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CORPORATE SPINOFFS IN AN AGENCY FRAMEWORK

by

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Abstract

A model is developed in which corporate spinoffs are a feature of incentive contracts for product managers in diversified firms. Spinoff contracts exploit the fact that, after a spinoff, the stock value of the product line is a much cleaner signal of managerial productivity than when the division belongs to the parent firm. Both spinoff and later acquisition of the product line are efficient activities and should be accompanied by a positive stock price reaction. The empirical implications of the model include: (a) the probability that any one division of a firm spins off is increasing in the number of product lines in the parent firm; (b) the share price response to spinoff will be greater the fewer is the number of divisions in the parent firm; (c) after a spinoff we are likely to see an increase in investment by the spun-off firm; (d) managers of spun off divisions of corporations will accompany the spun off firm rather than remain with the parent corporation; (e) the compensation of managers of spun off divisions will, on average, rise after the spinoff.

1. Introduction

The many forms of corporate organization and reorganization constitute something of a mystery for organization theorists. Empirical research on the financial effects of reorganizations has outpaced the efforts of theorists to explain the empirical results or predict new ones. In this paper I propose a model of one important form of corporate reorganization, corporate spinoffs. I argue that spinoffs are an ex ante efficient response to the incentive problems firms have with divisional managers, and derive the empirical implications of such a model. In my model a spinoff followed later by reacquisition does not indicate a mistake; both actions can be efficient. The main results are:

a. the probability that any one division of a firm spins off is increasing in the number of product lines in the parent firm;

b. the share price response to spinoff will be greater the fewer is the number of divisions in the parent firm;

c. after a spinoff we are likely to see an increase in investment by the spun-off firm;

d. managers of spun off divisions of corporations will accompany the spun off firm rather than remain with the parent corporation;

e. the compensation of managers of spun off divisions will, on average, rise after the spinoff.

A spinoff is a form of corporate divestiture in which the original corporation is separated into two corporations, each with separately traded stock. The stock of the spun off division is distributed on a pro rata basis to shareholders of the original corporation, so that the owners of the original firm remain the owners of the separate firms, and no cash is generated for either the parent or the spinoff. The feature of spinoffs that I will focus on here is that after the spinoff the newly created firm has stock that trades independently of the parent corporation and reflects the operations of that division alone. This differs from, in particular, a sell-off, in which assets or divisions of one corporation are sold to another corporation.

A number of recent studies have documented a positive share price reaction to spinoff announcements. Miles and Rosenfeld (1983) find that the share price reaction is larger for large spinoffs (relative to the parent) than small spinoffs; Hite and Owers (1983) find negative returns to firms responding to legal or regulatory constraints, but positive gains to other voluntary spinoffs. Rosenfeld (1984) documents positive share price reactions to both spinoff and sell-off announcements, but finds that the response is greater for the spinoffs.

Schipper and Smith (1983) attempt to identify sources of the gains from spinoffs. They reject the hypothesis proposed by Galai and Masulis (1976) that spinoffs are a way of redistributing wealth from bondholders to stockholders. They conclude that tax benefits cannot be the source of all of the gains to spinoffs, and that the high growth rate of firms in the five years prior to spinoff is consistent with the view that spinoffs are a means of alleviating managerial diseconomies. Further, they show that spun off firms are significantly different (in terms of market model parameters for the stock) from the parent corporation.

My model is consistent with the main empirical regularity of an increase in stock value associated with a spinoff announcement. It is also consistent with the finding that the share price response associated with large spinoffs is larger than that for small spinoffs. The model relies on the assumption that spun off firms are different from the parents in precisely the way documented by Schipper and Smith.

The paper is organized as follows. Section 2 describes the framework and introduces the model. In Section 3 the technology of the firm is presented and the incentive problem is analyzed in Section 4. The main technical results are proved in Section 5. Section 6 presents further empirical implications of the model, and Section 7 contains concluding remarks.

2. The Model

The basic argument that I wish to make is that the fundamental difference between a product line operating as a division of a firm and as a "free standing" firm is that the stock value of the latter reflects the market's valuation of the division's operations only, whereas the stock value of the former reflects the value of the assets in all of the other operations of the parent corporation as well. This is important when incentive problems make it desirable to tie a manager's compensation to the market value of the firm. When a division is part of a multiproduct corporation, the stock value of the firm is a noisy signal of the market's evaluation of any one divisional manager's productivity. Loosely speaking, the more noise there is in the signal, the costlier it is to properly motivate the manager.

This is a problem in a corporation only if other good measures of the manager's productivity are not available. Obvious candidates are accounting measures of the division's productivity, such as return on assets or return on equity. The difficulty with compensating a manager as a function of the accounting value of his division is that it will give him an incentive to maximize the short run value of the firm (or the accounting value over his own expected tenure at the firm) rather than or even at the expense of the long run value. For example, suppose the manager knows that it is an appropriate time to make capital investments in his plants, perhaps because the product market is expected to grow in the future. The effect of the investment may well be to increase the value of the firm, but depress the current accounting return due to the large expenditure. The incentives of a manager with a short expected tenure at the firm relative to the life of the investment will be distorted or even perverse if his compensation is tied to accounting returns.[1]

A standard tenet of the theory of corporate finance is that the price of a firm's stock reflects the market's best estimate of the firm's long run value. This underlies the emphasis in the compensation literature on incentive pay tied to stock returns. If indeed the stock value of a diversified corporation is a weak signal of the productivity of any division, then single product firms would strictly dominate diversification, from an incentive perspective.

In this paper I wish to explore spinoffs as an alternative incentive mechanism to simple stock based incentive pay when there are countervailing efficiencies to diversification. I will be fairly agnostic about the benefits to diversification, since my focus is on the incentives for spinoffs given that there are efficiencies to being a multiproduct firm. The benefits to diversification that I appeal to here are managerial scope economies at the level of the chief executive. I adopt the view of Chandler

(1966) and Williamson (1975) that the role of the chief executive is fundamentally different from that of the divisional managers; it calls for broad strategic decisions that are removed from the operational and tactical duties of the product line managers. To the extent that these strategic activities have a public goods component for the firm as a whole, economies of scope are created.

We will adopt a stylized model of firm structure. A firm may produce many products, and we will assume that the firm is organized by product line. The managerial structure consists of a chief executive, whose productivity affects the firm as a whole (even if there are many product lines), and divisional managers. As it is the productivity and incentives of the divisional managers that I wish to focus on here, I will assume away any incentive issues regarding the CEO.

The nature of the incentive problem is that each product manager must gather and assimilate information in each period about the state of nature concerning his product line, and determine the optimal action to take based on that information. I will refer to all of these activities together as information gathering, and I assume this requires some effort. For simplicity, I assume that there is some critical level of effort, k, such that no valuable information is gathered if effort is less than k, but greater effort has no additional value. Thus, a manager will choose effort equal to k or zero. Once the manager has the information he makes an action decision, but his effort is independent of the action actually taken.

Division managers are risk averse agents with utility functions of the form

$$U(w,e) = V(w) - c(e),$$

where w is monetary income and e is information gathering effort. I assume $V' > 0$, $V'' < 0$, $c' > 0$, $c'' > 0$, and V bounded below.[2]

Now consider the technology for a product line. A product line j has a "pseudo" net present value function at time t defined by

$$f(\theta_{jt}, \tilde{I}_{jt}, K_{jt}, L_{jt}, X_{jt}),$$

where $f(\cdot)$ accounts for all production costs <u>except</u> managerial compensation and return to capital. The variables K_{jt}, L_{jt}, and X_{jt} are capital, labor, and other productive inputs, respectively, in product j, period t.

$\tilde{I}_{jt} \in I$ is a random variable that summarizes the information about the state of nature concerning product j at time t. For example, I_{jt} may contain marketing reports about trends in demand for the product or related products, regulatory decisions that affect the product, changes in factor prices, and so forth. Any information known or available in the market is assumed to be contained in I_{jt}.

The variable θ_{jt} is the set of decisions or actions taken by the manager of product line j at time t. This includes choosing the level of productive inputs and the price and quantity of output, but also includes choices of product characteristic, levels of investment, choice of production technology, and marketing strategy. Maximizing the long-run value of the firm requires that the manager take into account the information I_{jt} when making his decisions θ_{jt}. It is assumed that the pseudo net revenue function $f(\cdot)$ is strictly concave in output and that there exist some finite output level at which net revenue is maximized, given any value of I.[3] We will henceforth suppress the productive inputs in the notation.

Let

$$\theta^*_{jt} \equiv \theta^*(I_{jt}) \equiv \operatorname{argmax}_\theta f(\theta, I_{jt})$$

and let

$$\bar{\theta} = \operatorname{argmax}_\theta Ef(\theta, \tilde{I}).$$

The variable θ^*_{jt} denotes the manager's optimal actions given the state of nature, and $\bar{\theta}_{jt}$ denotes the manager's optimal action if he does not know the state of nature in time t. Note that given the information, the value of $f(\cdot)$ is deterministic. We assume information is valuable in the following sense:

$$\text{(A.1)} \qquad E[f(\theta^*_{jt}, \tilde{I}_{jt})] > E[f(\bar{\theta}_{jt}, \tilde{I}_{jt})]$$

Assumption 1 means that, on average, the value of the division is higher when the manager knows the state of nature and acts so as to maximize the value of the product line given that information, than when he does his best to maximize the product line's value without having the information.

We further assume:

$$\text{(A.2)} \qquad \{s | s = f(\theta^*(I), I),\ I \in \mathbf{I}\} = \{s | s = f(\bar{\theta}, I),\ I \in \mathbf{I}\}$$

$$\text{(A.3)} \qquad f(\theta^*(I), I) \geq f(\bar{\theta}, I),\ \forall\ I \in \mathbf{I}$$

(A.4) Define: $\Delta\tilde{S}^*_{it} \equiv f(\theta^*(\tilde{I}_{it}),\tilde{I}_{it}) - f(\theta^*(\tilde{I}_{it-1}),\tilde{I}_{it-1})$

$$\Delta\bar{S}_{it} = f(\bar{\theta},\tilde{I}_{it}) - f(\bar{\theta},\tilde{I}_{it-1})$$

Then both $\Delta\bar{S}_{it}$ and $\Delta\tilde{S}_{it}$ are independently distributed over t and i.

(A.5) For every $s \in \{f(\theta,I): \theta \in \Theta, I \in \mathbf{I}\}$, the set $\{I | f(\theta,I) = s\}$ is nontrivial for each $\theta \in \Theta$, i.e., it has more than one element.

(A.6) The set $\{f(\theta^*(i),I), I \in \mathbf{I}\}$ is nontrivial.

(A.7) $E[f_i(\theta^*(I),I)] = E(f_j(\theta^*(I),I)] \equiv f^*$, for all product lines i and j.

By Assumption 2, there are no possible outcomes when the agent takes action θ^* that are not also possible when the agent is ignorant and does $\bar{\theta}$. Assumption 5 means that even if you observe s and the action θ you cannot invert f to find I, so you do not know if the agent took the optimal action by observing s and θ.

Assumption 3 means that it can never make the firm worse off to act on information. (The optimal action may be to ignore the information.) This assumption implies first order stochastic dominance of the ex ante distribution of $f(\cdot)$ under θ^* over $f(\cdot)$ under $\bar{\theta}$. The purpose of Assumption 4 is to ensure that inferences about the new information regarding product i in period t cannot be made by observing past information or other product lines. By Assumption 6, the value of the firm under the optimal action varies with the state of nature. Assumption 7 is merely for convenience.

3. <u>The Structure of a Firm</u>

The discounted present value of the firm (still not accounting for managerial costs) will be specified as

$$a_t(n) \left[\sum_{i=1}^{n} f_i \left(\theta_{it}, \tilde{I}_{it}\right)\right]$$

The variable a_t is the productive input of the CEO at time t. To avoid incentive problems for the CEO, I will assume that a_t does not represent effort by the CEO, but is determined by his exogenously endowed managerial ability.[4]

The CEO's ability to manage a multiproduct firm depends on the number of products n. As the number of products becomes larger, the complexity of the organization increases and the strategic decisions become more difficult. We capture this by assuming $\gamma g(n) \equiv a(n) \cdot n$ has the following properties:[5]

$$\begin{aligned} & g' > 0 \\ \text{(A.8)} \qquad & g'' < 0 \\ & \lim_{n\to\infty} g'(n) = 0 \\ & \lim_{n\to 0} g'(n) = \infty \end{aligned}$$

and γ is a scalar measure of the CEO's "inherent" ability (independent of n). Notice that the CEO's input enters as a public good in the value of the firm.

We will further assume that

$$\text{(A.9)} \qquad g(1) + g(n - 1) > g(n), \ \forall \ n > 1.$$

Suppose that there is a perfectly elastic supply of product managers and of CEO's, but not capital. Further, assume that by the nature of the technology, one person cannot serve in two managerial roles in the firm.

Let $\bar{U}$ be the exogenously determined reservation utility level for product managers, and $\bar{R}$ for the CEO's, and define $\bar{m}$ as the certainty wage such that

$$V(\bar{m}) - c(k) = \bar{U},$$

and $\bar{z}$ as the certainty wage such that

$$V(\bar{z}) = \bar{R}.$$

Before proceeding with an analysis of the incentive problem, let us first consider the optimal firm structure in the absence of incentive problems. We assume that in the absence of incentive problems it would be optimal to pay the managers to acquire the information I. Then the wages paid to the managers and CEO, respectively, would be $\bar{m}$ and $\bar{z}$. The expected present value of the firm at time t to the capital owners would be

$$S_t = E[a_t(n)\ (\Sigma_{j=1}^{n}\ f_j(\theta^*_{jt}, I_{jt})] - n\bar{m}/r - \bar{z}/r,$$

where r is the discount rate. By Assumption (5) this becomes

$$S_t = E[a_t(n) \cdot nf] - n\bar{m}/r - \bar{z}/r.$$

By assumption A.8 and standard comparative statics:

<u>Lemma 1</u>:

$n^*(\gamma)$ is strictly increasing in γ

and

$$\exists\ \bar{\gamma}\ \text{s.t.} \qquad n^{*}(\gamma) > 1 \qquad \forall\ \gamma > \bar{\gamma}.$$

I assume that there is an infinitely elastic supply of CEOs of ability $\gamma^{*} > \bar{\gamma}$.

This establishes the optimality of multiproduct firms, in the absence of incentive problems. For the remainder of the paper I will continue to assume that there is no incentive problem regarding the CEO. We will focus on the incentives of the product managers.

4. The Incentive Problem

Divisional mangers can maximize the value of their divisions by keeping abreast of developments in the product market. Indeed, this is the role of divisional managers. Because it is costly for a manager to keep track of all the new opportunities, changes in technology, and so forth, he must be provided an incentive to do so. Normally we think of solving this problem by tying the manager's compensation to the stock value of the firm. I here argue that this is particularly costly in a multiproduct firm because the stock value reflects the productivity in all divisions. I will assume that the stock value of the firm in any time t is equal to its discounted net present value, S_t. The view I will take is that information about the product market is gathered by investors, because the information is valuable for making money on the stock. The information is also gathered by the manager, if he has an incentive to incur the costs of doing so. However, the CEO is not an expert in the product market - his job is not product-specific, or does not require the type or level of product-specific detail that is valuable to the product manager. The only value such information would have to the CEO is to evaluate the managers' decisions. We assume it is prohibitively costly for the CEO to do his own job and, at the same time, maintain an expertise in the product markets. This assumption is discussed further in Section 6.

Suppose the firm solves the incentive problem with respect to its product managers in the standard way, by writing incentive contracts as a function of stock value. I will refer to such compensation schemes as "standard contracts." Then the stock value of the firm is

$$a(n)\ f_1(\theta_1,\ I_1) + a(n)\ f_2(\theta_2,\ I_2) + \ldots$$
$$+ a(n)\ f_n(\theta_n, I_n) - \bar{z}/r - (n/r)E(W)$$

where E(W) is the expected value of the compensation of divisional managers under standard contracts when incentives must be provided.

From the perspective of the CEO designing the compensation scheme for managers, the functions $f_i(\cdot,\ \cdot)$ are random variables. This is true even if the CEO knows that the managers are investing in information, by assumption (A.5), since the individual functions $f_i(\theta, I)$ are not observed in a multiproduct firm. Consider manager 1. From his perspective, the stock value of the firm is

$$a(n)\ f(\theta,\ \tilde{I}) + a(n)\ [\varepsilon_2 + \ldots + \varepsilon_n],$$

where ε_i is the random variable $f(\theta_i^* (\tilde{I}_i),\ \tilde{I}_i)$.

Let $S_{in} \equiv a(n)f_i(\theta,I) + a(n) \sum_{\substack{j=1 \\ j\neq i}}^{n} \varepsilon_j$.

The standard compensation contract is $W(S_{in})$. Let the expected cost of this contract be

$$\rho(n) = E(W(S_{in})).$$

Then:

Lemma 2: The cost of the standard contract, $\rho(n)$, rises with n.

Proof: See the Appendix.

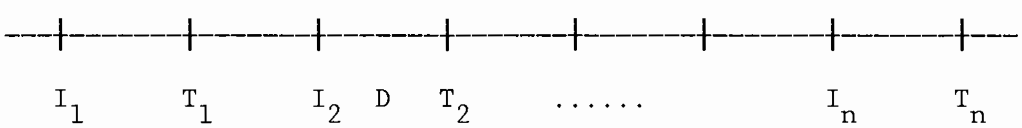
Thus, for incentive purposes, multiproduct firms are costly because of the noise in the relationship between product line productivity and stock value. On the other hand, while single product firms can more efficiently provide incentives for product managers, they suffer the loss of economies of scope.[6]

5. Spinoffs as an Incentive Device

We consider now the use of spinoffs as an incentive mechanism. The form of the contract is as follows: a manager of a product line in a multidivisional corporation receives a salary that is independent of observed stock values. At any time, however, he may announce to the CEO that it is an appropriate time to spin off his division. In this event the division is spun off, the manager accompanies the spinoff, and his compensation becomes a function of the stock value of the spinoff.

When will the manager chose to spin off? When he gets "good news" about the value of his division, or perceives an opportunity that will allow the manager to increase its value. By spinning off, the manager enjoys the gains because his compensation becomes a function of the division's stock value. Simply put, the incentive in each period for a manager to stay on top of his market is that he may find an opportunity that will make it valuable to spin off and gain from the increased stock value. His incentive to gather information after spinning off is that his compensation is then a function of the firm's stock value. The benefit to this scheme over a standard agency contract is that the firm can enjoy the efficiency gains of conglomeration for part of its life without imposing the risk of the noisy signal on managers.

The timing in the market is specified as follows:



At each time T_i the stock market meets. At each time I_i information is released to the market. The market and the manager get the information simultaneously. Suppose that at I_2 information is released that makes spinoff desirable. D represents the spinoff decision, that is, at time D the manager may go to the CEO and announce that he wishes to spin off. At this time, the decision is announced to the public. At time T_2 the stock market responds to the information and spinoff decision. At some time T^* the actual spinoff occurs.

In our simplified model all of the increase in stock value due to the good news at I_2 will be capitalized into the stock value of the parent at T_2, rather than after the spinoff. Nevertheless, it is possible for the manager to reap these gains as follows. At each time T_t the stock value of the firm S_t is composed of the implicit stock values of each division. The fraction of total firm value accounted for by each division is unknown, of course, but the firm can impute or estimate this fraction based on accounting data. For example, the firm might look at the fraction of firm accounting revenues brought in by the division over some appropriate time period. We will call the estimated fraction of firm value attributed to division i at time t α_{it}, and we will be agnostic about how it is determined. If the true fraction is α_{it} then we will assume that

$$E\,\hat{\alpha}_{it} = \alpha_{it}.$$

Of course, there will be times when the accounting value is a bad prediction of division value; this is precisely why accounting data are poor signals on which to base incentives. We merely assume that they average out.

At any time t the true value of the firm is

$$S_t = \Sigma_{i=1}^{n} a(n) f_i(\cdot,\cdot) - n\psi/r - \bar{z}/r,$$

where ψ is the expected payment to each product manager under the spinoff scheme. Suppose at time t+ some good news arrives, increasing $f_{it}(\theta^*)$ to

$f_{it}(\theta^*) + \Delta$. The firm's stock value rises at t + 1 to

$$S_{t+1} = \Sigma\, a(n)\, f_i(\cdot, \cdot) + a(n)\, \Delta.$$

When the spinoff actually occurs at t^* the value of the division's stock will be

$$s_{it} = a(1)[f_i(\cdot,\cdot) + \Delta - n\psi/r - \bar{z}/r$$

(as long as no new information changes the value in the intervening periods). Thus, the manager can gain from the good news by being paid as a function of

$$s_{it^*} - \hat{\alpha}_{it}\, S_t \quad \text{at time } t^*.$$

This could be in the form of a stock option that is in the money whenever $s_{it^*} > \hat{\alpha}\, s_{it}$. Notice that for $S_{it^*} > \hat{\alpha}\, S_{it}$ it is necessary that Δ be bounded away from zero since there is an efficiency loss to becoming a single product firm.

After the spinoff the manager can be paid as a function of the true productivity of his division, s_i, since this is now observed as the spinoff's stock value.

We can divide the spinoff contract into three sequential components. First is the constant wage, $\bar{w}$, paid while the product line is part of the conglomerate. Second is the "bonus" that the manager gets as a function of the stock price s_i in the event of a spinoff. This bonus, which we will denote $B(s_i)$, is essentially a lump sum that the manger receives immediately after the spinoff. The third phase of compensation, after spinoff, constitutes the solution to a standard agency contracting problem, which will be payment contingent on the stock value of the firm. Call this contract $W(s_i)$.

In what follows we will consider a representative product line i and denote s_i as s. Recall that $\bar{U}$ is the exogenously determined reservation utility of the manager. I assume that a contract in which the manager waives his right to quit his job is unenforceable. Thus, the contract W(s) must provide the manager with expected utility at least $\bar{U}$, i.e.,

$$EU(W(s)) - c(k) = \bar{U} \tag{3}$$

It is not necessary, however, that the utility of $\bar{w}$ (minus effort costs) be $\bar{U}$. The manager's expected utility in any period in which he is still a member of the parent firm includes the expected utility of the spinoff bonus. The individual rationality constraint is that the manager's utility of $\bar{w}$, plus his expected utility of the bonus, taking into account the probability that he will choose spinoff (minus effort costs), must be $\bar{U}$.[7]

For simplicity I will proceed as if the spinoff occurs in the same period as the decision and announcement. Consequently, the manager receives the spinoff bonus in the announcement period. It is only a matter of discounting and appropriately adjusting the rationality constraints to allow for B(s) to actually be received in any period after the spinoff decision.[8]

Suppose the contract $\{\bar{w}, B(s), W(s)\}$ implements information gathering. The contract must satisfy in each period

$$(4)\quad E_{\theta*}[V(\bar{w} + B(s))|B(s) \geq B*(s)]pr(B(s) \geq B*(s)|\theta*) + V(\bar{w})pr(B(s) < B*(s)|\theta*) - c(k)$$
$$> E_{\bar{\theta}}[V(\bar{w} + B(s))|B(s) \geq B*(s)]pr(B(s) \geq B*(s)|\bar{\theta}) + V(\bar{w})pr(B(s) < B*(s)|\bar{\theta}).$$

$$(5)\quad E_{\theta*}[V(\bar{w} + B(s))|B(s) \geq B*(s)]pr(B(s) \geq B*(s)|\theta*) + V(\bar{w})pr(B(s) < B*(s)|\theta*) - c(k) = \bar{U}$$

$$(6)\quad E_{\theta*}[V(W(s)) - c(k)] \geq E_{\bar{\theta}}[V(W(s))]$$

$$(7)\quad E_{\theta*}[V(W(s)) - c(k)] = \bar{U}$$

where in each period B*(s) is the critical value of the bonus, above which the manager will always choose to spin off. Inequalities (4) and (6) are the incentive compatibility constraints for the pre- and post-spinoff contracts, respectively. Equations (5) and (7) are the corresponding individual rationality constraints.

Lemma 3: In each period B*(s) = 0.

Proof: Let the manager's tenure with the firm be n periods. Consider the nth period, after the manager has observed I_n. If the manager spins off, his utility is $V(\bar{w} + B(s)) - c(k)$. If he does not spin off his utility is

$V(\bar{w}) - c(k)$. (In the last period of his tenure at the firm the manager cannot "go with" the spinoff, but his compensation or severance pay is a function of the spinoff's value.) By monotonicity of $V(\cdot)$, the manager will spin off in the last period whenever $B(s) \geq 0$.

By (5), the ex ante (i.e., before I_n is observed) expected utility in period is $\bar{U}$, when $B^*(s) = 0$.

In period n - 1, if the manager does not spin off (again, after observing I_{n-1}), his expected utility is

$$V(\bar{w}) - c(k) + (1/(1 + r))[E_{\theta^*}\{V(\bar{w} + B(s))|B(s) \geq 0]pr(B(s) \geq 0)$$
$$+ V(\bar{w})pr(B(s) < 0) - c(k)] = V(\bar{w}) - c(k) + 1/(1 + r)\bar{U}.$$

If he does spin off his expected utility is

$$V(\bar{w} + B(s)) - c(k) + 1(1 + r)\bar{U}.$$

Again, he will spin off whenever $B(s) \geq 0$.

Now let ν denote the ex ante discounted present value of the manager's expected utility at time i, i < n, when (4)-(7) are satisfied. Then by (5) and some algebra, ν satisfies

$$\nu = [\Sigma_{j=0}^{n-i} \bar{U}/(1 + r))^j$$

If the manager chooses to spin off his expected utility is

$$V(\bar{w} + B(s)) - c(k) + \Sigma_{j=1}^{n-i} (\bar{U}/(1 + r))^j$$

If not, it is

$$V(\bar{w} + B(s)) - c(k) + \Sigma_{j=1}^{n-i} (\bar{U}/(1 + r))^{j}$$

Again, he will spin off whenever $B(s) \geq 0$. Q.E.D.

Thus, the manager's strategy is the same in each period: spin off iff $B(s) \geq 0$. Given this rule, the contract $\{\bar{w}, B(s)\}$ must be designed to satisfy (4) and (5). Notice that by manipulating B(s) the probability of spinoff is affected as well as the manager's compensation in the event of spinoff.

I will proceed as if the optimal contract $\{\bar{w}, B(s)\}$ is monotonic in s. In particular, this means that there will exist some cutoff value of s, $\hat{s}$, such that $B(s) \geq 0$, $\forall\ s \geq \hat{s}$, and $B(s) < 0$, $\forall\ s < \hat{s}$. The logic of the proofs does not rely on monotonicity, however, and the proofs can easily be generalized, but with more cumbersome notation.

<u>Lemma 4</u>: The cost of an optimal spinoff contract is finite for all positive probabilities of spinoff.

<u>Proof</u>: Let F(s) be the cdf of s when $\theta = \theta^*$. Clearly, if B(s) is such that $F(s) = 1$, the incentive compatibility constraint is violated. However, for all cutoff values $\hat{s}$ such that $F(\hat{s}) < 1$ the constraint set (4) and (5) can be satisfied at finite cost by choosing B(s) to be a constant B, $\forall\ s > \hat{s}$. In this case the constraint set is one equation and one inequality in two

unknowns, B and W. Q.E.D.

Lemma 5: The cost of an optimal spinoff contract is nonincreasing in the probability of spinoff.

Proof: Let $\phi_1 = \{w_1, B_1(s)\}$ be an optimal contract with probability of spinoff given by $(1 - F(\hat{s}_1))$ where

$$\hat{s}_1 \equiv \min\{s | B_1(s) \geq 0\}.$$

Now consider another contract, $\phi_2 = \{w_2, B_2(s)\}$ such that $\hat{s}_2 \equiv \min\{s | B_2(s) \geq 0\} < \hat{s}_1$. Thus, $(1 - F(\hat{s}_1)) < ((1 - F(\hat{s}_2))$. The cost of ϕ_2 cannot exceed that of ϕ_1 because ϕ_2 can perfectly replicate ϕ_1 by setting $w_2 = w_1$ and $B_2(s) = 0$ for $\hat{s}_2 \leq s \leq \hat{s}_1$. Under this contract the cost of ϕ_2 is identical to that of ϕ_1. Q.E.D.

The intuition behind this result is that a higher probability of spinoff is associated with a larger set of observed stock values on which to write the bonus contract, in the event of a spinoff. This additional information cannot increase the cost of the contract, as it can always be ignored.

In the presence of economies of scope there is an efficiency loss associated with higher probabilities of spinoff. The ex ante expected value of capital in a single product line when incentive problems are absent is

$$\omega = [a(n)f^* - \bar{m} - \bar{z}/n] + (\pi/r)[a(1)f^* - \bar{m} - \bar{z}] + [(1 - \pi)/(1 + r)]\omega$$

$$\Rightarrow \omega = [(1 + r)/(r + \pi)]\{a(n)f^* - \bar{m} - \bar{z}/n) + (\pi/r)(a(1)f^* - \bar{m} - \bar{z})\}$$

where π is the probability of spinoff, and recall,

$$f^* \equiv Ef(\theta^*, I).$$

Since $a(n)f^* - \bar{m} - \bar{z}/n > a(1)f^* - \bar{m} - \bar{z}$ at $n = n^*$,

$$d\omega/d\pi < 0 \text{ at } n = n^*.$$

Now consider the effect of n on the cost of the spinoff incentive scheme. Any effect of a change in n will be via its effect on the probability of spinoff. Any contract $(\bar{w}, B(s), W(s))$ that satisfies (4)-(7) will satisfy those constraints for any n. Thus, the cost of the optimal spinoff cannot increase with n.

For what follows I will further simplify the analysis by isolating one product line as a candidate for the spinoff scheme and let the probability of spinoff for the other product lines be zero. As long as the information flows are independent across products, this merely simplifies the algebra; allowing all product lines a positive probability of spinoff will decrease the ex ante expected economies of scope of the firm but will not change the qualitative results.

Lemma 6: The cost of the spinoff contract falls as γ increases.

Proof: Although the incentive features of a spinoff contract are independent of n, the efficiency costs of the spinoff are not. For any $n^*(\gamma)$, decreasing the number of product lines by 1 has no first order efficiency effect. The value of the spinoff firm, however, is higher as γ is higher, holding the CEO's compensation, m, constant. Let $\rho(n)$ denote the expected dollar value of compensation to the product managers under the standard contract, and $m(\pi)$ under the spinoff contract, where π denotes the probability of spinoff. Algebraically, under the standard contract the value of the firm is

$$\omega^{ST} = (1/r)[\gamma g(n)f^* - \bar{z} - (n - 1)\bar{m} - \rho(n)]$$

under spinoff the expected ex ante value of the firm is

$$\omega = [(1 + r)/(r + \pi)[\gamma g(n)f^* - \bar{z} - (n - 1)\bar{m} - m(\pi) + (\pi/r)(\gamma g(n - 1)f^* + \gamma g(1)f^* - 2\bar{z} - \rho(1) - (n - 1)\bar{m}].$$

This entails an efficiency loss because after spinoff two CEO's are required to do the work previously done by one. After spinoff the total output of the two firms in each period is

$$[\gamma g(n - 1) + \gamma g(1)]f^*.$$

The efficiency loss is that you pay $2\bar{z}$ rather than $\bar{z}$. Thus, the efficiency loss from spinoff is

$$L = \gamma g(n)f^{*} - [\gamma g(n-1) + \gamma g(1)]f^{*} + \bar{z}$$

$$dL/d\gamma = \{g(n) - g(n-1) - g(1)\}f^{*} + \{\gamma[g'(n) - g'(n-1)]\}f^{*}(dn/d\gamma)$$

The second term is negative by concavity of g, and the first term is negative by Assumption (A.9). Standard comparative statics show that $dn/d\gamma$ is positive under the spinoff scheme.[9] Therefore, $dL/d\gamma < 0$; that is, the efficiency cost of spinning off <u>decreases</u> as managerial ability of the CEO (and hence firm size) rises.

<u>Proposition 1</u>: For sufficiently large managerial ability, γ, the spinoff contract dominates the standard agency contract for product managers.

<u>Proof</u>: As managerial ability rises, the optimal number of divisions rises. Increasing n increases managerial costs without limit under standard contracts, by Lemma 2. Under spinoff contracts, managerial costs are finite and, by Lemma 4, do not rise with n. The efficiency costs of spinoff contracts fall with n, by Lemma 6. Thus, there will be some $\hat{\gamma}$ such that the cost of standard contracts exceed the cost of the spinoff contracts. Q.E.D.

We have considered a fairly restrictive spinoff contract, for expositional purposes. More generally, the compensation of the manager in each non-spinoff period can be a function of the stock value of the firm. Clearly this cannot make the spinoff scheme less attractive, and by Holmstrom's (1979) result on the value of signals, will typically improve its value. Nevertheless, the lemmas that relate to the spinoff contract do not rely on compensation in pre-spinoff periods being a constant. They hold, with the obvious changes in the proofs, for this more general contract as well.

<u>Proposition 2</u>: Firms with more product lines will be disproportionately more likely to engage in spinoffs. That is, the probability that any one product line is spun off is increasing in the number of product lines in the parent firm.

<u>Proof</u>: By standard comparative statics, $dn/d\gamma > 0$ and $d\pi/d\gamma > 0$. Hence, $d\pi/dn > 0$. Q.E.D.

As noted earlier, the preceeding analysis does not require that the bonus B(s) be monotonic in the stock value s. However, if the optimal contract B(s) is monotonic the following corollary holds:

<u>Corollary</u>: The stock price increase associated with spinoff will be larger the <u>smaller</u> the number of divisions in the parent firm.

<u>Proof</u>: Let $\hat{s}_m$ be the optimal cutoff value such that $B(s) \geq 0 \;\; \forall s \geq \hat{s}_m$, $B(s) < 0 \;\; \forall s < \hat{s}_m$, when there are m divisions in the firm. By Proposition 2, the smaller the number of divisions, the lower is the probability of spinoff, i.e., $pr\{s \geq \hat{s}_m\}$ is decreasing in m. Thus, $\hat{s}_m$ is increasing in m. Q.E.D.

When all of the divisions are the same size, as in the model, the Corollary is equivalent to the empirical finding by Miles and Rosenfeld

(1983) that the share price reaction to spinoffs is larger when the spun off division is large relative to the parent than when it is small. Of course, real firms have divisions of various sizes, and in that case the obvious caveats apply in interpreting the Corollary vis a vis the above empirical result.

Proposition 3: Measured compensation of the product manager after spinoff will exceed on average his compensation before spinoff.

Proof: Notice that the cost of the contract $\{\bar{w}, B(s)\}$ will exceed that of $\{W(s)\}$ by Lemma 5. However, the bonus B(s) will be realized after the spinoff occurs and will typically be measured as post-spinoff compensation. Thus, compensation in the spinoff period, when the manager receives B(s), will exceed his observed pre-spinoff compensation, $\bar{w}$.

Comparing compensation in pre-spinoff periods to that in post-spinoff periods (periods after (B(s) has been realized and the standard contract is effective), by (7)

$$E_{\theta*}[V(w(s))] = \bar{U} - c(k).$$

By (5),

$$E_{\theta*}[V(\bar{w} + B(s))|B(s) \geq 0]pr(B(s) \geq 0) + V(\bar{w})pr(B(s) < 0)] = \bar{U} - c(k).$$

Let $\rho = E_{\theta*}[w(s)]$. If $\bar{w} = \rho$,

$$E_{\theta*}[V(\rho + B(s))|B(s) \geq 0]prB(s) \geq 0) + V(\rho)pr(B(s) < 0)$$
$$> V(\rho) > E_{\theta*}V(w(s)) = \bar{U} - c(k),$$

where the second inequality is by concavity of V(•). But (5) is binding at an optimal contract (by Lemma 7). Q.E.D.

It is not strictly necessary for the spinoff mechanism that the product manager "go with" the spinoff. The contract only requires that the manager be paid as a function of the division's post-spinoff stock value. There are compelling reasons within the model, however, that suggest that managers will accompany the spinoff.

The inducement for spinoff in the model is that the manager has learned of a profitable opportunity for his product line. By the nature of the information, it is costly to transfer this knowledge to another manager. The manager should accompany the spinoff, then, because he has information about the profitable project to be undertaken. In the model the manager is indifferent ex post between staying at the parent firm and going with the spinoff, but if he has superior information about the profitable project, the shareholders are not indifferent. The ex post value of the spinoff will be lower if a new manager, with inferior information, enters. If shareholders believe this is likely, the stock price reaction to the market information be dampened and incentives thereby become more costly to implement. Thus, it is in the interest of all parties to commit ex ante that the manager will accompany the spinoff. Conversely, if this commitment is not perfect, the news that the manager will accompany the spinoff will be accompanied by a positive stock price response.

6. Further Implications of the Model

Spinoffs occur in this model because the product manager perceives the market value of his division to exceed significantly its value as estimated within the firm. This divergence may be due to profitable new opportunities or an exogenous increase in the division's value, or it may be because the product line is seriously undervalued within the firm. Recall we were agnostic about how that internal evaluation was made. If the firm is particularly bad at making internal evaluations, it will encourage spinoff in the divisions it undervalues. Thus, spinoffs can occur simply in reaction to the product line being internally undervalued relative to the product manager's (correct) estimate of its true value. Because such a spinoff is not motivated by new real profit opportunities, its announcement should not be accompanied by a stock price jump.

A stock price increase that accompanies a spinoff announcement indicates new profit opportunities for the spinoff. Therefore, in these cases, the model suggests that behavior of the division will change after spinoff. After the spinoff the new firm should be engaging in the profitable project that motivated the spinoff. This may entail introduction of a new product, service of a new market, or increased investment in current operations in response to perceived future growth. It is likely that all of these activities entail increased investment expenditures, either in physical capital, advertising, or R&D.

I have implicitly treated the product lines as monopolies. However, to the extent that several multiproduct firms have product lines in the same industry, the news of interest to these product lines may be positively correlated. This is particularly likely when the good news involves future growth in product demand or improved technology, rather than a new product introduction. This suggests that spinoffs are likely to occur in waves within industries, when, ex post, the industry as a whole shows an increase in profitablity. In such industries, the probability that product line x in firm A spins off will be higher if it is observed that product line x has spun off from firm B.

To summarize, the model suggests the following additional empirical regularities should be associated with spinoff:

- The product manager will go with the spinoff rather than stay with the parent firm.
- New investment in spinoffs in the period immediately following the spinoff will be higher than before the spinoff, and higher than firms of similar characteristics that were not recently spun off, particularly when the spinoff was accompanied by a significant positive share price response.
- Spinoffs are likely to occur in industry waves in industries that, ex post, turned out to have increasing profitability.

In this model of spinoffs, the spinoff itself is efficient ex ante for incentive reasons, but is inefficient ex post. Therefore, the firm must be able to commit ex ante to effecting the spinoff when the product manager suggests it. On the other hand, it is not surprising that shareholders occasionally protest a spinoff, despite the fact that there is no change in ownership.

Since our previous results show that the efficiency costs of spinoff are highest when the number of product lines is small, these are the cases when shareholders have the greatest incentive to object. Thus, we should see the frequency of shareholder objections increase as the size of the parent firm (the number of product lines) falls.

When spinoffs are part of an incentive mechanism there is no reason for the spinoffs to remain independent indefinitely. Spun off firms forego scope economies enjoyed by multiproduct firms. Therefore, it is efficient that, once the development of a new project has been carried out by the management, the spinoff be acquired by another conglomerate. (It is irrelevant in this stylized framework whether the acquirer is the original parent or another firm.) Anecdotal evidence suggests that it is common for spinoffs to be acquired later.[10] Rather than indicating that the spinoff was a mistake, it is consistent with this model that both the spinoff and the acquisition are optimal. This is true even if both transactions involve the same parent, and both should be accompanied by positive stock price reactions.

Throughout the paper I have assumed that the CEO cannot acquire the information necessary to evaluate the actions of the product managers. Suppose instead that the CEO could acquire the product market information on each product line at the same cost, per market, as the product managers. He could then replicate standard contracts based on the market value of each division. If the CEO's compensation were tied to the stock value of the firm he would be rewarded for acquiring the information. It is clear, however, that with convexity in the CEO's disutility of effort function it would be extremely costly to do so as the number of product lines gets large. Indeed, it may become impossible if time is a constraint on the

CEO's ability to invest in information. In addition, one could easily imagine (and model) that if a CEO devotes time and effort to becoming an expert in each product line it will reduce the effectiveness with which he performs his other duties. Clearly, as the economies of scope increase, it becomes less desirable to have the CEO play such a role, because the costs of doing so increase. It is evident that if these costs are high enough (or if time constraints bind), it will be optimal to let the stock market monitor the markets rather than the CEO. This is the essence of the spinoff scheme.

Note, too, that one cannot solve the information problem by merely hiring an outside expert to report on the appropriateness of the manager's action. In doing so the problem of motivating the manager merely becomes the equivalent problem of motivating the "expert."

The premise of this paper is that the value of spinning off arises from the creation of a market measure of profitability that reflects only the productivity of one product line. In principle, this could be achieved as well by creating instead a wholly-controlled subsidiary with separately traded stock. This appears attractive since it achieves the benefits of spinoff without loss of scope economies.

The problem with such a scheme is that shareholders of the subsidiary cannot be sure that the parent firm will not transfer resources between the firms in a way that adversely affects the subsidiary. When ultimate control is maintained by the parent, the subsidiary is vulnerable to such activity. At best, the stock price of the subsidiary will reflect not only the profitability of its own products, but the degree to which such interference is likely. This weakens its value as a signal.

Of course, if complete contracts could be written and enforced between the parent and subsidiary this problem would be avoided. I am implicitly assuming that such contracts are not feasible. In this sense, my model is fundamentally based on a notion of incomplete contracts.[11]

5. Conclusions

Business firms commonly use managerial compensation schemes that appear very crude to economists. However, these observations may be misleading. If one were to study the compensation of managers holding the kind of incentive contracts proposed in this paper, it would appear to have very weak incentive properties indeed. This is because most of the incentive pay in these contracts is received only in the event of a spinoff. This suggests that studies that measure the incentive features of a compensation scheme as the correlation between total pay and stock value may seriously underestimate the incentives the managers actually have.

We still understand very little about corporate reorganizations of all forms, and their relationships to managerial incentives. Of course it is clear that, in some sense, all reorganizations must be the result of managerial incentives. The underlying theme of this paper is that they may be a <u>source</u> of incentives as well. The extent to which this idea is appropriate to forms of reorganization and structure other than spinoffs, and the empirical validity of such models, awaits further research.

Appendix

Proof of Lemma 2: Note that S_{n+1} can be written as $S_n + \varepsilon_{n+1}$, where ε_{n+1} has some distribution $g(\cdot)$ and S_n, ε_{n+1} independent. Let $h(\cdot)$ and $r(\cdot)$ denote the pdf's of S_{n+1} and S_n, respectively. It is clear that $\rho(S_n)$ cannot be greater than $\rho(S_{n+1})$ because a firm observing S_n can always perfectly mimic observing S_{n+1} in the following way: if the optimal contract based on S_{n+1} is $W_{n+1}(\cdot)$, then for each S_n observed by the firm, it independently draws from $g(\cdot)$ to get an ε. It adds this value ε to the observed S_n to get a S_{n+1} and pays according $W_{n+1}(\cdot)$. Thus, the firm observing S_n always has the option of observing S_{n+1} instead, so it cannot do worse by observing S_n.

To prove that S_n is better than S_{n+1} we need only present a contract that implements effort k at the same expected utility, but at a lower cost than the optimal S_{n+1} contract.

If $W_{n+1}(\cdot)$ is the optimal contract under S_{n+1}, it solves the program

$$\min_W \int W(S_{n+1})h(S_{n+1};\theta^*)dS_{n+1}$$
$$\text{s.t.} \int V(W(S_{n+1}))h(S_{n+1};\theta^*)dS_{n+1} - c(k) \geq V(W(S_{n+1})h(S_{n+1};\bar{\theta})dS_{n+1}$$

and

$$\int V(W(S_{n+1}))h(S_{n+1};\theta^*)dS_{n+1} - c(k) \geq \bar{U}$$

for given $\bar{U}$. Recall that $S_{n+1} = S_n + \varepsilon$ so that we can replace $W(S_{n+1})$ by $W(S_n + \varepsilon)$ and $h(S_{n+1};\theta)$ by $h(S_n + \varepsilon;\theta)$. Now suppose the firm can observe S_n. Then, observing $S_n + \varepsilon$ is equivalent to observing (S_n,ε). The contract $W(S_n + \varepsilon)$ can be written as $\hat{W}(S_n,\varepsilon)$ where

$$\hat{W}(S_n, \varepsilon) \equiv W(S_n + \varepsilon)$$

for each (S_n, ε). Consider the contract $W_n(\cdot)$ defined by

$$V(W_n(S_n)) \equiv \int V(\hat{W}(S_n, \varepsilon))g(\varepsilon)d\varepsilon$$

for each S_n. (Note that $g(\cdot)$ does not depend on θ). Expected utility for each e is

$$\begin{aligned}&\int V(W_n(S_n))r(S_n, \theta)dS_n - c(e)\\ &\quad = \iint V(\hat{W}(S_n, \varepsilon)g(\varepsilon)r(S_n, \theta)dS_n d\varepsilon - c(e)\\ &\quad = \iint V(W(S_n + \varepsilon))g(\varepsilon)r(S_n, \theta)dS_n d\varepsilon - c(e).\end{aligned}$$

Now if $Z = Z(x,y)$ is some real valued function of two-dimensional random variable (x,y), then

$$\int Zf_Z(Z)dZ \equiv \int Z(x,y)f_Z(Z)dZ = \iint Z(x,y)f(x,y)dxdy.$$

Thus (since the joint distribution of (S_n, ε) is $r(S_n, \theta)g(\varepsilon)$),

$$\begin{aligned}&\iint V(W(S_n + \varepsilon))r(S_n, \theta)g(\varepsilon)dS_n d\varepsilon - c(e)\\ &\quad = \int V(W(S_{n+1}))h(S_{n+1}, \theta)dS_{n+1} - c(e)\end{aligned}$$

for each e. Similarly,

$$\int V(W_n(S_n))r(S_n,\theta^*)dS_n - c(k)$$
$$= \iint V(\hat{W}(S_n,\varepsilon))g(\varepsilon)r(S_n,\theta^*)dS_n d\varepsilon - c(k)$$
$$= \int V(W(S_{n+1}))h(S_{n+1},\theta^*)DS_{n+1} - c(k) = \bar{U}.$$

Thus, $W_n(S_n)$ satisfies the constraints. By concavity of $V(\cdot)$,

$$V(\int \hat{W}(S_n,\varepsilon)g(\varepsilon)d\varepsilon) > \int V(\hat{W}(S_n,\varepsilon))g(\varepsilon)d\varepsilon = V(W_n(S_n)).$$

So by monotonicity of $V(\cdot)$,

$$\int \hat{W}(S_n,\varepsilon)g(\varepsilon)d\varepsilon > W_n(S_n).$$

For each S_n. But then

$$\iint \hat{W}(S_n,\varepsilon)g(\varepsilon)r(S_n,\theta^*)d\varepsilon dS_n > \int W_n(S_n)r(S_n,\theta^*)dS_n.$$

The left side is $\rho(S_{n+1})$ and the right side is the expected cost of the candidate contract under S_n. Since $\rho(S_n)$ cannot be greater than this value we have $\rho(S_{n+1}) > \rho(S_n)$. Q.E.D.

Lemma 7: The individual rationality constraint (5) is binding for any optimal spinoff contract.

Proof: Consider a candidate optimal contract $C_1 = \{w_1,B_1(s)\}$ and suppose that under this contract (5) is not binding. Let $C_2 = \{w_2,B_1(s)\}$ be an alternative contract with $w_2 < w_1$ such that (5) holds. Notice that the probability of spinoff under C_2 is identical to that under C_1, as is the expected bonus conditional on spinoff. Therefore, the expected cost of C_2,

$$w_2 + (1 - F(\hat{s}))E[B_1(s) | s \geq \hat{s}]$$

is clearly less than the expected cost of C_1,

$$w_1 + (1 - F(\hat{s}))E[B_1(s) | s \geq \hat{s}],$$

where $\hat{s}$ is the cutoff value such that $B(s) \geq 0 \quad \forall\ s \geq \hat{s}$. Let $G(\cdot)$ denote the c.d.f. of s when $\theta = \overline{\theta}$. We only need show that C_2 does not violate incentive compatibility, (4). Since C_1 satisfies (4),

$$\text{(L.1)} \qquad \begin{aligned} &E_{\theta*}\{[V(w_1 + B_1(s) | s \geq \hat{s}][1 - F(\hat{s})] + [V(w_1)F(\hat{s})]\} - c(k) \geq \\ &E_{\overline{\theta}}\{[V(w_1 + B_1(s) | s \geq \hat{s}][1 - G(\hat{s})] + [V(w_1)G(\hat{s})]\}. \end{aligned}$$

We wish to show that

$$\text{(L.2)} \qquad \begin{aligned} &E_{\theta*}\{[V(w_2 + B_1(s) | s \geq \hat{s}][1 - F(\hat{s})] + [V(w_2)F(\hat{s})]\} - c(k) \geq \\ &E_{\overline{\theta}}\{[V(w_2 + B_1(s) | s \geq \hat{s}][1 - G(\hat{s})] + [V(w_2)G(\hat{s})]\}. \end{aligned}$$

(L.1) implies (L.2) if

$$\begin{aligned} &E_{\theta*}\{[V(w_1 + B_1(s) | s \geq \hat{s}][1 - F(\hat{s})] + [V(w_1)F(\hat{s})] - c(k) \\ &\qquad - [V(w_2 + B_1(s) | s \geq \hat{s})](1 - F(\hat{s})) + V(w_2)F(\hat{s}) - c(k)\} \\ &< E_{\overline{\theta}}\{[V(w_1 + B_1(s) | s \geq \hat{s}][1 - G(\hat{s})] + [V(w_1)G(\hat{s})] \\ &\qquad - (V(w_2 + B_1(s) | s \geq \hat{s})(1 - G(\hat{s})) + V(w_2)G(\hat{s})]\}. \end{aligned}$$

Rewriting,

$$
\begin{aligned}
\text{(L.3)} \quad & E_{\theta*}\{[V(w_1 + B_1(s) | s \geq \hat{s}) - V(w_2 + B_1(s) | s \geq \hat{s})][1 - F(\hat{s})]\} \\
& \qquad + [V(w_1) - V(w_2)]F(\hat{s}) \\
& < E_{\overline{\theta}}\{[V(w_1 + B_1(s) | s \geq \hat{s}) - V(w_2 + B_1(s) | s \geq \hat{s})][1 - G(\hat{s})] \\
& \qquad + [V(w_1) - V(w_2)]G(\hat{s})
\end{aligned}
$$

Let

$$
\begin{aligned}
A &\equiv E_{\theta*}[V(w_1 + B_1(s) | s \geq \hat{s}) - V(w_2 + B_1(s) | s \geq \hat{s}) \\
B &\equiv E_{\overline{\theta}}[V(w_1 + B_1(s) | s \geq \hat{s}) - V(w_2 + B_1(s) | s \geq \hat{s})] \\
C &\equiv V(w_1) - V(w_2).
\end{aligned}
$$

By concavity of $V(\cdot)$, and first order stochastic dominance (A.3)

$$\text{(L.4)} \qquad A < B < C.$$

Rewriting (L.3),

$$[A - C][1 - F(\hat{s})] + C < [B - C][1 - G(\hat{s})] + C$$

or

$$(C - A)(1 - F(\hat{s})) > (C - B)(1 - G(\hat{s}))$$

which is true by (L.4) and first order stochastic dominance. Q.E.D.

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Endnotes

1. It is well understood in the accounting literature that compensating managers as a function of accounting returns can distort incentives. See, for example, DeCoster and Shafer, 1979.

2. For the complete set of technical conditions sufficient to ensure existence of an optimal standard contract, see Clarke and Darrough (1980).

3. Notice that this generates an optimal output level per product, not merely per plant. This may be due to increasing marginal costs at the product level, or that products are sufficiently differentiated that firms face downward sloping demand for their products. The latter reason is convenient for our purposes because it mitigates the benefits to relative performance evaluations, which we will ignore.

4. When a_t is unobserved effort, the incentive problem for the CEO is similar to that studied by Aron (1988). Diversification is an efficient response to the agency problem is that setting. This provides an additional justification for diversification to the one appealed to here.

5. This structure is formally similar to that in Lucas (1978).

6. Or they are less efficient at providing incentives for the CEO, as in Aron, 1988.

7. It is shown in the Appendix as Lemma 7 that the individual rationality constraint (5) holds with equality.

8. Adjustment would also be necessary to account for any uncertainty regarding the division's value in the periods between the announcement and the spinoff event. This would not materially alter the analysis.

9. For this result and the comparative statics in Proposition 2 it is necessary that $m''(\pi) > 0$ to satisfy the second order conditions. Intuition strongly suggests that this will be the case but I do not have a proof. I assume it to hold in what follow.

10. However, one must take care to separate true spinoffs from those that are merely a brief intermediate step in what is in fact intended as a sell-off.

11. I am grateful to Bengt Holmstrom for pointing this out.