The benefit and cost of winner-picking: Redistribution vs. Incentives

by
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This paper examines the agency cost of winner-picking in multidivision firms and uses explicit incentive contracts to analyze the interaction between corporate headquarters' investment and incentive policies. Winner-picking, i.e. the efficient reallocation of scarce resources in an internal capital market, adds an extra layer of noise to the moral hazard problem of incentivizing division managers to produce the resources that can then be redistributed. In particular, division managers with strong future investment opportunities anticipate that headquarters will bail them out should they fail to produce enough resources themselves. This reduces incentives to create the resources in the first place with possible consequences for the optimal investment policy. (JEL: G31, L25)

1 Introduction

The presence of large conglomerates is a dominant feature of advanced economies. In 1992, 88% of the 500 largest US public companies, producing three-quarters of the output of all U.S. public companies, are conglomerates operating in more than one line of business (Montgomery [1994]).

Within a conglomerate, corporate headquarters has the possibility to reallocate the resources of one business segment to another i.e., to operate an internal capital market. Lamont [1997] and Shin and Stulz [1998] provide evidence that conglomerates indeed actively reallocate resources across divisions.

Alchian [1969], Williamson [1975] and, more recently, Stein [1997] argue that the reallocation is efficient. They claim that a key advantage of conglomerate firms is the value-enhancing reallocation of scarce resources across divisions, i.e. a "smarter-money" or "winner-picking" effect. But this raises the question of why conglomerates

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do then not trade at a premium compared to (a suitably chosen) portfolio of single-division firms (Lang and Stulz [1994] and Berger and Ofek [1995] even document a "conglomerate discount").[1]

One possible answer is that the reallocation of resources within a conglomerate is not efficient. In Scharfstein and Stein [2000], corporate headquarters' ownership of assets makes it vulnerable to wasteful influence activities by division managers and in Rajan, Servaes and Zingales [2000] corporate headquarters uses its allocative authority to minimize wasteful bargaining among division managers. In both cases, corporate headquarters does not maximize value but inefficiently cross-subsidizes divisions, i.e. there is "corporate socialism". Maksimovic and Phillips [2002] and Khanna and Tice [2001], however, produce evidence that is inconsistent with corporate socialism in that in both cases the reallocation of resources across divisions appears to be efficient.

We therefore explore a second possibility: that the reallocation is efficient, i.e. that there is winner-picking, but that winner-picking has a dark side to it. The starting point of our analysis is that corporate headquarters needs to incentivize divisional managers to produce the resources that it then reinvests efficiently. Our central assertion is that there is a tension between headquarters' investment and incentive policies. Winner-picking adds noise to the moral hazard problem between corporate headquarters and divisional managers.

The moral hazard problem between headquarters and division managers is a standard one (and the same as in a single-division firm): headquarters does not know whether good performance is due to managerial skill or sheer luck. Winner-picking in a multidivision firm adds an extra layer of noise because it is not possible to ascertain whether good divisional performance is due to skill, luck or because headquarters bails out an unlucky manager, whose division however has strong future investment opportunities, with resources from another division. Managers of winning divisions have lower incentives since they may be able to free-ride on the resources from losing divisions.

In our analysis, we initially assume that the incentive contract offered to a divisional manager depends only on the performance of his own division, as prescribed by Holmström's [1979] informativeness principle in the case without ex post intervention and with uncorrelated output across divisions. Evidence suggests that such incentive contracts are indeed common practice in multidivision firms (see for example Bushman, Indjejikian and Smith[1995] and Wulf [2002]).

But once managerial effort has been incurred, headquarters has an incentive to intervene ex post and to reallocate scarce resources to divisions with strong future investment opportunities. Rational divisional managers anticipate the possibility of winner-picking. In particular, the manager of a division with strong future investment opportunities ends up working less. She knows that headquarters has an ex post incentive to reallocate resources towards her. This reduces her incentives to create her own resources.

[1]Recent work questions the existence of a discount on econometric grounds. Finding a discount on average may be driven by selection biases (e.g. Chevalier [2004], Campa and Kedia [2002] and Graham, Lemmon and Wolf [2002]) or measurement error (e.g. Whited [2001]).

The manager of a weak division, however, does not end up working less in our set-up, even though he expects to lose resources. The reason is that headquarters can adjust his incentive contract and compensate him for his loss by paying more when he does not lose resources. Managers of losing divisions are simply paid more less often. Taken together, the efficient reallocation of resources within a multidivision firm therefore increases the incentive cost of producing those resources. Depending on the importance of the benefit of winner-picking relative to its agency cost, a conglomerate may create or destroy value.

The incentive cost of winner-picking could be avoided by using more sophisticated incentive schemes based on information about the performance of all the divisions of a conglomerate. For example, a contract that pays all managers only when their divisions succeed jointly does not create an extra agency cost.[2] When all divisions succeed jointly, then headquarters does not need to redistribute resources and managerial pay is trivially independent of headquarters' ex post intervention. But with such an incentive contract headquarters may have incentives to strategically liquidate divisions in order to save on managerial pay. In theory, taking fully into account the conflict between investment decisions and managerial incentives, especially when there are many divisions, leads to complex incentive contracts. In practice however, such complex contracts are rarely observed (Bushman, Indjejikian and Smith [1995]). A simpler alternative may be bonus pools that are distributed at headquarters' discretion. Headquarters, in contrast to outsiders, can observe which division has produced the resources that may then be redistributed within the firm. Such bonus pools depend, however, on headquarters' reputation of rewarding only successful managers and may be subject to collusion or the kind of influence activities described in Scharfstein and Stein [2000] and Rajan, Servaes and Zingales [2000].

Our analysis is related to Rotemberg and Saloner [1994] and Brusco and Panunzi [2005] who both identify ex ante agency costs of ex post intervention in multidivision firms. In Rotemberg and Saloner [1994] divisional managers need to develop ideas that headquarters can then implement. A manager can only be paid if his own idea is implemented. Headquarters may fail to implement a manager's idea and instead use another idea generated elsewhere in the firm. This ex post intervention lowers managers' incentives to produce a valuable idea in the first place. Brusco and Panunzi [2005] argue that winner-picking hurts ex ante incentives because managers of divisions with weak investment opportunities lose private benefits. The private benefits for a manager are specific to the resources of his division so that he cannot be adequately compensated for losing them.[3]

Both models share the feature that the agency cost arises in losing divisions because their manager cannot be compensated fully for the expropriation by headquarters. We allow for explicit incentive contracts that can be used to compensate the manager of a losing division. Instead, we identify an agency caused by free-riding of managers in winning divisions. They cannot be punished for receiving resources.

[2]This assumes that managers are risk neutral. If they are risk averse, then a contract that pays them only if they all succeed together may well be prohibitively costly.

[3]Gertner, Scharfstein and Stein [1994] and Aghion and Tirole [1997] analyze similar conflicts between ex post intervention and ex ante incentives in settings other than multidivision firms.

Inderst and Laux [2005] show how ex post winner-picking can improve ex ante incentives in a conglomerate when divisions are homogeneous. They focus on the incentive problem of generating future investment opportunities taking resources as given while we focus on the incentive problem of generating resources taking future investment opportunities as given. The competition for scarce resources in their model gives managers incentives to produce winning investment opportunities.[4]

Section 2 introduces the model and section 3 analyzes a portfolio of independent single-division firms as a benchmark. Sections 4 and 5 examine the multidivision firms. Section 4 considers the possibility that headquarters decides not redistribute resources ex post. Section 5 considers redistribution (winner-picking). Section 6 compares results from the previous sections to determine i) when headquarters prefers to pick winners and ii) when the multidivision firm has a higher value than the portfolio of independent single-division firms. Section 7 discusses the robustness of our results with respect to alternative incentive schemes. Section 8 concludes.

2 The Model

Our model combines winner-picking and moral hazard in a multidivision firm. Headquarters maximizes value and owns all productive assets, but it has no expertise in managing them, so that it must employ self-interested managers to run the divisions. All parties are risk-neutral and the risk-free interest rate is normalized to zero.

To introduce the model, consider first a single-division firm. The model extends over two periods, from t=0 to t=1 and from t=1 to t=2. If the manager exerts an unobservable effort at cost c during the first period, then production succeeds with probability p_h and fails with probability $(1 - p_h)$. If he does not exert effort, the probabilities are $p_l < p_h$ and $(1 - p_l)$ respectively. If first period production was not successful, then second period production cannot take place, the model ends, the manager loses his job and the value of the firm is zero. If first period production was successful, then there are two possibilities. Either production continues for a second period or production is stopped after the first period and the manager loses his job. The gross values of the firm, i.e. without taking into account managerial pay, are $\gamma\alpha > 1$ and 1 respectively. The decision whether to continue production or not at t=1 is taken by headquarters.

Our model captures a situation where initial managerial moral hazard affects the probability of attaining future profitable production stages. For example, a hard working manager is more likely to maintain the quality of the assets he is in charge of. Machines that are not properly looked after break down more often and cannot be used for future production. In that case, production must be stopped and the manager is fired. For simplicity, we assume that the value of the division is zero and nothing can be paid to the manager. In contrast, well maintained machinery may be used for future production leading to a final firm value of $\gamma\alpha$ at t=2 or, alternatively, may be liquidated early at t=1 and sold to other users for a value of 1.

[4] Gautier and Wauthy [2007] consider a related multi-tasking problem where competing managers must raise money and develop valuable investment opportunities.

The intermediate production result after the first period is observable but not contractible. The decision of what to do with the assets belongs to headquarters who, as the owner of assets, has the residual control rights over their use (see Grossman and Hart [1986] and Gertner, Scharfstein and Stein [1994]).[5] In the case of a single-division firm, headquarters' control rights are modeled here as the decision either to continue production or to stop production and liquidate assets early.

The liquidation values 1 (early, at t=1, after success in the first period and stopping production) and $\gamma\alpha > 1$ (late, at t=2, after success in the first period and continuing production) result from a sale of assets to other users and are contractible. The incentive contract that headquarters gives to the divisional manager therefore specifies two payments. A payment w out of $\gamma\alpha$ when his successful division is continued and a payment s out of 1 when his successful division is liquidated. Nothing can be paid if his division was unsuccessful in the first period. We call the payment s severance pay, since it compensates the manager for early liquidation and being fired although first period production was successful. Headquarters can use the severance pay to commit ex ante not to inefficiently liquidate a successful division ex post.

Since we want to analyze the negative incentive effect of winner-picking by headquarters on divisional managers in a conglomerate, our model has headquarters oversee two divisions indexed i=1,2. The divisions are as just described. The only extra assumption is that division 1's production in the second period is more valuable than division 2's production: $\gamma_1\alpha > \gamma_2\alpha$, and for simplicity $\gamma_1 = \gamma$ and $\gamma_2 = 1$. The difference across divisions in the second period does not affect the structure of the moral hazard problem in the first period. The parameter γ measures the extra productivity of the strong division 1 over the weak division 2, which is known to everybody from the beginning. The divisions have identical and independent success probabilities (with and without managerial effort), first period success means the same in both divisions, and their managers have the same cost of effort. Having headquarters oversee two divisions who have different future prospects allows it to engage in winner-picking, i.e. to redistribute scarce resources towards the best use at t=1 (see Stein [1997]).

Divisions are identical in the first production period but they may not all succeed at the same time. Table 1 shows headquarters' possible actions (rows) in the different cases it encounters (columns) at t=1. The likelihood of each case depends on divisional managers' efforts. When both divisions have succeeded in the first period, headquarters can continue production in both. The gross value of the firm is $\gamma\alpha + \alpha$. Instead, headquarters could also stop production and realize gross values of $\gamma\alpha + 1$, $\alpha + 1$ or 2 depending on whether it stops division 2, division 1 or both. When both divisions failed in the first period, the value of the firm is zero.

Due to the scarcity of resources only one division can be continued when first period production fails in one of the two divisions. But we allow headquarters to choose which of the two divisions to continue. Since we assume that second period production is

[5] The ownership of assets, and hence having unconditional residual control rights, distinguishes headquarters from a single outside financier, e.g. a bank, which only owns production assets in the case of bankruptcy. These unconditional control rights cannot be contracted away to a third party. They also give headquarters incentives to be well informed about its division(s) (see also Stein [1997]).

Table 1

Headquarters' possible actions at t=1 (winner-picking in italics)

Both divisions succeed	Only strong division 1 succeeds	Only weak division 2 succeeds	Neither division succeeds
continue both continue 1, stop 2 stop 1, continue 2 stop both	continue 1, stop 2 stop 1, continue 2 stop both	stop 1, continue 2 *continue 1, stop 2* stop both	stop both

more valuable in division 1, headquarters will never want to continue the weak division 2 when only the strong division 1 succeeded. The interesting case (in italics) therefore occurs when the strong division 1 failed and the weak division 2 succeeded. In that case, headquarters has the possibility of winner-picking, i.e. to continue division 1 and realize a gross value of $\gamma\alpha$ instead of continuing division 2 for a gross value of $\alpha < \gamma\alpha$.

Our model describes the situation in which headquarters can redeploy assets that have maintained a sufficient level of quality - managerial effort makes this more likely - in order to be used for further production. The redeployability of assets across divisions has been identified as a major advantage of conglomerates and their internal capital markets (see Gertner, Scharfstein and Stein [1994]). If headquarters has redeployed the assets of a division, then the assets are no longer in place in that division to reach the second production stage. As in the case of failure, the division is shut down and the divisional manager is fired. The value of the division is zero and nothing can be paid to the divisional manager.

For example, a manufacturer of electronic goods may have a division producing personal computers and another one producing mobile phones. Suppose that the mobile-phone division has better prospects but its machines have broken down and cannot be used for future production. The machines of the computer division, however, have not not broken down and can be used for production, either of computers or of mobile-phones (e.g. the machines are used to manufacture integrated circuits). In this case, headquarters could decide to transfer the machines from the computer division to the mobile-phone division. Of course, this means that production in the computer division has to be stopped, since its machines have been taken away. The manager of the computer division loses his job despite good performance while the manager of mobile-phone division keeps his job despite bad performance.[6]

The ownership of the assets of more than one division enhances headquarters' control rights at t=1. In addition to continue or stop a successful division, it can now

[6]We assume that headquarters cannot access external capital markets to buy additional assets. Without scarce resources there is no scope for winner picking. Scharfstein and Stein [2000] show how an agency problem between outside investors and headquarters affects the agency problem between headquarters and divisional managers. Inderst and Müller [2003] consider the difference between single- and multidivision firms with respect to debt finance. De Motta [2003] argues that divisional managers may free-ride on the perception of the multidivision firm as a whole when accessing external capital markets.

also redeploy assets. That is, headquarters can stop a successful division in order to continue a failed division. Instead of selling assets to outside users it can transfer them internally. We are interested in the incentive effect for divisional managers of enhancing headquarters' control rights to engage in winner-picking by redeploying assets.

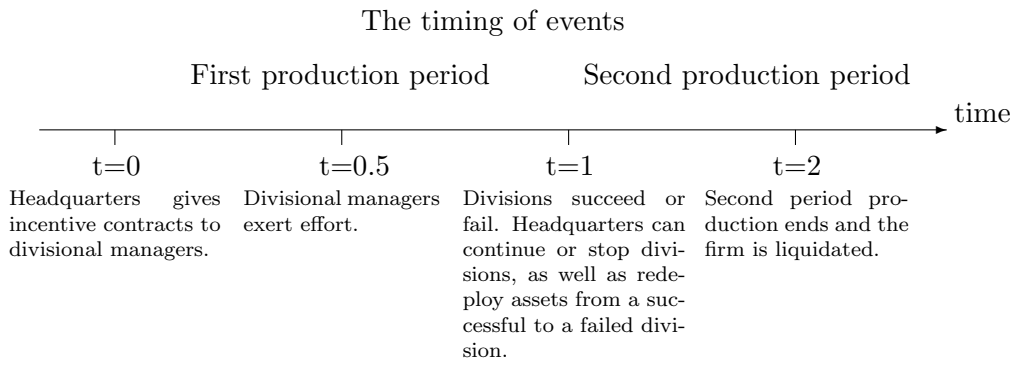
It is important to recall that only the liquidation values 1 (from early liquidation at t=1) and $\gamma\alpha$ or α (from late liquidation at t=2) are contractible in our model. Redeploying assets internally is observable but not contractible. In this key ingredient of the model we follow Gertner, Scharfstein and Stein [1994] and Stein [1997]. It would be difficult for an outside court to verify the internal transfer of assets in a conglomerate. To come back to our example, suppose that second period production takes place in the mobile-phone division only. It not possible to write an incentive contract, enforceable by outsiders, that distinguishes whether the production used well-maintained machines from the mobile-phone or from the computer division. Although second period production does not take place in the computer division (since its assets have be redeployed), it is impossible to ascertain for outsiders whether this was not caused by machines having broken down in that division.

We consider first a benchmark case in section 3. Suppose that the firm is a portfolio of two single-division firms so that assets cannot be redeployed. Given that the probabilities of success of first period production are independent across divisions, the optimal incentive contract exposes a manager only to the performance of his own division.[7] As in the single division case, the contract specifies a wage w_i out of the continuation value of division i: $\gamma\alpha$ for division 1 and α for division 2. The contract also specifies severance pay s_i to compensate a manager for being fired after the early liquidation of his successful division. As in the single-divisional case, the severance pay is a modeling device to ensure that a successful division is not inefficiently liquidated. Without the severance pay there may be inefficient liquidation, clouding the incentive effect of winner-picking. The impact of inefficient liquidation on ex ante behavior is not specific to multidivision firms and has been examined elsewhere in the literature (see for example Bolton and Scharfstein [1990] and Gertner, Scharfstein and Stein [1994]).

In order to expose the adverse incentive effect of winner-picking in sections 4 and 5, we continue to base a manager's pay only on the performance of his own division but allow assets to be redeployed. The key inefficiency is due to the inability to contract on the transfer of assets. In particular, the incentives of the manager of the strong division 1 weaken, since he anticipates that his division will be continued even when it fails in the first period. The incentives of the manager of the weak division 2, however, do not weaken. Although he is paid less often (because production in his division is stopped and he is fired when assets are redeployed), headquarters will compensate for that loss by paying him more when it does not need to redeploy the assets of his division. Given that the divisions are technologically independent and that headquarters may not always want to redistribute resources, it is clear that linear contracts based on total firm value

[7]This is an immediate application of Holmström's [1979] informativeness principle. If, there however were some shock to the values of both divisions and this shock were contractible, (e.g. industry wide factors driving also the value of competitors), then there would be a scope for relative performance pay to filter out this shock.

Figure 1



cannot be optimal. In section 7 we therefore ask whether complex, non-linear contracts, or simpler but subjective incentive arrangements such as bonus pools, can eliminate the agency cost of winner-picking.

Figure 1 summarizes the sequence of events in our model.

3 Single-division firms

In this section we explore the moral hazard problem between headquarters and its manager in a firm with only one strong division with a final liquidation value of $\gamma\alpha$. In that case, there cannot be any winner-picking and we show that there is no inefficient liquidation and no agency cost over and above the normal rent the agent must earn in a standard moral hazard problem.

To fix ideas, we first present a hypothetical first-best situation: what if there was no moral hazard problem? Then, we move to the second-best situation where there is moral hazard. Lastly, we introduce a reference point - a portfolio of two independent single division firms - to be able to assess the value consequences of winner-picking later on.

3.1 First Best: No moral hazard

If there was no moral hazard, it is as if headquarters performed the effort itself. Headquarters therefore fully internalizes the impact of its investment decision.

Consider first headquarters' decision at t=1 to continue or to stop production. If the division did not succeed, then there is no choice: production cannot be continued. If headquarters exerted effort at cost c and the division succeeded, it obtains $\gamma\alpha - c$ from continuation and $1 - c$ from stopping. If instead it exerted no effort, it obtains $\gamma\alpha$ and 1 respectively. Since $\gamma\alpha > 1$, a successful division is always continued. Consider next headquarters' effort decision at t=0.5. Headquarters knows that it will continue a successful division and thus exerts effort if and only if $p_h\gamma\alpha - c \geq p_l\gamma\alpha$. We therefore have the following result:

PROPOSITION 1 *In a firm with one strong division only and no moral hazard, successful first-period production is always continued. Effort occurs if* $(p_h - p_l)\gamma\alpha \geq c$.

3.2 Second Best: Simple managerial moral hazard

We now turn to case when there is moral hazard, i.e., the manager must be incentivized to exert effort. As usual, we proceed backwards and first analyze headquarters' investment decision at t=1.

Again, if production failed in the first period, headquarters has no choice. But if it was successful, headquarters can either continue production for a second period and obtain the value net of payment w to the manager, $\gamma\alpha - w$, or it can stop production and obtain the value net of severance pay $1 - s$. At t=1, headquarters therefore continues a successful division if the following continuation constraint is met:

$$\gamma\alpha - w \geq 1 - s \tag{1}$$

The continuation pay w and the severance pay s that headquarters chooses ex ante to incentivize its manager clearly affect its ex post investment decision.

In order to determine the incentive pay for the manager, we must turn to his incentive to exert effort at t=0.5. The incentive depends on headquarters' investment decision at t=1. Conditional on headquarters continuing a successful division, the manager exerts effort if:

$$p_h w - c \geq p_l w$$

Conditional on headquarters stopping a successful division (equation (1) does not hold), the manager exerts effort if:

$$p_h s - c \geq p_l s$$

Note that the manager is only paid if first-period production succeeds. If it fails, the value is zero and nothing can be paid to him.

Consider first the case of liquidating a successful division at t=1. Headquarters can always commit to do so with $w = \gamma\alpha$. If it wants to induce managerial effort it sets $s = \frac{c}{p_h - p_l}$ which yields expected profits $p_h - \frac{p_h}{p_h - p_l}c$. If it does not want to induce effort, it sets $s = 0$ which yields expected profits p_l.

Consider next the case of continuing a successful division at t=1. Headquarters can always commit to do so with $s = 1$. If it wants to induce managerial effort it sets $w = \frac{c}{p_h - p_l}$ which yields expected profits $p_h\gamma\alpha - \frac{p_h}{p_h - p_l}c$. If it does not want to induce effort, it sets $w = 0$ which yields expected profits $p_l\gamma\alpha$.

Comparing profits, we reach the following proposition.

PROPOSITION 2 *In a firm with one strong division only and moral hazard, successful first-period production is always continued. Effort occurs if* $(p_h - p_l)\gamma\alpha \geq \frac{p_h}{p_h - p_l}c$.

The first part of proposition 2 shows that headquarters' ex post investment decision remains efficient even in the presence of managerial moral hazard. The intuition is that by granting maximal severance pay to its manager, $s = 1$, headquarters can perfectly

commit to continue a successful division for a second period. Similarly, with $w = \gamma\alpha$, headquarters can perfectly commit to stop a successful division should it wish to do so.

The second part of proposition 2 describes the agency cost due to moral hazard. Compared to the first-best in proposition 1 it is more costly to have effort. The manager must be left with some rent, $p_h \frac{c}{p_h - p_l} - c > 0$. Note that the rent is *independent* of headquarters' investment decision. In a single-division firm with explicit incentive contracting, it is possible to separate ex ante incentive from ex post investment decisions.

3.3 A reference point: no winner-picking, no extra agency costs

In order to assess the value consequences of winner-picking, we need a reference point. Our benchmark is a portfolio of two independent single-division firms, a strong firm 1 and a weak firm 2 with respective second period production values of $\gamma\alpha$ and α. To keep the subsequent analysis tractable, we assume that managerial effort is optimal:

ASSUMPTION 1 $p_h \frac{c}{(p_h - p_l)^2} < \alpha$.

The combined value of one strong and one weak firm, is:

$$V^* = V_1 + V_2 = p_h\gamma\alpha + p_h\alpha - 2p_h\frac{c}{p_h - p_l} \tag{2}$$

where $p_h c/(p_h - p_l)$ is the expected payment to a manager.

In the subsequent analysis, we will use the value V^* as a benchmark to assess the value consequences of having a multidivision firm. Using V^* assumes that there cannot be any redistribution of scarce resources unless several divisions are grouped together in one firm. Despite this bias in favor of winner-picking, we will show that headquarters' ability to pick winners can destroy value due to larger incentive costs.

4 Multidivision firm: No winner-picking

We will show shortly that winner-picking creates an agency cost. However, headquarters does not necessarily have to pick winners. If the incentive cost of winner-picking outweighs its investment benefit, then perhaps headquarters could simply decide not to pick winners?

In this section, we show that there are costs even if headquarters decides not to pick winners. The reason is that headquarters must increase managerial pay to commit to a no-redistribution policy.

4.1 Headquarters' investment decision

There are four situations that headquarters can encounter at t=1 after the first production period. Either both divisions have succeeded, or just the strong division 1 or the weak division 2 has succeeded, or neither division has succeeded. In each situation headquarters has the investment choices shown in the rows of table 1.

In order to carry out a policy of *no-redistribution* it must be optimal for headquarters to continue production at t=1 for another period in each division whenever it has succeeded in the first period:

$$\begin{aligned} \gamma\alpha - w_1 &\geq 1 - s_1, \\ \alpha - w_2 &\geq 1 - s_2. \end{aligned}$$

These conditions are the continuation constraints that we already encountered in the analysis of a single-division firm (equation (1)) and, likewise, headquarters will set the maximum severance pay $s_i = 1$ in order to commit not to stop a successful division.

Moreover, if headquarters wants to carry out a policy of no redistribution then it must also be optimal to continue a successful division instead of transferring its assets to the other division:

$$\begin{aligned} \gamma\alpha - w_1 &\geq \alpha - w_2, \\ \alpha - w_2 &\geq \gamma\alpha - w_1. \end{aligned}$$

4.2 Managers' effort decision

Given that headquarters does not redistribute resources between production periods at t=1, the manager of division i exerts effort when:

$$p_h w_i - c \geq p_l w_i.$$

In a multidivision firm where divisions are technologically independent, incentive pay is contingent on divisional performance and headquarters does not pick winners, the managerial incentive problem is therefore the same as in a single-division firm.

4.3 Interaction of incentives and not picking winners

We now ask: When headquarters does not redistribute resources between the production periods, can the value of the firm be lower than V^*? Given the optimality of effort (assumption 1), it suffices to consider the case when both managers exert effort. If they did not, then the value of the firm without winner-picking would automatically be lower than V^*.

At t=0, headquarters therefore solves:

(3)
$$\max_{w_i} p_h(\gamma\alpha - w_1) + p_h(\alpha - w_2)$$

subject to:

$$\begin{aligned} \gamma\alpha - w_1 &= \alpha - w_2 && \text{(Transfer Constraint)} \\ w_1 &\geq \tfrac{c}{p_h - p_l} && \text{(Incentive Constraints)} \\ w_2 &\geq \tfrac{c}{p_h - p_l} \end{aligned}$$

A priori, headquarters wants to minimize the rent given to divisional managers by setting $w_1 = w_2 = \frac{c}{p_h - p_l}$. However this is not feasible, due to the transfer constraint, since $\gamma > 1$. With equal wages headquarters would find it profitable to transfer the resources from a successful weak division to an unsuccessful strong division (which happens with probability $(1 - p_h)p_h$). Thus, headquarters must leave an extra rent to the manager of the strong division over and above what is necessary to induce his effort in order to commit not to redistribute. We therefore have:

PROPOSITION 3 *No redistribution always does worse than the benchmark V^*.*

To ease the transfer constraint, headquarters could decide not to induce effort in the weak division 2. Saving managerial rent in the weak division makes it more attractive to leave the assets in the weak division. The advantage is that the manager of the strong division 1 can be given a smaller rent. The disadvantage is that without effort, a division fails more often making second period production less likely in the first place.

PROPOSITION 4 *If headquarters does not redistribute, then having effort only in the strong division is preferred to having effort in both divisions when $\alpha < \alpha^* = 2p_h \frac{c}{(p_h - p_l)^2}$ and $\gamma > \frac{2p_h}{p_h + p_l} - \frac{1}{\alpha} \frac{c}{p_h + p_l}$.*

PROOF in Appendix A.1

Figure 2 illustrates the proposition. When implementing a no-redistribution policy, headquarters does not incentivize the manager of the weak division when the overall profitability is weak (low α) and the difference between the divisions' profitability is large enough (high γ).[8]

5 Multidivision firm: Winner-picking

This section repeats the analysis of the previous section, except that now headquarters does redistribute resources to pick a winner.

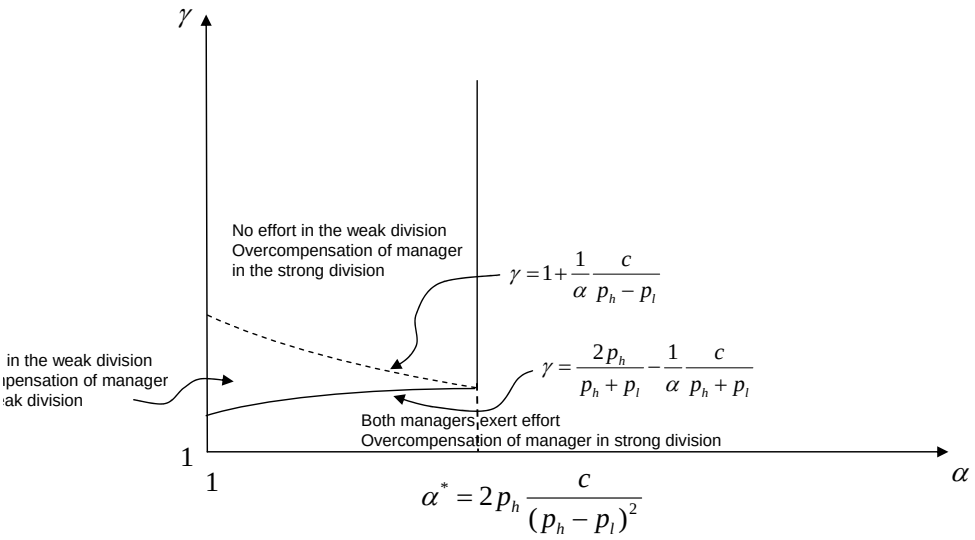
5.1 Headquarters' investment decision

As described in the previous section, headquarters can encounter four situations after the first production period at t=1 (see table 1). If headquarters wants to carry out a policy of *redistribution*, we need to reconsider its decision when the strong division 1 failed but the weak division 2 succeeded. The choice now is between i) continuing the successful weak division 2 (obtaining $\alpha - w_2$), ii) stopping and liquidating it (obtaining

[8]The dashed curve separates two different regimes in which headquarters does not incentivize the manager of the weak division. Above this curve, headquarters overcompensates the manager in the strong division ($w_1 > c/(p_h - p_l)$) while it overcompensates the manager in the weak division ($w_2 > 0$) below the curve.

Figure 2

The case of no winner-picking



$1 - s_2$) and iii) transferring its assets to the unsuccessful strong division 1, i.e., winner-picking (obtaining $\gamma\alpha - w_1$). For winner-picking to be optimal, we therefore have the following transfer constraints:

$$\gamma\alpha - w_1 \geq \alpha - w_2,$$
$$\gamma\alpha - w_1 \geq 1 - s_2.$$

In addition, the usual continuation constraints continue to apply. And, again, headquarters sets $s_i = 1$ to ease the continuation and transfer constraints.

5.2 Managers' effort decision

Under winner-picking, the manager of the strong division 1 is always refinanced unless both divisions fail. Conditional on effort in division 2, the manager in division 1 exerts effort when:

$$[p_h + (1 - p_h)p_h]w_1 - c \geq [p_l + (1 - p_l)p_h]w_1, \tag{4}$$

and conditional on no effort in division 2, he exerts effort when:

$$[p_h + (1 - p_h)p_l]w_1 - c \geq [p_l + (1 - p_l)p_l]w_1. \tag{5}$$

The situation of the manager in the weak division 2 is different. He only attains the second production period, and is paid w_2, if his division 2 *and* and the strong division

1 produced resources in the first period, so that the latter does not need the former's resources. Conditional on effort in the strong division 1, the manager of the weak division 2 exerts effort when:

$$p_h^2 w_2 - c \geq p_h p_l w_2, \tag{6}$$

and conditional on no effort in division 1, he exerts effort when:

$$p_l p_h w_2 - c \geq p_l^2 w_2. \tag{7}$$

Proposition 5 shows that when compensation is based on divisional performance, winner-picking makes it more difficult to induce effort in the strong but not in the weak division.

PROPOSITION 5 *Winner-picking leads to an additional agency cost: the manager in the strong division who gains resources requires a larger rent to exert effort than in a single-division firm. The manager of the weak division who loses resources requires the same rent as in a single-division firm to exert effort.*

PROOF in Appendix A.2

The key is that winner-picking introduces extra noise into incentive contracting. It is not possible for incentive purposes to ascertain ex post in a verifiable way whether production in the strong division continued because of previous success in that division or because of previous success elsewhere in conjunction with redistribution. Incentives in a weak division are unaffected since production in a weak division continues *only if* there has been previous success in that division.

Our assumptions on contractability and incentive contracts isolate this incentive cost of winner-picking. Allowing for explicit incentive contracting shows that the cost is not due to an inefficient decision to liquidate. Headquarters can use the payment s_i to commit not to liquidate inefficiently. Inefficient liquidation has been examined elsewhere in the literature and is not specific to multidivision firms (see for example BOLTON AND SCHARFSTEIN [1990] and GERTNER, SCHARFSTEIN AND STEIN [1994]). Allowing for explicit incentive contracting also shows that the incentive cost of winner-picking is not due to taking resources away from a successful division. The payment w_i can be used to make up for the expected loss by paying the manager more when his division succeeded in the first period and its assets are not transferred elsewhere. Again, the adverse incentive effect of taking resources away ex post has been examined elsewhere in the context of both single-division firms (GERTNER, SCHARFSTEIN AND STEIN [1994], AGHION AND TIROLE [1997]) as well as multidivision ones (BRUSCO AND PANUNZI [2005]).

5.3 Interaction of incentives and picking winners

Suppose that headquarters wants to induce effort in both divisions. Given the new continuation, transfer and incentive constraints, it solves at t=0:

$$\max_{w_i}(p_h+(1-p_h)p_h)(\gamma\alpha-w_1)+p_h^2(\alpha-w_2) \tag{8}$$

subject to:

$$\begin{aligned} \gamma\alpha-w_1 &\geq \alpha-w_2 && \text{(Transfer Constraint)}\\ w_1 &\geq \tfrac{1}{1-p_h}\tfrac{c}{p_h-p_l} && \text{(Incentive Constraints)}\\ w_2 &\geq \tfrac{1}{p_h}\tfrac{c}{p_h-p_l} \end{aligned}$$

Disregard the transfer constraint for a moment so that w_1 and w_2 are given by the incentive constraints. The value of the multidivision firm that transfers funds, where both managers exert effort and are not overcompensated is:

$$V_{ee}^t=(p_h+(1-p_h)p_h)\gamma\alpha+p_h^2\alpha-(1+\frac{1}{1-p_h})p_h\frac{c}{p_h-p_l}-p_h\frac{c}{p_h-p_l}. \tag{9}$$

The first and second term are the expected benefit from second period production in the strong and weak division, respectively. The third and fourth term are the expected cost of inducing effort in the strong and the weak division. Redistribution has no effect on the cost in the weak division but it increases the cost in the strong division by a factor $1+\frac{1}{1-p_h}$.

The multidivision firm does better than the benchmark when $V_{ee}^t>V^*$, i.e. when:

$$(1-p_h)p_h(\gamma-1)\alpha>\frac{p_h}{1-p_h}\frac{c}{p_h-p_l}. \tag{10}$$

The term on the left-hand side is the benefit of winner-picking. With probability $(1-p_h)p_h$ there are only resources in the weak division and by redistributing them, headquarters raises productivity from α to $\gamma\alpha$. The term on the right-hand side is the agency cost of winner-picking. It is more difficult to incentivize the manager of the strong division since he knows that headquarters will always bail him out.

When is V_{ee}^t feasible? Again, headquarters sets $s_1=s_2=1$ in order to satisfy the continuation constraints. Suppose that w_1 and w_2 are given by the binding incentive constraints. The transfer constraint is then satisfied if:

$$\gamma>1+\frac{1}{\alpha}\frac{c}{p_h-p_l}\frac{2p_h-1}{p_h(1-p_h)}. \tag{11}$$

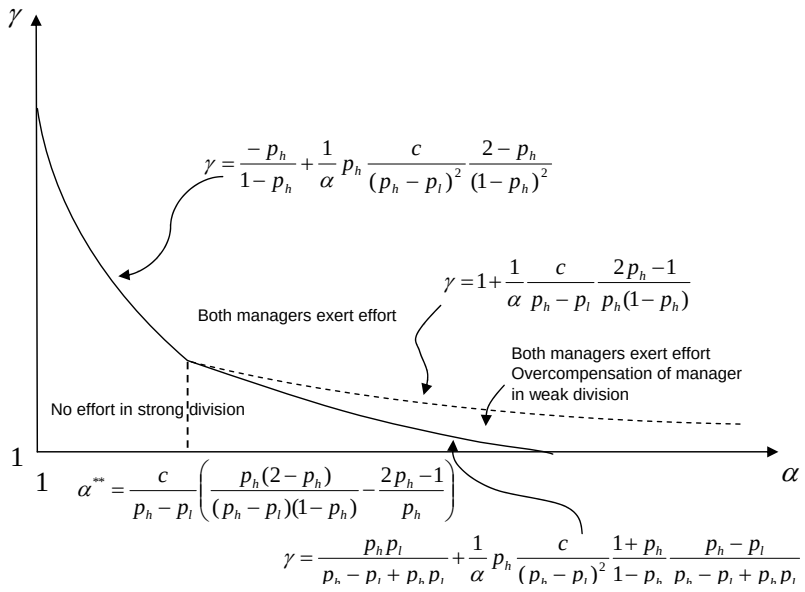
If this condition does not hold, then w_2 is given by the transfer constraint and the second incentive constraint is slack.[9] It immediately follows that

PROPOSITION 6 *If headquarters redistributes and induces effort in both divisions, it must overcompensate the manager of the weak division 2 if (11) does not hold.*

[9]Note that condition (11) is always satisfied if $p_h\leq 1/2$. In that case, the optimal payments are such that $w_1<w_2$ and the binding incentive constraints never violate the transfer constraint. In the remainder of the paper we assume that $p_h>1/2$.

Figure 3

The case of winner-picking



As before, headquarters may choose not to induce effort by one manager. In order to facilitate winner-picking, it may choose to not incentivize the manager of the strong division. Again, the cost of no managerial effort is that his division is less likely to succeed in the first period. In contrast, there are now two benefits. Not only will it ease the transfer constraint, but there will also be no incentive cost of winner-picking in the strong division.[10]

Proposition 7 describes the efficient effort policy in a conglomerate that picks winners.

PROPOSITION 7 *If headquarters redistributes, then having effort only in the weak division is preferred to effort in both divisions when* $\gamma < Max \left[\frac{-p_h}{1-p_h} + \frac{1}{\alpha} p_h \frac{c}{(p_h - p_l)^2} \frac{2-p_h}{(1-p_h)^2}, \frac{p_h p_l}{p_h - p_l + p_h p_l} + \frac{1}{\alpha} p_h \frac{c}{(p_h - p_l)^2} \frac{1+p_h}{1-p_h} \frac{p_h - p_l}{p_h - p_l + p_h p_l} \right]$. *Headquarters always induces effort in the weak division.*

PROOF in Appendix A.3

Figure 3 illustrates propositions 6 and 7.

Under winner-picking, headquarters does not incentive the manager of the strong division when the overall profitability α is low and the difference between the divisions' profitability γ is not too large. When the difference across divisions is small but the overall profitability is large, then headquarters wants both managers to exert effort. But

[10]The benefit is reduced if less pay is needed to incentivize the manager of the strong division, e.g., if managerial ability is correlated with the productivity of his division (or if first and second period productivity are positively correlated). Hence, headquarters may be able to increase the value of the firm if managerial talent is matched to investment opportunities.

to commit to picking the winner in this situation may require an overcompensation of the manager of the weak division.

6 Comparisons

Propositions 4 and 7 describe the optimal effort policy of a multidivision firm without and with winner-picking respectively. In this section, we combine the results to describe when winner-picking is optimal in a multidivision firm (proposition 8), and confront the resulting value of the multidivision firm with the benchmark value V^* (proposition 9).

PROPOSITION 8 *In a multidivision firm, no redistribution does better than winner-picking if* $\gamma < Min\left[\frac{p_h(2-p_l)}{p_h+p_l(1-p_h)} - \frac{1}{\alpha}\frac{c}{p_h-p_l}\frac{p_h}{p_h+p_l(1-p_h)}, 1+\frac{1}{\alpha}\frac{c}{p_h-p_l}\frac{1}{(2-p_h)(1-p_h)})\right]$.

PROOF in Appendix A.4

Figure 4 shows the optimal investment and incentive policies in a multidivision firm. For all levels of the overall profitability α there is an upper bound (solid curves) for the difference between the divisions' profitability γ below which headquarters prefers not to pick winners in order avoid the associated incentive costs. Without winner-picking both managers always exert effort. Above this threshold, headquarters does pick winners. Under winner-picking there are two incentive regimes (separated by the dashed curve, which is given by the first term in the Max expression of proposition 7). For a low level of overall profitability α, only the manager of the weak division exerts effort. For a high level of α, both managers exert effort.

In a multidivision firm, there are costs associated with both no redistribution and redistribution. If headquarters does not pick winners then the value of the firm is always lower than the benchmark V^* since it is costly to commit to not redistribute. If headquarters does pick winners then either it has to suffer larger incentive costs or it does not incentivize the manager of the strong division. The next proposition shows the condition under which a conglomerate with an efficient internal capital market does worse than the portfolio of independent single-division firms.

PROPOSITION 9 *The multidivision firm does worse than the benchmark* V^* *if* $\gamma < Min\left[\frac{p_h(1-p_l)}{p_l(1-p_h)} - \frac{1}{\alpha}\frac{c}{p_h-p_l}\frac{p_h}{p_l(1-p_h)}, 1+\frac{1}{\alpha}\frac{c}{p_h-p_l}\frac{1}{(1-p_h)^2})\right]$.

PROOF in Appendix A.5

Figure 5 illustrates proposition 9. It is similar to figure 4. The difference is that the curves bounding γ from below in proposition 9 lie strictly above the curves that provide the upper bound on γ in proposition 8. The reason is that the value of a conglomerate that does not redistribute is always lower than the benchmark value V^* (proposition 3).

Figure 4

The optimal investment and effort decisions

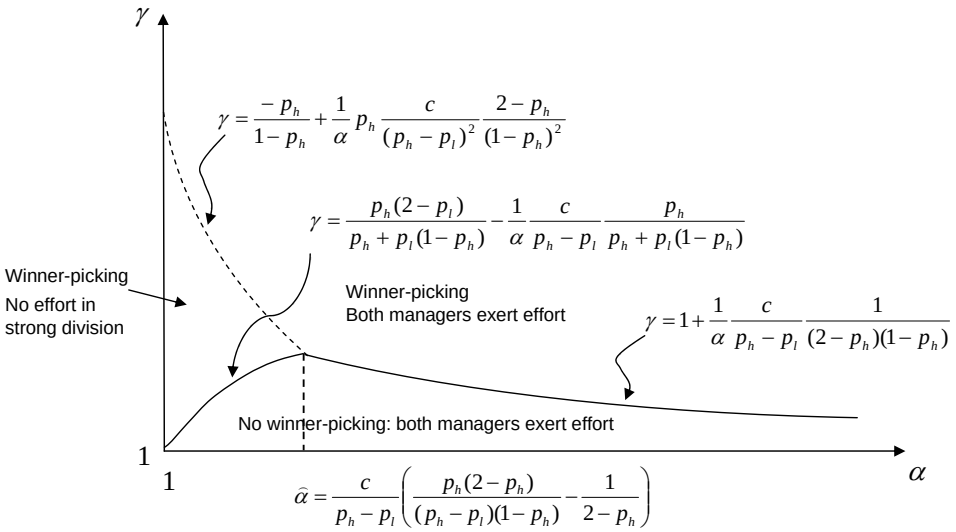
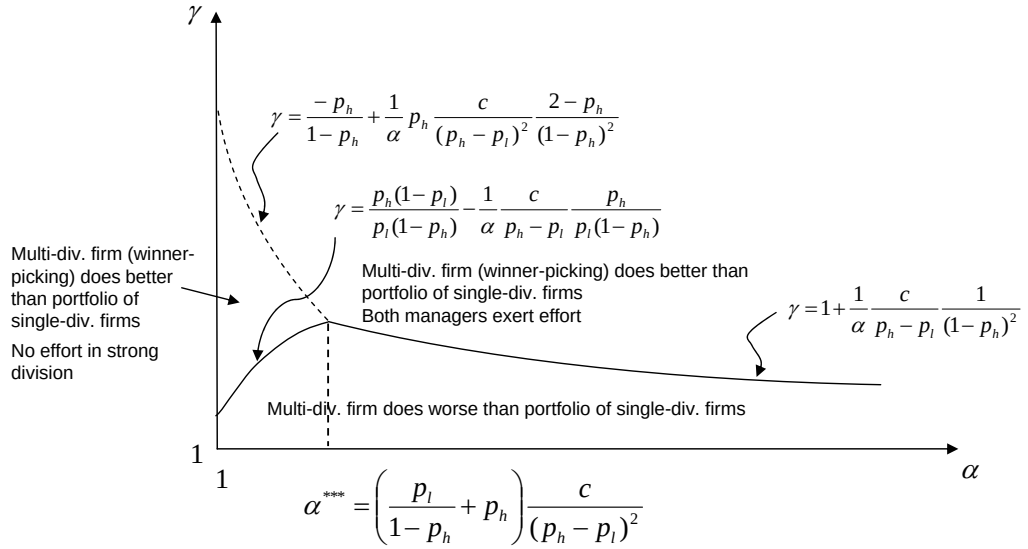


Figure 5

Conglomerate vs. stand-alone



7 Managerial incentive contracts

The agency cost of winner-picking in our model arises because an incentive contract based on the value of the division, while optimal in the case of no redistribution, does not specify different payments in the case in which the manager of the strong division was successful in producing resources and the case in which he was *unsuccessful* but his division receives the resources from the weak division (winner-picking). In this section, we consider alternative incentive structures, e.g., non-linear contracts based on the overall value of the firm and bonus pools, to explore the robustness of our results.

Empirical evidence suggest that various incentive structures are used in multidivision firms. But the largest source of managerial compensation is tied to divisional performance as assumed so far in this paper. Bushman, Indjejikian and Smith [1995] and Wulf [2002] both use information about incentives consisting of survey data on bonuses for managers at different levels of the corporate hierarchy and the extent to which these bonuses are determined by performance at different levels (e.g., plant, division, overall firm). Bushman, Indjejikian and Smith [1995] show that for the median divisional manager, 50% of his pay is determined by performance at the divisional level (Wulf [2002] finds a similar value), while only 15% of his pay is determined by performance at the overall corporate level. The remaining proportion of bonuses is determined by other e.g., individual performance measures. These numbers provide support for our assumption that divisional managers' pay depends on the performance of their own divisions. Aggarwal and Samwick [2003] provide further supporting evidence by showing that the "pay for divisional performance" for divisional managers is higher than for CEOs. Moreover, the precision of divisional performance increases divisional managers' pay for divisional performance but decreases their pay for overall firm performance.

7.1 Contracts based on the overall value of the firm

Consider a contract that specifies a different payment $w_{i,v}$ to the manager of division i for each of the two firm values possible under redistribution at t=2: $v = \gamma\alpha, \gamma\alpha + \alpha$.[11]

We know from proposition 5 that redistribution does not create an additional agency cost in the weak division if its manager's pay is based only on the value of his own division: $w_{2,\gamma\alpha} = 0$ and $w_{2,\gamma\alpha+\alpha} = \frac{c}{p_h(p_h - p_l)}$. Such a contract effectively pays the manager of the weak division only if his own division and the strong one both have succeeded at t=1 so that there is no need for headquarters to redistribute resources.

To avoid the agency cost of winner-picking in the strong division, its manager should only be paid when he succeeds *and* when he does not need a transfer of resources from the weak division: $w_{1,\gamma\alpha} = 0$ and $w_{1,\gamma\alpha+\alpha} = \frac{c}{p_h(p_h - p_l)}$. Such a contract does not pay the manager of the strong division according to the performance of his own division but effectively links his pay to the success of the weak division.

Such an incentive scheme may however increase the tension between investment and incentives in a conglomerate as it makes the continuation of two successful divisions less

[11] Nothing can be paid if both divisions failed and the value of the firm is zero. Furthermore, the firm value α never occurs under redistribution.

attractive. Headquarters may be tempted to liquidate a successful weak division in order to avoid paying the manager of the strong division. Such a liquidation would reduce the value of the firm from $\gamma\alpha + \alpha$ (where managers are paid) to $\gamma\alpha$ (where they are not paid). Formally, the constraint guaranteeing the continuation of two successful divisions relative to continuing only a successful strong division is:

$$\gamma\alpha - w_{1,\gamma\alpha+\alpha} + \alpha - w_{2,\gamma\alpha+\alpha} \geq \gamma\alpha - w_{1,\gamma\alpha} + 1 - s_2$$

With pay based on divisional performance only, we had $w_{1,\gamma\alpha+\alpha} = w_{1,\gamma\alpha}$. Now we have $w_{1,\gamma\alpha+\alpha} > w_{1,\gamma\alpha} = 0$ in order to avoid the agency cost of redistribution in the strong division. Headquarters prefers to continue two successful division only if:

$$\alpha \geq 2\frac{c}{p_h(p_h - p_l)}$$

where we set $s_2 = 1$ to make the liquidation of the weak division less attractive. A policy of redistribution with effort in both divisions can no longer be implemented at low levels of the overall profitability α.

In addition, the above contract, which avoids the incentive cost of winner-picking by paying managers only when the overall value of the firm is highest, exposes managers to considerable income risk, especially as the number of divisions increases. If managers dislike risk, then headquarters would face an additional trade-off between insurance and incentives in a multidivision firm. More generally, there appear to be limits to the complexity of explicit incentive structures in multidivision firms. Bushman, Indjejikian and Smith [1995] for example argue that multidivision firms do not condition a divisional manager's pay on the full vector of the performance of all the firm's divisions.

7.2 Bonus pool

Because general optimal contracts based on firm and/or divisional value may turn out to be quite complex, headquarters could instead use a flexible bonus pool to overcome the incentive cost of winner-picking. In our analysis, we assume that the intermediate production results within a multidivision firm are not-contractible. For example, it would difficult for an outside court to ascertain which division was successful in maintaining the quality of its machinery so that it can be used for a second production period. Intermediate production results are, however, observable within the firm since headquarters uses this information to engage in winner-picking. Thus, headquarters can use this information also to allocate bonuses to managers. Murphy and Oyer [2003] document that subjective performance evaluation is more important for determining business-unit manager than CEO pay. They also show that business-unit manager pay tends be be more based on business-unit rather than firm-wide performance.

Consider then the following incentive arrangement: headquarters specifies that it will allocate a bonus pool equal to $\frac{c}{p_h - p_l}$ if one division is continued and equal to $2\frac{c}{p_h - p_l}$ if two divisions are continued. That is, the bonus pool is proportional to the overall value of the firm. The allocation of the bonus pool across divisional managers is not specified and is left at headquarters' discretion. As headquarters has no preference about who receives

what fraction of the bonus pool, it will allocate it based on the observed performance at t=1. Headquarters can therefore give a bonus to those managers who succeeded in the first production period. Since the success of a division in the first period is a sufficient statistic for managerial effort (continuing to assume that the probability of success is independent across divisions), such a bonus is an efficient way to provide incentives.

An incentive mechanism using bonuses requires that headquarters has a reputation for promoting those divisional managers who are successful at the interim stage and not those who are successful at the last stage after winner-picking may have taken place. Reputation, corporate culture and the separation of incentive from capital budgeting decisions, are therefore an important element for bonus schemes to work. Also, rewards given at headquarters' discretion may not be immune to collusion or lobbying by managers. Rent-seeking activities might be particularly important in a conglomerate because headquarters has some discretion over the allocation of resources and because managers may be evaluated not on their absolute but their relative performance to others. Scharfstein and Stein [2000] and Rajan, Servaes and Zingales [2000] develop models where managers in multi-division firms inefficiently invest in rent-seeking activities. Using contracts based on the divisions' value, imperfect as they may be, may therefore be seen as a credible means to limit headquarters' discretion and thus curb inefficient influence activities by managers.

8 Conclusion

This paper argues that winner-picking, i.e. the efficient redistribution of scarce resources across divisions in an internal capital market of a multidivision firm, creates an incentive cost. Winner-picking adds noise to the moral hazard problem of incentivizing divisional managers to produce the resources that can subsequently be redistributed by headquarters.

While the previous literature focuses on the expropriation of managers in losing divisions, we point to the free-riding by managers in winning divisions. In our set-up, the expropriation of the manager in a losing division can be compensated financially by using explicit incentive contracts. These managers end up being paid more less often. However, with incentive contracts based on divisional value, it is impossible to eliminate the free-riding of the manager in a winning division on the resources produced in a losing division. Headquarters cannot write incentive contracts that distinguish managerial luck from skill, i.e. the standard moral hazard problem, and whether an unlucky manager in a division with good investment opportunities is bailed out with resources from a division with poor investment opportunities.

In the paper, we discuss three different types of incentive schemes. Each of them is associated with a trade-off between investment and incentive decisions. Contracts based on the value of a manager's own division create an incentive cost of winner picking. Contracts based on the overall value of the firm, or the full vector of divisional performance, are complex, expose the manager to considerable income risk and may induce headquarters to inefficiently liquidate divisions. Bonuses paid at headquarters discretion could overcome the contractual restrictions of explicit incentive contracts, but may in

turn be subject to influence activities and reputation concerns. In practice, one observes all three types of incentive structures. Their mix will depend on their relative cost in relation to the investment opportunities of a multidivision firm.

In our analysis, we consider a multidivision firm whose divisions are technologically independent. In this case, a strong division must be sufficiently productive in order for the reallocation benefit of winner-picking to outweigh its incentive cost. The result is consistent with evidence that unrelated diversification hurts performance, especially when investment prospects are similar across divisions, (see for example Montgomery and Wernerfelt [1988], Comment and Jarrel [1995] and Rajan, Servaes and Zingales [2000]). Our result can thus display a conglomerate discount despite winner-picking and without assuming a form of "corporate socialism", i.e. an ex post inefficient redistribution of resources for which the evidence is mixed (see Khanna and Tice [2001] and Maksimovic and Phillips [2002]).

When divisions are no longer technologically independent, then the relative benefit and cost of winner-picking change. If a multidivision firm has divisions that operate in similar business areas (related diversification), then it is more likely that the divisions all succeed or fail at the same time. In this case, the scope for picking winners is lower. But the incentive cost is lower too since it is tied to the availability of funds elsewhere in the conglomerate. A fruitful avenue for future research would therefore be a model that would evaluate the reallocation benefit and the incentive cost of winner-picking, and hence to optimal size and scope of an internal capital market, as well as the structure of incentive contracts, in relation to the degree of diversification of the conglomerate. Along these lines, Gautier and Wauthy [2007] show that incentive problems exacerbate when the number of division increases. Stein [1997] shows that the optimal degree of focus of a conglomerate depends on a trade-off between diversifying risk and the quality of the relative performance assessment made by headquarters. Empirically, the relationship between conglomerate value and an appropriate measure of diversification are mixed. Montgomery and Wernerfelt [1988] and Comment and Jarrel [1995] find evidence that unrelated diversification hurts conglomerate performance while Rumelt [1982], Berger and Ofek [1995] and Khanna and Tice [2001] find support for the opposite.

Appendix

A.1 Proof of proposition 4

To solve the program (3), headquarters sets $s_1 = s_2 = 1$ and $w_2 = \frac{c}{(p_h - p_l)}$ and w_1 is given by the transfer constraint. The value of the firm is:

$$V_{e^o e}^{nt} = 2p_h\alpha - 2p_h\frac{c}{p_h - p_l}.$$

If headquarters wants to induce effort in the strong division only then it sets $s_1 = s_2 = 1$ and solves the following program:

$$\max_{w_1, w_2} p_h\gamma\alpha + p_l\alpha - p_h w_1 - p_l w_2$$

subject to $w_1 \geq \frac{c}{p_h - p_l}$, $\frac{c}{p_h - p_l} > w_2 \geq 0$ and $\gamma\alpha - w_1 = \alpha - w_2$.

When $\gamma \geq 1 + \frac{1}{\alpha}\frac{c}{p_h - p_l}$, the solution to this program is $w_1 = (\gamma - 1)\alpha$ and $w_2 = 0$ leading to a firm value of:

$$V^{nt}_{e^o n} = (p_h + p_l)\alpha.$$

When $\gamma \leq 1 + \frac{1}{\alpha}\frac{c}{p_h - p_l}$, the solution is $w_1 = \frac{c}{p_h - p_l}$ and $w_2 = \frac{c}{p_h - p_l} - (\gamma - 1)\alpha$ and the value of the firm is:

$$V^{nt}_{en^o} = (p_h + p_l)\gamma\alpha - (p_h + p_l)\frac{c}{p_h - p_l}.$$

Comparing $V^{nt}_{e^o e}$, $V^{nt}_{e^o n}$ and $V^{nt}_{en^o}$, effort in the strong division only is optimal when:

$$\alpha < 2\frac{p_h}{p_h - p_l}\frac{c}{p_h - p_l},$$

and

$$\gamma > \frac{2p_h}{p_h + p_l} - \frac{1}{\alpha}\frac{c}{p_h + p_l}.$$

Given assumption 1, having effort in the weak division only or no effort in both divisions is always dominated by having effort in both divisions.

A.2 Proof of proposition 5

In a single-division firm, a manager requires an expected payment $p_h\frac{c}{p_h - p_l}$ to exert effort. With redistribution, the smallest continuation reward that motivates managers is given when the incentive constraints (4) to (7) bind. The manager of the strong division then receives an expected payment of $(1 + \frac{1}{1-p_h})p_h\frac{c}{p_h - p_l}$ if the manager of the weak division exerts effort, or $(1 + \frac{1}{1-p_l})p_h\frac{c}{p_h - p_l}$ if he does not. If the manager of the weak division exerts effort, he receives an expected payment of $p_h\frac{c}{p_h - p_l}$ independent of whether the manager of the strong division exerts effort or not.

A.3 Proof of proposition 7

To solve the program (8), headquarters sets $s_1 = s_2 = 1$ and $w_1 = \frac{1}{1-p_h}\frac{c}{p_h - p_l}$ and w_2 is given by either the incentive or the transfer constraint depending on the condition of proposition 6. In the first case the value of the firm is given by (9). In the second case, $w_2 = -(\gamma - 1)\alpha + \frac{1}{1-p_h}\frac{c}{p_h - p_l}$ and the value of the firm is:

$$V^{t}_{ee^o} = 2p_h\gamma\alpha - 2\frac{p_h}{1 - p_h}\frac{c}{p_h - p_l}.$$

If headquarters wants to induce effort in the weak division only then it sets $s_1 = s_2 = 1$ and $w_1 = 0$. This means that w_2 is given by the second, binding incentive constraint: $w_2 = \frac{1}{p_h}\frac{c}{p_h - p_l}$. The value of the firm then is:

$$V^{t}_{ne} = (p_l + (1 - p_l)p_h)\gamma\alpha + p_l p_h \alpha - p_h\frac{c}{(p_h - p_l)}. \tag{A1}$$

Suppose headquarters wants to induce effort only in the strong division. Under redistribution it is more difficult to incentivize only the manager of the strong division than to incentivize only the manager of the weak division (see proposition 5 and the preceding analysis). But the benefit under redistribution is the same as if only the manager of the weak division exerts effort. Moreover, it is always possible to induce effort in the weak division only. Hence effort in the weak division only dominates effort in the strong division only.

Given that i) it costs the same to induce effort in the weak division as in a single-division firm (see proposition 5 and the preceding analysis) and ii) that effort is desirable (assumption 1), no effort in both divisions is dominated by inducing effort in the weak division only.

The question then is: when does headquarters prefer not to induce effort in the strong division? If (11) holds then the relevant condition is $V^t_{ne} > V^t_{ee}$:

$$\gamma < \frac{-p_h}{1-p_h} + \frac{1}{\alpha} p_h \frac{c}{(p_h - p_l)^2} \frac{2-p_h}{(1-p_h)^2}. \tag{A2}$$

If (11) does not hold then the condition is $V^t_{ne} > V^t_{ee^o}$:

$$\gamma < \frac{p_h p_l}{p_h - p_l + p_h p_l} + \frac{1}{\alpha} p_h \frac{c}{(p_h - p_l)^2} \frac{1+p_h}{1-p_l} \frac{p_h - p_l}{p_h - p_l + p_h p_l}. \tag{A3}$$

The curves in (11), (A2) and (A3) intersect at $\alpha^{**} = \frac{c}{p_h - p_l}\left(\frac{p_h(2-p_h)}{(p_h-p_l)(1-p_h)} - \frac{2p_h-1}{p_h}\right)$. For $\alpha < \alpha^{**}$, high effort in one division dominates if (A2) holds. Notice that in this case, (11) holds. For $\alpha > \alpha^{**}$ it dominates if (A3) holds and in this case, (11) does not hold .

A.4 Proof of proposition 8

We have six values for the multidivision firm depending on whether there is redistribution and effort by divisional managers: $V^{nt}_{e^oe}, V^{nt}_{e^on}, V^{nt}_{en^o}, V^t_{ne}, V^t_{ee}$ and $V^t_{ee^o}$. First, we note that whenever $V^t_{ee^o}$ is the outcome under redistribution, it is dominated by no-redistribution: $V^t_{ee^o} < V^{nt}_{e^oe}$. One condition for $V^t_{ee^o}$ is that (11) must not hold. $V^t_{ee^o} < V^{nt}_{e^oe}$ holds when:

$$\gamma < 1 + \frac{1}{\alpha} \frac{c}{p_h - p_l} \frac{p_h}{1-p_h},$$

which always holds when (11) holds.

Similarly, whenever $V^{nt}_{e^on}$ or $V^{nt}_{en^o}$ is the outcome under no-redistribution, it is dominated by redistribution. Recall that $V^{nt}_{e^on}$ is feasible if:

$$\gamma \geq 1 + \frac{1}{\alpha} \frac{c}{p_h - p_l}. \tag{A4}$$

$V^{nt}_{e^on} < V^t_{ne}$ holds when:

$$\gamma > 1 + \frac{1}{\alpha} \frac{c}{p_h - p_l} \frac{p_h}{p_h + p_l - p_h p_l},$$

which always holds when (A4) holds.

$V^{nt}_{en^o}$ is only feasible when A4 does not hold. $V^{nt}_{en^o} < V^{t}_{ne}$ holds when:

$$\gamma < 1 + \frac{1}{\alpha}\frac{c}{p_h(p_h - p_l)},$$

that is for all the parameters constellation where $V^{nt}_{en^o}$ is feasible.

It remains to characterize for which parameter constellations $V^{nt}_{e^oe}, V^{t}_{ne}$ or V^{t}_{ee} applies. $V^{nt}_{e^oe} > V^{t}_{ne}$ can be rewritten as:

$$\gamma < \frac{p_h(2-p_l)}{p_h + p_l(1-p_h)} - \frac{1}{\alpha}\frac{c}{p_h - p_l}\frac{p_h}{p_h + p_l(1-p_h)},$$

which is the first term in the Min expression. Next, $V^{nt}_{e^oe} > V^{t}_{ee}$ can be rewritten as:

$$\gamma < 1 + \frac{1}{\alpha}\frac{c}{p_h - p_l}\frac{1}{(2-p_h)(1-p_h)},$$

which is the second term in the Min expression. Finally, it is easily verified that these two conditions intersect at a point that lies on the curve describing the boundary between V^{t}_{ne} and V^{t}_{ee}, i.e. condition (A2). The corresponding α at this intersection point is $\hat{\alpha} = \frac{c}{p_h - p_l}\left(\frac{p_h(2-p_h)}{(p_h-p_l)(1-p_h)} - \frac{1}{2-p_h}\right)$, which is smaller than α^{**}.

A.5 Proof of proposition 9

When there is no winner-picking, the conglomerate's value is strictly smaller than V^* (proposition 3). We are then left with two comparisons due to the two possible values under winner-picking (see the proof of proposition 7): $V^{t}_{ee} > V^*$ and $V^{t}_{ne} > V^*$. We have made the first comparison in (10). Rewriting (10) yields the second condition on γ in the Min expression. Comparing V^{t}_{ne} (from equation (A1)) to V^* yields the first expression in the Min condition. Finally, the two conditions as well as condition (11) (the boundary of V^{t}_{ee} and V^{t}_{ne}) all intersect at:

$$\alpha^{***} = \left(\frac{p_l}{1-p_l} + p_h\right)\frac{c}{(p_h - p_l)^2},$$

which is smaller than $\hat{\alpha}$.

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