint incorporation is that headquarters can reallocate funds so as to maximize profits.

Let $K_i(t_i, t_j)$ be the investment level that headquarters allocates to project i when it is of type t_i and the other project is of type t_j. The respective investment levels maximize $Y_1(K_1(t_1, t_2), t_1) + Y_2(K_2(t_2, t_1), t_2)$ subject to the resource constraint $K_1(t_1, t_2) + K_2(t_2, t_1) \leq X_0$, with $X_0 \equiv X_1 + X_2$. By (A.1) this program has a unique solution for all pairs (t_i, t_j): If

[18] Given that it is optimal to induce high effort, it is always possible to pay the wage (after realization of future profits) since $X_i + Y_i(K_i, t_i) \geq w_i(t_i)$.

[19] See, however, Section 6 where contracting on the capital allocation is considered.

the capital constraint does not bind given (t_i, t_j), $K_i(t_i, t_j) = K_i^*(t_i)$. If the capital constraint is binding, the optimal capital allocation is either (i) uniquely determined by the first-order condition $y_1(K_1(t_1, t_2), t_1) = y_2(K_2(t_2, t_1), t_2)$ and the resource constraint or (ii) a corner solution exists so that one project does not receive any funds while the other project receives X_0.

Managers anticipate the capital allocation to be chosen in the different states. The wage paid in the bad state is again zero. It remains to determine $w_i^M(g)$. Manager i chooses to exert high effort—given high effort by manager j—if

$$w_i^M(g) + p_j^h \alpha \left[K_i(g, g) - K_i(b, g)\right] + (1 - p_j^h)\alpha \left[K_i(g, b) - K_i(b, b)\right] \geq d_i.$$

By assumption, the incentive constraint is binding and $w_i^M(g)$ will be chosen to induce high effort at minimal costs:

$$w_i^M(g) = d_i - p_j^h \alpha \left[K_i(g, g) - K_i(b, g)\right] - (1 - p_j^h)\alpha \left[K_i(g, b) - K_i(b, b)\right]. \tag{2}$$

Project i's capital allocation sensitivity now depends on, p_j^h, $y_i(\cdot, t)$ for all $i \in I$ and $t \in T$, and X_0. If the other project is of type g, it is $K_i(g, g) - K_i(b, g)$, which occurs with probability p_j^h. If the other project is of type b, it is $K_i(g, b) - K_i(b, b)$, which occurs with probability $(1 - p_j^h)$. Incentives from the capital allocation decision are determined by the unconditional (expected) sensitivity.

The capital constraint still has the negative effect of constraining headquarters to carry out profitable investment opportunities. The effect of the capital constraint on incentives, however, is no longer unambiguous. In the next section we explore how competition for corporate financial resources and the level of the capital constraint affects managers' incentives.

5 Costs and Benefits of Competition

5.1 Comparing Separate and Joint Incorporation of Projects

Clearly, one advantage of integration is that headquarters can put scarce funds to their optimal use (i.e., pick winners). The more interesting question is: how does competition for corporate financial resources affect managers' incentives to exert high effort? The wage, which has to be paid in the good state to elicit high effort, provides a measure for these incentives. The lower the wage, the higher are the incentives from the investment decision. The effect of integration on manager i's incentives can therefore be measured as the difference between his wage payments under joint and separate incorporation:

$$\Delta_i \equiv \frac{w_i^M(g) - w_i^S(g)}{\alpha}. \tag{3}$$

Substituting (1) and (2) in (3) and rearranging terms yields

$$\begin{aligned}\Delta_i = &-p_j^h \left[(K_i(g,g) - K_i(b,g)) - (K_i(g) - K_i(b)) \right] \\ &- (1-p_j^h) \left[(K_i(g,b) - K_i(b,b)) - (K_i(g) - K_i(b)) \right].\end{aligned} \tag{4}$$

Integration increases incentives if $\Delta_i < 0$. In this case the (unconditional) capital allocation sensitivity given joint incorporation exceeds the one when the project is carried out on a stand-alone basis. This is clearly the case if $K_i(g,g) - K_i(b,g) > K_i(g) - K_i(b)$ and $K_i(g,b) - K_i(b,b) > K_i(g) - K_i(b)$, i.e., the conditional sensitivities given joint incorporation both exceed the one given separate incorporation. The sensitivities depend on the projects' relative profitabilities in the different states as well as their relative endowment levels.

5.2 Symmetric Projects

5.2.1 The Effect of Competition on Incentives

In this section we analyze the case of "symmetric" projects and assume that both projects are identical in the following two dimensions. First, they have identical endowments, $X_1 = X_2 \equiv X$. Second, their net present values are identical if they are of the same type, i.e., $y_1(K,t) = y_2(K,t) \equiv y(K,t)$ for all $K \geq 0$ and $t \in T$. The projects may, however, differ in the remaining parameters, p_i^h, p_i^l, and c_i.

This assumption considerably reduces the set of possible capital allocations to consider. If both projects are of the same type, each receives the same capital allocation as in the stand-alone case, i.e., $K(g,g) = K(g) = X$ and $K(b,b) = K(b) = min\{K^*(b), X\}$.[20] Capital is reallocated if both are of different types. By (A.1) the good type receives more funds than the bad type so that $K(g,b) > X > K(b,g)$. In addition, a bad type's capital allocation is weakly decreasing in the profitability of the other project's investment opportunities, i.e., $K(b,b) \geq K(b,g)$.

Given these allocations, it is straightforward to show that $K(g,b) - K(b,b) \geq K(g,g) - K(b,g) \geq K(g) - K(b)$, with at least one inequality being strict. (An example where both inequalities are strict is depicted in Figure 2.) Integration therefore unambiguously increases the capital allocation sensitivity, which directly leads to the following proposition:

[20]Since the investment opportunities for both projects are identical, capital allocations are symmetric. We therefore omit indices on the investment level $K(\cdot)$.

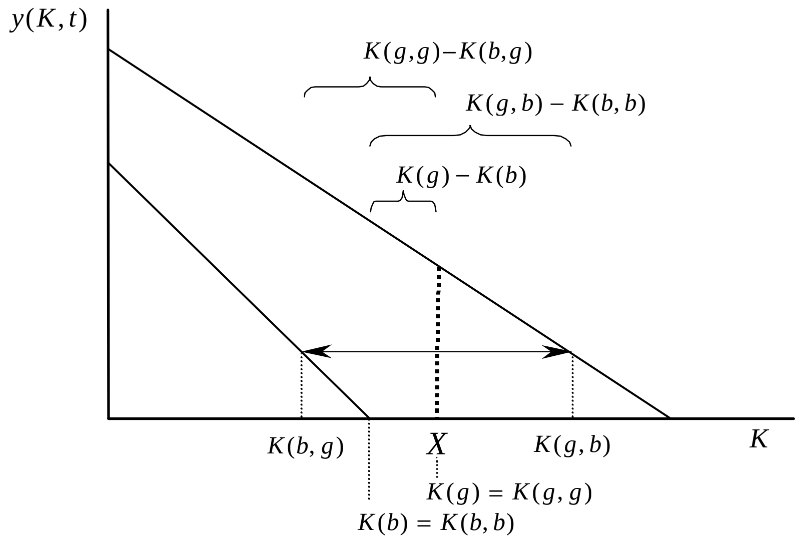

Figure 2: The optimal capital allocation and its sensitivity.

Proposition 1 *Suppose that* $I = \{1, 2\}$*,* $X_1 = X_2$*, and* $y_1(K,t) = y_2(K,t)$ *for all* $t \in T$ *and* $K \geq 0$*. Competition for corporate financial resources increases managers' incentives to increase the profitability of their investment opportunities.*

In order to interpret this result, it is useful to substitute $K(g,g) = X$ and $K(b,b) = K(b)$ in (4), which then yields

$$\Delta_i = -p_j^h\,[K(b) - K(b,g)] - (1 - p_j^h)[K(g,b) - X]. \tag{5}$$

>From the discussion of optimal capital allocations, it follows that $K(b) - K(b,g) \geq 0$ and $K(g,b) - X > 0$. It is now straightforward to observe the reasons underlying the increase in sensitivity: Compared to the stand-alone case, the allocation in the good state strictly increases by $K(g,b) - X$ if the other project is of type b. The reallocation of funds from a type b project to a type g project provides (additional) incentives to exert effort. Note that there are two sources of reallocation. First, "excess funds" may be reallocated (if $X > K^*(b)$). Second, the capital allocation to a type b project may be reduced in favor of a higher investment level for a type g project. This is optimal for headquarters if not enough (or no) "excess funds" are available so that the capital constraint is binding, i.e., if $2X < K^*(g) + K^*(b)$. In this case $K(b) - K(b,g) > 0$, and, compared to the stand-alone case, the capital allocation to a type b project is strictly lower if the other project is of type g.

To summarize: The operation of an integrated capital market increases the capital allocation sensitivity by increasing the capital allocation to "outperforming" and (possibly) reducing the allocation to "underperforming" divisions. The positive effect of competition on incentives is another advantage of integration besides the advantage of improving the allocation of financial resources. Note, however, that the positive effect of competition on incentives is rather sensitive to the underlying scenario. It is important to keep in mind that it was derived here for the case of two symmetric projects.

5.2.2 Comparative Statics of the Resource Constraint

In this section we investigate the impact of the amount of available financial resources on incentives. The important finding is that the amount of financial resources may adversely affect managers' incentives under joint incorporation. To analyze the effect of an increase in the total endowment, X_0, we can draw on our results in the previous section and state the following lemma.

Lemma 1 *Consider the case with symmetric projects (as in Proposition 1) and aggregate endowment X_0. A marginal increase in X_0 has the following effect on $w_i^M(g)$ $(i \in I)$:*

i) $K^*(g) + K^*(b) \leq X_0 < 2K^*(g)$ *(large funds case): $w_i^M(g)$ decreases.*

ii) $2K^*(b) \leq X_0 < K^*(g) + K^*(b)$ *(medium funds case): $w_i^M(g)$ decreases if*

$$\frac{dK(g,b)}{dX_0} > \frac{1}{2}p_j^h, \tag{6}$$

while $w_i^M(g)$ increases if the converse holds.

iii) $X_0 < 2K^*(b)$ *(small funds case): $w_i^M(g)$ decreases if*

$$\frac{dK(g,b)}{dX_0} > \frac{1}{2}, \tag{7}$$

while $w_i^M(g)$ increases if the converse holds.

Proof. The assertion is proven by differentiating (2) w.r.t. X_0 for all possible cases.[21] For case i) an increase in X_0 only affects the allocation $K(g,g) = \frac{1}{2}X_0$. Hence, $dw_i(g)/dX_0 = -\alpha p_j^h \frac{1}{2} < 0$. In case ii) we can substitute $K(g,g) = \frac{1}{2}X_0$, $K(b,b) = K^*(b)$, and $K(g,b) +$

[21] By (A.1) and optimality, the allocation $K_i(t,t')$ is clearly continuous and (weakly) increasing in X_0, which implies differentiability a.e.

$K(b,g) = X_0$, which yields $dw_i(g)/dX_0 = \alpha(\frac{1}{2}p_j^h - dK(g,b)/dX_0)$, implying (6). For case iii) we obtain $K(g,g) = K(b,b) = \frac{1}{2}X_0$ and $K(g,b) + K(b,g) = X_0$, which yields $dw_i(g)/dX_0 = \alpha(\frac{1}{2} - dK(g,b)/dX_0)$, implying (7). **Q.E.D.**

Clearly, the availability of more financial resources increases the amount of capital invested when both projects are of type g. All else equal, this has a positive effect on incentives. All else is, however, only equal in the large funds case. In the medium funds case $K(g,b)$ and $K(b,g)$ are also affected and in the small funds case the capital allocation is increased when both projects are of type b. The interesting observation is that the effect of a marginal increase of X_0 on the optimal capital allocation may reduce incentives from competition in an internal capital market.

Proposition 2 *With two symmetric projects (as in Proposition 1) a marginal increase in the aggregate endowment X_0 may reduce the incentive effect of competition for corporate financial resources if*

$$\frac{dK(g,b)}{dX_0} < \frac{dK(b,g)}{dX_0}.$$

Proof. Condition (7) for the small funds case can be rewritten as $\frac{dK(g,b)}{dX_0} > \frac{dK(b,g)}{dX_0}$. $\frac{dK(g,b)}{dX_0} < \frac{dK(b,g)}{dX_0}$ is therefore a necessary and sufficient condition for incentives to decreases if X_0 is marginally increased in the small funds case. Condition (6) for the medium funds case implies that $\frac{dK(g,b)}{dX_0} < \frac{dK(b,g)}{dX_0}$ is a necessary condition for incentives to decrease in the medium funds case. **Q.E.D.**

The condition in the proposition implies that when both types differ, the good type receives a lower fraction of the additional capital than the bad type, i.e., $K(g,b) - K(b,g)$ decreases when the endowment increases. Whether or not this is the case, depends on the shape of the marginal net present value functions, $y(\cdot,g)$ and $y(\cdot,b)$. We explore this by means of two examples.

Suppose first that $y(K,g) = 1 - K$ and $y(K,b) = A - BK$, where $0 < A < B < 1$, which implies $K^*(b) = A/B < K^*(g)$. The example is depicted in Figure 3. To discuss cases ii) and iii) in Lemma 3, we can restrict attention to $X_0 < 1 + A/B$. If projects have different types, we obtain the following optimal allocations: If $X_0 \leq 1 - A$, all capital is allocated to the good project, i.e., $K(g,b) = X_0$ and $K(b,g) = 0$. For the remaining parameters $X_0 \in (1 - A, 1 + A/B)$ we obtain

$$\begin{aligned} K(g,b) &= X_0 - \frac{X_0 - 1 + A}{1 + B}, \\ K(b,g) &= \frac{X_0 - 1 + A}{1 + B}, \end{aligned}$$

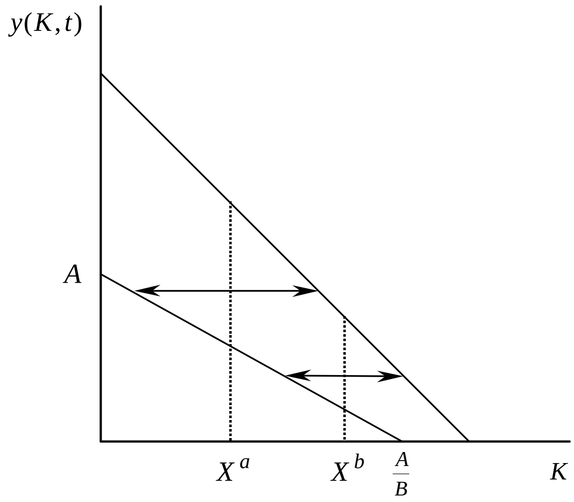

Figure 3:

implying $dK(g,b)/dX_0 < dK(b,b)/dX_0$. Hence, the bad project receives a higher fraction of each additional unit of available resources, which reduces incentives.

The effect that a type b project receives a higher fraction of additional resources than a type g project also arises naturally if investments require a minimum level of capital, implying that the optimal capital allocation is discontinuous. (Admittedly, this is not covered by (A.1).) As X_0 increases, there exists a threshold at which it is optimal to finance project i if $t_i = b$ and $t_j = g$, whereby the allocated capital jumps up. This has the same effect as the condition in Proposition 2.

5.2.3 The Effect of a Cash Cow

The analysis in the previous section has direct implications for the incentive effect of a "cash cow". Consider a situation where the firm has a project with no (worthwhile) future investment opportunities, which merely generates cash from assets in place. Whereas such a cash cow is always of advantage if the firm has only one division generating new investment opportunities, its effect on project managers' incentives may be negative if the firm has multiple (competing) divisions with investment opportunities. This is a direct consequence of Proposition 2. Hence, additional resources may reduce the profitability as they mitigate competition between project managers for (previously scarce) resources.

While an increase in X_0 may thus lead to higher wages, we have so far neglected the positive effect of increased funds. As long as funds are rationed, which is a necessary requirement to create competition between project managers, there still exist profitable investment opportunities that can be carried out if more funds are available. However, it is straightforward to come up with examples where the wage increase more than outweighs the gains from additional investments. For instance, this is accomplished by choosing α sufficiently high while ensuring that the marginal profitability $y(\cdot)$ becomes sufficiently flat as it approaches zero.

Corollary 1 *The presence of a cash cow may reduce managers' incentives from competition for corporate financial resources. The increase in expected wage costs may offset the advantage from carrying out more profitable investment opportunities.*

It is interesting to note that the negative effect of a cash cow arises here despite the fact that funds are only invested in projects with positive net present value. That is, despite the fact that free cash flow is never wasted. The negative effect arises because it reduces incentives rather than because it is invested to build an empire as in Jensen (1986). We elaborate on this in the following section.

5.2.4 Endogenous Resource Constraints

Suppose that the aggregate resource constraint of the integrated firm could be determined endogenously. Under which circumstances would one wish to make this constraint binding, implying capital rationing in some states? So far the literature has provided mainly one rational why capital rationing may be optimal. Capital rationing occurs as owners or headquarters have limited control on spending or limited information about profitability, while managers have a general tendency to overinvest.[22] Our results offer a new view on this prevailing phenomenon: stimulation of competition between projects. We illustrate this using the linear example provided after Proposition 2. Assume that $0 < A = B < 1$, which implies that $K^*(g) = K^*(b) = 1$.[23] (This is illustrated in Figure 4.) Consider now the problem of choosing the amount of resources with which the firm shall be endowed. Assume that $X_0 = 2$. In this case there will be no rationing in any state of the world and total funds are always invested. Hence, there are no incentives arising from the allocation of capital given this level of endowment. A marginal reduction in the endowment has a positive incentive

[22] E.g., Antle and Eppen (1985), Holmstrom and Ricart i Costa (1986), Harris and Raviv (1996, 1997), and Stein (1997, 2000). Of course, capital rationing may occur as firms are exogenously constrained as, for instance, in Thakor (1990) where projects are rationed so a to save scarce internal resources for future investment opportunities.

[23] Though this case is not covered by (A.1), our previous results still apply as (A.1) holds for $K < 1$. Effort increases the return on (existing) investment opportunities.

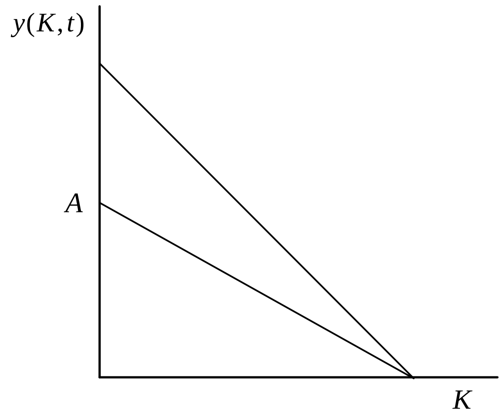

Figure 4:

effect and reduces expected wage costs (Lemma 1) while the first order effect on profits is zero. Total expected net profits therefore increase if the endowment is reduced.

5.3 Asymmetric Endowments

In this section it is assumed that projects' endowments, X_i, differ, e.g., because their assets in place generate different levels of cash flow. Assume that project 1 is endowed with more resources than project 2, i.e., $0 < X_2 < X_1$. Aggregate resources are again denoted by $X_0 = X_1 + X_2$. Hence, none of the two projects has excess cash if it is of the good type.

Integration now has a different impact on the incentives of the two project managers. This difference results from the differences in the capital allocation sensitivities when the projects are incorporated separately. The capital allocation given joint incorporation is symmetric for both projects and equal to the allocation discussed for the symmetric case in Section 5.2.1.

Incentives for project manager 2 It is straightforward to show that $\Delta_2 < 0$. That is, integration always increases the incentives of the manager with the lower endowment. As both projects offer symmetric investment opportunities and given the discussion for the symmetric case, this result is intuitive. If both projects have a good type, the more constrained project 2 receives more funds than in the stand-alone case, i.e., $\frac{1}{2}X_0 > X_2$. This provides additional incentives for the respective manager, which was not the case in Section 5.2, where both projects had symmetric endowments. Analogously, the allocation when having a good type while the other project is a bad type is also increased. A similar spill-over of resources may also occur when project 2 has a bad type. Integration is nevertheless always optimal since this may only happen when $X_2 < K^*(b)$, and in this case there are no incentives from the capital allocation decision in the stand-alone case.

Incentives for project manager 1 The impact of integration on the incentives of the manager with the higher endowment is more intricate. Capital is transferred to project 2 if $t_1 = t_2 = g$. This has a negative effect on the incentives of manager 1, which is absent when the individual endowments are identical. As a consequence, the reduction of capital allocated to project 1 in the bad state given $t_2 = g$ is no longer sufficient to increase incentives. The negative effect due to a reduction in rewards has now to be more than compensated by this "punishment" effect. This may not always be the case. In particular, the aggregate effect depends on the success probability of the other project. For $p_2^h \to 0$ only the positive effect remains, while for $p_2^h \to 1$ only the negative effect survives.

While the sign of Δ_1 is ambiguous, the impact of a marginal increase of the difference in endowments, $X_1 - X_2$, is not. Increasing the difference in endowments—while holding the level of total endowments constant—increases Δ_1. That is, the positive (negative) effect of integration on manager 1's incentives is decreasing (increasing) in $X_1 - X_2$. The positive effect of integration on manager 2's incentives is increasing in $X_1 - X_2$. The following proposition summarizes the discussion. (See the appendix for a formal discussion.)

Proposition 3 *Suppose that $I = \{1, 2\}$, $X_2 < X_1$, and $y_1(K, t) = y_2(K, t)$ for all $t \in T$ and K.*

1. *Incentives of manager 2 (with the lower endowment) are strictly higher in the integrated case, i.e., wages are lower: $\Delta_2 < 0$.*
   Moreover, keeping X_0 constant, Δ_2 decreases in the difference in endowments.

2. *Incentives of the manager 1 (with the higher endowment) may be higher or lower in the integrated case. They are more likely to be lower as p_2^h increases.*
   Moreover, keeping X_0 constant, Δ_1 increases in the difference in endowments.

3. *Total wage costs may increase after integration.*

We provide again a linear example. Suppose that $X_2 < K^*(b) < X_1$ and $X_0 \geq 2K^*(b)$. Moreover, choose $p_1^h = p_2^h \equiv p^h$ and $d_1 = d_2$. Integration reduces wage costs if

$$2\left[p^h\left[X_0/2 - K(b, g)\right] + (1 - p^h)\left[K(g, b) - K^*(b)\right]\right] \geq X_1 - K^*(b). \tag{8}$$

Since $K(g,b) - K^*(b) > X_0/2 - K(b,g)$, (8) is surely violated whenever

$$K(g,b) \leq \frac{X_1 + K^*(b)}{2}. \tag{9}$$

Assume that $y(K,t) = 1 - K/a(t)$, with $a(g) > a(b)$. In this case $K^*(t) = a(t)$. The allocations if types differ are

$$\begin{aligned} K(b,g) &= X_0 \frac{a(b)}{a(b)+a(g)}, \\ K(g,b) &= X_0 \frac{a(g)}{a(b)+a(g)}. \end{aligned}$$

Choose, for example, $a(g)/[a(g)+a(b)] = 2/3$. (9) then transforms to $X_1 + 4X_2 \leq 3a(b)$. Even if we take into account the restrictions $X_2 < a(b) < X_1 \leq a(g)$ and $X_0 \geq 2a(b)$, the set of parameters satisfying (9) is surely non-empty. We have thus constructed an example where aggregate wages increase after integration.

In complete analogy to the case of integrating a cash cow project, we can now come up with examples where integration not only increases wage costs, but also reduces total profits even though "winner-picking" improves the allocational efficiency.

Corollary 2 *If projects differ in their endowments, joint incorporation may reduce total net profits.*

5.4 Asymmetric Investment Opportunities

In the previous section it has been shown that if both projects have different endowments, competition for financial resources has different effects on managers' incentives. While incentives always increase for the project manager who expects to receive additional funds from the cash-rich division, incentives for the project manager of the latter division may decrease. What is relevant is the cash endowment relative to the marginal profitability of investment opportunities. In the previous section it has been assumed that the projects' opportunities are identical if they are of the same type and that endowments differ. Another situation of an asymmetric reallocation of funds arises if both projects have identical endowments but different profitability.

The effect of competition on incentives for a project manager whose investment opportunities have *higher profitability* is then similar to the one described in the previous section for a manager whose project generates *less cash flow*. Also, the effect of competition on incentives for a project manager whose investment opportunities are *less profitable* is similar to the one described in the previous section for a manager whose project is endowed with *more cash flow*.

6 Contracting on the Allocation of Funds

6.1 On the Advantage of Contracting

So far we have assumed that only wages are specified by contracts, while the amount of capital allocated to projects in the different states was not contractible or negotiable (ex post). Rather, headquarters has always chosen the ex post optimal allocation of funds. The ex ante optimal allocation, however, takes into account the incentive effect of the capital allocation decision. In this section we allow for contracts which specify a type contingent allocation of capital. As might be expected, this additional possibility makes headquarters certainly not worse off. However, if contracts may be renegotiated, we show that it is strictly better off *only* in case of joint incorporation. Given separate incorporation, any attempt to increase the sensitivity of allocations is negated by headquarters' problem of commitment. In contrast, the creation of an internal capital market with conflicting preferences over the allocation of funds creates the possibility to deviate from the ex post profit maximizing capital allocation. Additionally, we show that given integration, contracts allow to take into account the asymmetries between projects. However, despite these additional possibilities offered by contracting, relaxing the financial constraint may still have a negative effect if renegotiation is possible.

We proceed as follows. In this section we set the stage by considering the benchmark case where the capital constraint never binds. Though this scenario violates (A.2), it allows to capture the important differences brought about by contracting on allocations. Subsequently, we discuss the effect of contracting given separate and joint incorporation if (A.2) holds. Finally, we turn to the discussion of the resource constraint in case of joint incorporation.

If the capital constraint never binds, the optimal capital allocation for the projects can be chosen separately.

Full Commitment Let $\hat{K}_i^*(g)$ and $\hat{K}_i^*(b)$ be the ex ante optimal capital allocation with full commitment and no financial constraints. $\hat{K}_i^*(g)$ and $\hat{K}_i^*(b)$ maximize the expected profit net of expected wage costs[24]

$$p_i^h Y_i(K_i(g), g) + (1 - p_i^h) Y_i(K_i(b), b) - p_i^h (d_i - \alpha[K_i(g) - K_i(b)])$$

This program has a unique solution where $\hat{K}_i^*(g)$ is determined by $y_i(\hat{K}_i^*(g), g) = -\alpha$, while $\hat{K}_i^*(b)$ is (i) determined by $y_i(\hat{K}_i^*(b), b) = \frac{p_i^h}{1-p_i^h}\alpha$ if $y_i(0, b) \geq \frac{p_i^h}{1-p_i^h}\alpha$ or (ii) zero. That is,

[24] Note that we continue to assume that a positive wage in the good state is necessary to induce high effort, so that $w_i(g) = d_i - \alpha[K_i(g) - K_i(b)]$.

ex ante it is optimal for headquarters to increase the sensitivity by increasing the level of investment in the good state and reducing it in the bad state. The sensitivity of the wage payment can then be reduced without violating the manager's incentive constraint.

Renegotiation The ex ante optimal allocation is not optimal ex post. Assume that, after realization of the type, headquarters makes the manager a take-it-or-leave-it offer to replace the initial contract by K_i and w_i. While $\hat{K}_i^*(g)$ is renegotiation proof, $\hat{K}_i^*(b)$ is not. Given the good state, headquarters would like to reduce $\hat{K}_i^*(g)$ to the ex post optimal level, $K_i^*(g)$. However, the manager will only give his consent to a reduction of the investment level if he is compensated for the resulting loss in private benefits. This, however, is not optimal for headquarters since the loss from the investment is lower. Given the bad state, headquarters wants to increase $\hat{K}_i^*(b)$ to the ex post optimal level $K_i^*(b)$. And indeed, it will do so. Headquarters interests go in the same direction as the manager's who would even be willing to pay for a higher level of capital. (However, he has no funds since $w_i(b) = 0$.)

The ex ante optimal renegotiation-proof capital allocation solves the above maximization problem and is renegotiation proof.[25] The discussion directly yields to the following lemma.

Lemma 2 *The ex ante optimal renegotiation-proof capital allocation without capital constraint is given by* $\hat{K}_i^*(g)$ *and* $K_i^*(b)$.

6.2 Separate Incorporation

Consider first the case with full commitment. Since $X_i < K_i^*(g)$, an increase of the capital allocation beyond $K_i^*(g)$ is not possible and the maximum level of investment in the good state is X_i. The capital allocation $\hat{K}_i^*(b)$ is only possible if $\hat{K}_i^*(b) \leq X_i$. Hence, $\hat{K}_i(b) = \min\{\hat{K}_i^*(b), X_i\}$.

We can now contrast this with the case where the allocation must be renegotiation proof. With renegotiation one obtains the following result.

Proposition 4 *Under separate incorporation contracting on capital allocations is without consequences if we admit for renegotiations.*

Proposition 4 directly follows from Lemma 2 and the capital constraint. A capital allocation below the ex post optimal level in the bad state is not renegotiation proof and a capital allocation above the ex post optimal level in the good state is not possible.

[25] That is, given the realization t_i, there does not exist a new capital allocation and wage payment, which yield a higher net profit, are feasible by $w_i \geq 0$ and $K_i \geq 0$, and accepted by the manager.

6.3 Joint Incorporation

Clearly, under full commitment joint incorporation strictly dominates separate incorporation. First, headquarters may increase the capital allocation sensitivity as discussed in Section 6.1. In the integrated case it has more freedom to do so as funds can be reallocated. Second, there is no negative effect of integration since headquarters may always simply replicate the stand-alone case by committing not to reallocate funds; however, it can do even better. A formal treatment is contained in the appendix.

More interestingly, the possibility to write contracts on the allocation of funds is now strictly beneficial even when renegotiation is possible.

Proposition 5 *1. Under joint incorporation the possibility to write renegotiation-proof contracts on the allocation of funds strictly increases total net profits.*

2. Whenever the optimal renegotiation-proof allocation implies a positive capital allocation for both projects if they are of different types, total net profits are strictly higher if commitment is possible.

A formal discussion of the proposition is contained in the appendix. Interestingly, in contrast to the stand-alone case (Proposition 4), the value of contracts is not negated by renegotiation when an internal capital market exists. There are two reasons. First, it is possible to assign more than $K_i^*(g)$ to a type g project if the firm is not capital constrained when projects' types differ. This allocation is renegotiation proof as discussed in Section 6.1. Second, if the capital constraint is binding, the allocation to the type b project can only be increased if the allocation to the type g project is reduced. Renegotiation therefore requires the consent of both managers. The manager of the type g project will, however, only accept the reallocation if he is sufficiently compensated. As the manager of the type b project has no funds, the compensation has to be borne by headquarters alone. Therefore renegotiation will not completely restore ex post profit maximization. However, whenever a positive amount of capital is allocated to the type b project (in renegotiation), renegotiation is a binding constraint and reduces the capital allocation sensitivity. The ability to commit therefore has a positive value (part 2 of the proposition).

The effect of integration on renegotiation is related to the literature on multiple source funding in which a second financier is introduced to distort ex post efficient behavior. Typically, this is achieved as the additional party does not participate in renegotiation.[26] In

[26] On multi-lender financing, see Berglöf and von Thadden (1994), Dewatripont and Tirole (1994), and Bolton and Scharfstein (1996).

the present paper all parties participate in the renegotiation but the manager of the type b project has nothing to offer in renegotiation.[27]

The advantage of an internal capital market in renegotiation also differs from the one discussed by Gertner et al. (1994). In Gertner et al. cash flow is assumed to be non verifiable. In this setting the threat of "liquidating" the assets (depriving the manager of the assets under his control) is necessary to force managers to pay out some of the cash.[28] The "value" of this threat in renegotiation, however, depends on the value of the assets in their next best alternative use. The advantage of an internal capital market arises because it is easier for headquarters to redeploy assets than for a bank when corporate headquarters owns multiple related business units.

6.4 Relaxing the resource constraint (cash cow effect)

We show now that contracting with renegotiation may not offset the possibly negative effect of relaxing the resource constraint by, for example, adding a cash cow to an existing internal capital market. The argument is analogous to that in Section 5.2.2. Suppose that projects are fully symmetric. In this case it is intuitive that the optimal renegotiation-proof allocation is symmetric as well. Moreover, we can continue to assume without loss of generality that positive wages are only paid in the good state where they are independent of the realization of the other project. In other words, the (residual) parameters are identical to those without contracting. We can thus immediately appeal to the results in Section 5.2.2.

To limit the amount of repetition, we restrict attention to a particular example. Assume that funds are rather scarce so that $X_0 < 2K^*(b)$. (Recall that projects are assumed to be fully symmetric.) In this case we obtain the following allocation if contracting is permitted. If both projects have identical realizations, funds are split equally, i.e., $K(g,g) = K(b,b) = \frac{1}{2}X_0$. Suppose next that types differ. Using (A.1) the allocation is uniquely determined as follows. Funds allocated to the good project are increased until either $K(g,b) = X_0$ or until the renegotiation constraint binds with $y(K(g,b),g) = y(K(b,g),b) - \alpha$. Using Lemma 1, a marginal increase in total funds X_0 *increases* wages if and only if $dK(g,b)/dX_0 < 0.5$. Take now the example of Section 5.2.2, where we specified that $y(K,g) = 1 - K$ and $y(K,b) = A - BK$ over the relevant range of K, with $0 < A < B < 1$. When both projects receive

[27] Clearly, if managers have sufficient wealth, renegotiation always leads to the ex post optimal capital allocation. In this case, however, the managers' rent from the incentive system is zero and the ex post optimal allocation equals the ex ante optimal allocation. That is, renegotiation is not an issue.

[28] See Bolton and Scharfstein (1990) and Hart and Moore (1997).

funds if types differ, we obtain[29]

$$K(g,b) = X_0 - \frac{X_0 - 1 + A - \alpha}{1+B},$$
$$K(b,g) = \frac{X_0 - 1 + A - \alpha}{1+B},$$

implying $dK(g,b)/dX_0 = B/(1+B) < 0.5$. In complete analogy to Proposition 3 it is now possible to provide parameter restrictions such that total profits decrease after a (marginal) increase in funds. We can therefore state the following result.

Proposition 6 *Even with renegotiation-proof contracts on the allocation of funds, a marginal increase in the endowment may lead to higher wages and to lower net profits.*

7 Conclusion

The present paper analyzes the effect of competition for scarce corporate financial resources on managers' incentives to generate profitable investment opportunities. Competition unambiguously increases incentives to generate investment ideas only when projects are symmetric. When projects are asymmetric, incentives may decrease. This is the case even though funds are allocated so as to maximize total profits. A reduced firm value may therefore be consistent with an allocation of capital which maximizes profits.

Ex ante it is optimal to strategically distort the allocation of funds in order to increase managers' incentives. Ex post, however, this distortion is no longer optimal. In the literature, which discusses optimal capital budgeting rules, capital budgeting is often treated as a mechanism design problem.[30] That is, it is (implicitly) assumed that it is possible to commit. This assumption is certainly extreme, in particular for the setting of the present paper. The important question is whether and how capital budgeting mechanisms may be used to credibly distort allocations. In this respect it is interesting to note that distortions are not credible if renegotiation is possible and if a project is carried out on a stand alone basis. If, however, projects are jointly incorporated, distorting the allocation of capital is possible.

The discussion in this paper has focused on analyzing competition between managers when projects are incorporated jointly given an exogenous financial constraint. There are several ways in which the analysis can be extended. Most importantly, it would be interesting

[29] Note that $K(b,g) > 0$ holds if $X_0 - 1 + A - \alpha > 0$, which is satisfied simultaneously with our assumption that $K_i^*(b) = A/B > X_0$ in case $\alpha < [A(1+B) - B]/B$.

[30] See, for example, Harris et al. (1982), Antle and Eppen (1985), and Harris and Raviv (1996, 1997).

to consider various ways how aggregate resources could be credibly constrained. This may provide an interesting role of capital structure choice for stimulating intra-firm competition (managers' incentives). In addition, competition for investment funds is not only prevalent in internal capital markets. Rather, firms compete for funds in the capital market. If the supply of these funds is not perfectly elastic, the incentive effect of competition in the capital market may complement the effect of product market competition on managers' incentives.[31] Headquarters may influence the competition for financial resources by influencing the degree to which division managers have to use the internal capital market and to which they are allowed to directly seek outside funding.

[31] See Hart (1983), Schmidt (1997) and Aghion et al. (1999) on the effect of product market competition on managers' incentives.

8 Appendix

8.1 Proof of Proposition 3

In order to analyze the effect of competition on manager i's incentives (wages) one has to analyze the sign of Δ_i. The following cases have to be distinguished:

A. Given $X_1 > X_2 \geq K^*(b)$, the capital constraint is not binding if the projects are of type b when incorporated separately. This implies the following capital allocations in the stand alone case: $K_1(b) = K_2(b) = K^*(b)$ and $K_i(g) = X_i$ for $i \in I$. When the projects are integrated, two scenarios are possible:

1. If $K^*(g) + K^*(b) \leq X_0$, the capital constraint is not binding when the projects are of different types and $K(g,g) = \frac{1}{2}X_0$, $K(g,b) = K^*(g)$, $K(b,g) = K^*(b)$, and $K(b,b) = K^*(b)$. Substituting the capital allocations in Δ_2 and Δ_1 yields:
   (a) $\Delta_2 = -p_1^h\left(\frac{X_1-X_2}{2}\right) - (1-p_1^h)\left(K^*(g) - X_2\right) < 0$, i.e., integration always increases incentives of manager 2.
   (b) $\Delta_1 = -p_2^h\left(\frac{X_2-X_1}{2}\right) - (1-p_2^h)\left(K^*(g) - X_1\right) < 0 \Leftrightarrow p_2^h\left(\frac{X_1-X_2}{2}\right) < (1-p_2^h)\left(K^*(g) - X_1\right)$, i.e., integration may increase or decrease incentives of manager 1.
   (c) for $p_1^h = p_2^h = p^h$: $\Delta_2 + \Delta_1 = -(1-p^h)(2K^*(g) - X_0) < 0$, i.e., total wage costs decrease under integration if $p_1^h = p_2^h$.

2. If $K^*(g) + K^*(b) > X_0$, the capital constraint is binding when the projects are of different types and $K(g,g) = \frac{1}{2}X_0$ and $K(b,b) = K^*(b)$. Substituting the capital allocations in Δ_2 and Δ_1 again yields that the incentives of manager 2 always increase, the incentives of manager 1 may decrease and the net effect is positive if $p_1^h = p_2^h$:
   (a) $\Delta_2 = -p_1^h\left(\frac{X_1-X_2}{2} + K^*(b) - K(b,g)\right) - (1-p_1^h)\left(K(g,b) - X_2\right) < 0$,
   (b) $\Delta_1 = -p_2^h\left(\frac{X_2-X_1}{2} + K^*(b) - K(b,g)\right) - (1-p_2^h)\left(K(g,b) - X_1\right) < 0 \Leftrightarrow$ $p_2^h\left(\frac{1}{2}X_0 - K^*(b)\right) < K(g,b) - X_1$,
   (c) for $p_1^h = p_2^h = p^h$: $\Delta_2 + \Delta_1 = X_0 - 2K(g,b) - (1-p^h)2K^*(b) < 0$.

B. Given $X_1 > K^*(b) > X_2$, the capital constraint is always binding for project 2 when carried out on a stand alone basis. The profit maximizing investment levels subject to the capital constraint are given by $K_1(b) = K^*(b)$, $K_1(g) = X_1$, and $K_2(g) = K_2(b) = X_2$. When the projects are integrated, two scenarios are possible:

1. If $2K^*(b) < X_0$, the capital constraint of the integrated firm is not binding when both projects are of the bad type. Hence, $K(g,g) = \frac{1}{2}X_0$ and $K(b,b) = K^*(b)$. Substituting the capital allocations in Δ_2 and Δ_1 again yields a similar result as above: the incentives of manager 2 always increase, the incentives of manager 1 may decrease. But now total wage costs may increase as well (for $p_1^h = p_2^h$):

   (a) $\Delta_2 = -p_1^h\left(\frac{1}{2}X_0 - K(b,g)\right) - (1-p_1^h)\left(K(g,b) - K^*(b)\right) < 0$,

   (b) $\Delta_1 = -p_2^h\left(\frac{X_2-X_1}{2} + K^*(b) - K(b,g)\right) - (1-p_2^h)\left(K(g,b) - X_1\right) < 0$
   $\Leftrightarrow p_2^h\left(\frac{1}{2}X_0 - K^*(b)\right) < K(g,b) - X_1$,

   (c) for $p_1^h = p_2^h = p^h$: $\Delta_2 + \Delta_1 = -2K(g,b) + X_1 + K^*(b) + 2p^h\left(\frac{1}{2}X_0 - K^*(b)\right) \lesseqgtr 0$.

2. If $2K^*(b) \geq X_0$, the capital constraint is binding if both projects are of type b and $K(g,g) = K(b,b) = \frac{1}{2}X_0$. Substituting the capital allocations in Δ_2 and Δ_1 now reveals that wage costs are always decreasing when the projects are incorporated jointly:

   (a) $\Delta_2 = -p_1^h\left(\frac{1}{2}X_0 - K(b,g)\right) - (1-p_1^h)\left(K(g,b) - \frac{1}{2}X_0\right) = \frac{1}{2}X_0 - K(g,b) < 0$,

   (b) $\Delta_1 = -p_2^h\left(\frac{1}{2}X_0 - X_1 + K^*(b) - K(b,g)\right) - (1-p_2^h)\left(K(g,b) - \frac{1}{2}X_0 - X_1 + K^*(b)\right) = \frac{1}{2}X_0 + X_1 - K(g,b) - K^*(b) < 0$,

   (c) $\Delta_2 + \Delta_1 < 0$.

C. If the capital constraint is binding for both projects under separate incorporation, i.e., $K^*(b) \geq X_1$, joint incorporation is also clearly beneficial as no incentive effect stems from the capital allocation under separate incorporation.

1. (a) $\Delta_2 = -p_1^h\left(\frac{1}{2}X_0 - K_2(b,g)\right) - (1-p_1^h)\left(K_2(g,b) - \frac{1}{2}X_0\right) < 0$,

   (b) $\Delta_1 = -p_1^h\left(\frac{1}{2}X_0 - K_2(b,g)\right) - (1-p_1^h)\left(K_2(g,b) - \frac{1}{2}X_0\right) < 0$,

   (c) $\Delta_2 + \Delta_1 < 0$.

All assertions follow immediately from inspection of the respective expressions.

8.2 Joint Incorporation and Contracting on the Allocation of Funds

Full Commitment Let $\hat{K}_i(t_i, t_j)$ be the ex ante optimal capital allocation to project i when it is of type t_i and the other project is of type t_j with full commitment and capital constraint. Headquarters chooses the respective investment levels in order to maximize total *expected* profits net of expected wage costs of inducing high effort

$$\begin{aligned}
& p_1 p_2[Y_1(K_1(g,g),g) + Y_2(K_2(g,g),g)] \\
+ \; & p_1(1-p_2)[Y_1(K_1(g,b),g) + Y_2(K_2(b,g),b)] \\
+ \; & (1-p_1)p_2[Y_1(K_1(b,g),b) + Y_2(K_2(g,b),g)] \\
+ \; & (1-p_1)(1-p_2)[Y_1(K_1(b,b),b) + Y_2(K_2(b,b),b)] \\
- \; & p_1(d_1 - p_2\alpha[K_1(g,g) - K_1(b,g)] - (1-p_2)[K_1(g,b) - K_1(b,b)]) \\
- \; & p_2(d_2 - p_1\alpha[K_2(g,g) - K_2(b,g)] - (1-p_1)[K_2(g,b) - K_2(b,b)])
\end{aligned}$$

subject to the constraints that the capital allocations must not exceed the total endowment, X_0, and must be non-negative.

By (A.1) this program has a unique solution for all (t_i, t_j): For all combinations (t_i, t_j) for which the capital constraint does not bind, the optimal capital allocation is given by $\hat{K}_i^*(t_i)$, which is the ex ante profit maximizing capital allocation with commitment and no capital constraint (Section 6.1). For all combinations (t_i, t_j) for which the capital constraint binds, the ex ante optimal capital allocation is either (i) uniquely determined by the first order condition

- $y_1(\hat{K}_1(g,g),g) - y_2(\hat{K}_2(g,g),g) = 0$ if $t_i = t_j = g$,
- $y_i(\hat{K}_i(b,g),b) - y_j(\hat{K}_j(g,b),g) = \alpha + \frac{p_i}{1-p_i}\alpha$ if $t_i \neq t_j$, and
- $y_1(\hat{K}_1(b,b),b) - y_2(\hat{K}_2(b,b),b) = \frac{p_1-p_2}{(1-p_1)(1-p_2)}\alpha$ if $t_i = t_j = b$

and the resource constraint or (ii) a corner solution exists so that one project receives the total funds. This result follows directly from the analysis of the maximization problem.

Several interesting observations emerge. First, the capital allocation when both projects are of the good type is identical to the one without contracting. Second, headquarters commits to the same magnitude of distortions given the capital constraint as without the capital constraint. The reason is that the effect of the distortions on the managers' effort incentives are the same in both cases. Third, the capital allocation in the bad state may be distorted even when projects are identical ex post, i.e., $y_1(K,b) = y_2(K,b)$, in order to adjust for differences in the success probabilities.

Renegotiation Renegotiation introduces a further constraint on the maximization program above. The capital allocation $K_1(t_1, t_2)$ and $K_2(t_2, t_1)$ is renegotiation proof given t_1 and t_2 if there is no pair of new wages (w_1, w_2) and capital allocations (K_1, K_2) which headquarters prefers and is accepted by division managers:

$$\begin{aligned} & Y_1(K_1(t_1,t_2),t_1) + Y_2(K_2(t_2,t_1),t_2) - w_1(t_1,t_2) - w_2(t_2,t_1) \\ < \; & Y_1(K_1,t_1) + Y_2(K_2,t_2) - w_1 - w_2 \end{aligned}$$

and

$$\begin{aligned} \alpha K_1(t_1,t_2) + w_1(t_1,t_2) & \leq \alpha K_1 + w_1, \\ \alpha K_2(t_2,t_1) + w_2(t_2,t_1) & \leq \alpha K_2 + w_2. \end{aligned}$$

Denote the solutions to the new program by $\bar{K}_i(t_i, t_j)$. By (A.1) this program has a unique solution for all (t_i, t_j): For all combinations (t_i, t_j) for which the capital constraint does not bind, the optimal renegotiation-proof capital allocation is given by $\bar{K}_i^*(t_i)$, which is the ex ante profit maximizing capital allocation with renegotiation and no capital constraint (Lemma 2, Section 6.1). For all combinations (t_i, t_j) for which the capital constraint binds, the ex ante optimal renegotiation-proof capital allocation is either (i) uniquely determined by the first order condition

- $y_1(\bar{K}_1(g,g),g) - y_2(\bar{K}_2(g,g),g) = 0$ if $t_i = t_j = g$,
- $y_i(\bar{K}_i(b,g),b) - y_j(\bar{K}_j(g,b),g) = \alpha$ if $t_i \neq t_j$, and
- $y_1(\bar{K}_1(b,b),b) - y_2(\bar{K}_2(b,b),b) = \begin{cases} \alpha \text{ if } \left|\frac{p_1-p_2}{(1-p_1)(1-p_2)}\alpha\right| \geq a \\ \frac{p_1-p_2}{(1-p_1)(1-p_2)}\alpha \end{cases}$ if $t_i = t_j = b$

and the resource constraint or (ii) a corner solution exists and one project receives the total funds.

Propositions 5 directly follows from comparing the ex ante optimal capital allocation with renegotiation to the ex post optimal capital allocation (part 1) and to the ex ante optimal capital allocation with commitment (part 2).

References

[1] Aghion, P., M. Dewatripont, and P. Rey, Financial Discipline and Growth, *Review of Economic Studies*, 6, 1999, 825-52.

[2] Antle, R., and G. D. Eppen: Capital Rationing and Organizational Slack in Capital Budgeting, *Management Science* 31, 1985, 163-174.

[3] Berger, P., and E. Ofek: Diversification's Effect on Firm Value, *Journal of Financial Economics* 37, 1995, 39-65.

[4] Berglöf, E., and E.-L. von Thadden: Short-Term Versus Long-Term Interests: Capital Structure with Multiple Investors, *Quarterly Journal of Economics* 109, 1994, 1055 - 1084.

[5] Berkovitch, E., R. Israel, and E. Tolkowsky: The Boundaries of the Firm: The Choice between Stand-Alone and Integrated Firms, Working Paper, 2000.

[6] Bolton, P., and D.S. Scharfstein: A Theory of Predation Based on Agency Problems in Financial Contracting, *American Economic Review* 80, 1990, 93-106.

[7] Bolton, P., and D.S. Scharfstein: Optimal Debt Structures and the Number of Creditors, *Journal of Political Economy* 104, 1996, 1-25.

[8] Brusco, S., and F. Panunzi: Reallocation of Corporate Resources and Managerial Incentives in Internal Capital Markets, CEPR Discussion Paper No. 2532, August 2000.

[9] Campa, J., and S. Kedia: Explaining the Diversification Discount, Working Paper, Harvard University, 1999.

[10] Chevalier, J.A.: What do We Know About Cross-Subsidization? Evidence From the Investment Policies of Merging Firms, Working Paper, University of Chicago, 2000.

[11] Comment, R. and G. Jarrell: Corporate Focus and Stock Returns, *Journal of Financial Economics* 37, 1995, 67-87.

[12] Daley, L., Mehrotra, V., and R. Sivakumar: Corporate Focus and Value Creation - Evidence from Spinoffs, *Journal of Financial Economics* 45, 1997, 257-281.

[13] Dewatripont, M., and J. Tirole: A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence, *Quarterly Journal of Economics* 109, 1994, 1027-1054.

[14] Donaldson, G.: Managing Corporate Wealth (Peager Publishers, New York), 1984.

[15] Gautier, A., and F. Heider: What Do Internal Capital Markets Do? Incentives vs. Redistribution, Financial Markets Group, London School of Economics, 2000.

[16] Gertner, R.H., D.S. Scharfstein, and J.C. Stein: Internal versus External Capital Markets, *Quarterly Journal of Economics* 109, 1994, 1211-1230.

[17] Graham, J., M. Lemmon, and J. Wolf: Does Corporate Diversification Destroy Value?, Working Paper, Duke University, 2000.

[18] Harris, M., C. Kriebel, and A. Raviv: Asymmetric Information, Incentives and Intrafirm Resource Allocation, *Management Science* 28, 1982, 604-620.

[19] Harris, M., and A. Raviv: The Capital Budgeting Process: Incentives and Information, *Journal of Finance* 51, 1996, 1139-1174.

[20] Harris, M., and A. Raviv: Capital Budgeting and Delegation, Working Paper, University of Chicago, 1997.

[21] Hart, O.: The Market as an Incentive Mechanism, *Bell Journal of Economics* 14, 1983, 366-382.

[22] Hart, O., and J. Moore: Default and Renegotiation: A Dynamic Model of Debt, Financial Markets Group Discussion Paper No 262, London School of Economics, 1997.

[23] Hellwig, M.:"On the Economics and Politics of Corporate Finance and Corporate Control", in: X. Vives (ed.), Corporate Governance, Cambridge University Press, Cambridge 2000, 95 - 134.

[24] Hellwig, M.: "Corporate Governance and the Financing of Investment for Structural Change", in: Deutsche Bundesbank (ed.), Investing Today for the World of Tomorrow: Studies on the Investment Process in Europe, Springer Verlag, Berlin, Heidelberg, New York 2001, 203-223.

[25] Holmstrom, B., and J. Ricart i Costa: Managerial Incentives and Capital Management, *Quarterly Journal of Economics* 101, 1986, 835-860.

[26] Hyland, D.: Why Firms Diversify: An Empirical Examination, Working Paper, University of Texas, 1999.

[27] Jensen, M.C.: Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers, *American Economic Review* 76, 1986, 323-329.

[28] Krishnaswami, S., and V. Subramaniam: Information Asymmetry, Valuation, and the Corporate Spin-Off Decision, *Journal of Financial Economics* 53, 1999, 73-112.

[29] Lazear, E.P., and S. Rosen: Rank-order Tournaments as Optimum Labor Contracts, *Journal of Political Economy* 89, 1981, 841-864.

[30] Lamont, O.: Cash Flow and Investment: Evidence From Internal Capital Markets, *Journal of Finance* 52, 1997, 83-109.

[31] Lamont, O., and C. Polk: Does Diversification Destroy Value? Evidence from Industry Shocks, CRSP Working Paper, University of Chicago, 2000.

[32] Lang, L.H.P., and R. Stulz: Tobin's q, Corporate Diversification, and Firm Performance, *Journal of Political Economy* 102, 1248-1280, 1994.

[33] Lins, K, and H. Servaes: International Evidence on the Value of Corporate Diversification, *Journal of Finance* 54, 1999, 2215-2239.

[34] Maskin, E., Y. Qian, and C. Xu: Incentives, Information, and Organizational Form, *Review of Economic-Studies* 67, 2000, 359-78.

[35] Matsusaka, J., and V. Nanda, Internal Capital Markets and Corporate Refocusing, Working Paper, University of Southern California, *Journal of Financial Intermediation*, forthcoming 2000.

[36] Milbourn, T., R. Shockley, and A. Thakor: Prestige, Intrafirm Tournaments, and Failure Aversion in Corporate Decisions, Working Paper, University of Michigan, 1999.

[37] Meyer, M., P. Milgrom, and D. Roberts: Organizational Prospects, Influence Costs, and Ownership Changes, *Journal of Economics and Management Strategy 1,* 1992, 9-35.

[38] Myers, S.C.: Determinants of Corporate Borrowing, *Journal of Financial Economics* 4, 1977, 147-175.

[39] Myers, S.C., and N.S. Majluf: Corporate Financing and Investment Decisions When Firms Have Information that Investors Do Not Have, *Journal of Financial Economics* 13, 1984, 187-221.

[40] Nanda, V., and M.P. Narayanan: Disentangling Value: Financing Needs, Firm Scope, and Divestitures, *Journal of Financial Intermediation* 8, 1999, 174-204.

[41] Rajan, R., H. Servaes, and L. Zingales: The Cost of Diversity: The Diversification Discount and Inefficient Investment, *Journal of Finance* 55, 2000, 35-80.

[42] Rato, J.M.: The Allocation of Control Rights between a Young Firm and His Financier, mimeo, University of Chicago, 2000.

[43] Scharfstein, D.S.: The Dark Side of Internal Capital Markets II: Evidence from Diversified Conglomerates, NBER Working Paper 6352, 1998.

[44] Scharfstein, D.S., and J.C. Stein: The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment, *Journal of Finance* 55, 2000.

[45] Schmidt, K.:. Managerial Incentives and Product Market Competition, *Review of Economic Studies* 64, 1997, 191-213.

[46] Schoar, A.: Effects of Corporate Diversification on Productivity, mimeo, MIT, 2000.

[47] Servaes, H.: The Value of Diversification during the Conglomerate Merger Wave, *Journal of Finance* 51, 1996, 1201-1225.

[48] Shin, H.-H., and R.M. Stulz: Are Internal Capital Markets Efficient?, *Quarterly Journal of Economics* 113, 1998, 531-552.

[49] Stein, J.C.: Internal Capital Markets and the Competition for Corporate Resources, *Journal of Finance* 52, 1997, 111-133.

[50] Stein, J.C.: Information Production and Capital Allocation: Decentralized vs. Hierarchical Firms, NBER Working Paper 7705, 2000.

[51] Thakor, A.V.: Investment "Myopia" and the Internal Organization of Capital Allocation Decisions, *Journal of Law, Economics, and Organization* 6, 1990, 129-154.

[52] Williamson, O.E.: Markets and Hierarchies: Analysis and Antitrust Implications (Collier Macmillan Publishers, Inc., New York), 1975.

[53] Wulf, J.: Influence and Inefficiency in the Internal Capital Market: Theory and Evidence, Working Paper, University of Pennsylvania, 2000a.

[54] Wulf, J.: Internal Capital Markets and Firm-Level Compensation Incentives for Divisional Managers, Working Paper, University of Pennsylvania, 2000b.