

# A theory of corporate spin-offs<sup>☆</sup>

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Received 14 August 2001; received in revised form 03 May 2003

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## Abstract

We develop a new rationale for corporate spin-offs, and for the performance and value improvements following them, based on corporate control considerations. We consider a firm with multiple divisions, with incumbent management having different abilities for managing these divisions. If the incumbent loses control to a more able rival, it benefits all shareholders (including the incumbent) by increasing equity value, but involves the incumbent losing his private benefits of control. We show that a spin-off increases the incumbent's chance of losing control to such a rival. This, in turn, motivates the incumbent either to work harder at managing the firm (in order to avoid any loss of control), or to relinquish control of one of the firms resulting from the spin-off (either immediately following the spin-off, or subsequently in a control contest). We show that spin-offs will be associated with positive announcement effects and increases in long-term operating performance. Further, certain categories of spin-offs will exhibit long-term positive abnormal stock returns.

*JEL classification:* G34; G32

*Keywords:* Spin-offs; Restructuring; Takeovers; Corporate control

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<sup>☆</sup> The working paper version of this paper circulated under the title "Corporate control contests and the disciplining effect of spin-offs: A theory of performance and value improvements in spin-offs". For helpful comments or discussions, we thank Franklin Allen, Richard Arnott, Sris Chatterjee, Art Durnev, Espen Eckbo, John Finnerty, Chinmoy Ghosh, Gautam Goswami, Jayant Kale, George Kanatas, David Nachman, Vik Nanda, Tom Noe, Jun Qian, Steve Raymar, Fabio Schiantarelli, Susan Shu, Venkat Subramaniam, Bob Taggart, Hassan Tehrani, as well as participants at the August 2001 EFA meetings, the 2002 Asian Corporate Governance Conference, the 2002 FMA meetings, the 2003 WFA meetings, and seminars at Boston College, Boston University, Brandeis University, Fordham University, Georgia State University, McGill University, and Tulane University. Special thanks to the editor Bill Schwert, and an anonymous referee for several helpful suggestions. All errors remain our own responsibility.

## 1. Introduction

In recent years, the number of corporate spin-offs has accelerated. While the motivation often given for such spin-offs is corporate focussing (or re-focussing), little is known about the precise source of any benefits from such corporate restructuring (see, e.g., Comment and Jarrell, 1995; and Berger and Ofek, 1995, for examples of the corporate focus literature). The empirical literature has repeatedly documented that parent-company stockholders gain by spin-off announcements while bondholders are unaffected (see, e.g., Hite and Owers, 1983; Miles and Rosenfeld, 1983; or Schipper and Smith, 1983). However, the precise source of such value gains is still a matter of considerable debate.

Recent empirical evidence, however, goes beyond showing the positive announcement effects of spin-offs on stock price. Cusatis, Miles, and Woolridge (1993) show that, in addition to the positive abnormal stock returns for parent firms on the announcement date, both spin-offs and their parents experience significantly positive abnormal returns for up to three years beyond the spin-offs' announcement date. Further, both spin-offs and their parents experience significantly more takeovers than do control groups of similar firms. Finally, they show that spin-off/parent combinations not reporting takeover activity within three years do not have positive long-term abnormal stock returns.

This paper develops a new rationale for the performance and value improvements arising from spin-offs which is consistent with this recent (as well as earlier) empirical evidence. We develop a theoretical analysis which demonstrates how spin-offs can increase the probability of a takeover by the right kind of (value-improving) management team. We show how such spin-offs can enhance the level of firm performance even in the absence of such a value-improving takeover by serving to discipline firm management. Finally, our analysis demonstrates that, while a spin-off will lead to positive abnormal stock-price returns on the announcement day, it will also lead to increases in operating performance and to abnormal stock price performance (on average) in the period following the spin-off for certain categories of firms.

We study a setting where, while management would like to increase equity value, incumbent firm management also derives private benefits from control. The firm has two divisions, and current management could have the same or differing abilities for managing these two divisions. Giving up control to a rival man-

agement team, while it can benefit equity holders (including the incumbent management) by increasing firm value, is costly to the incumbent in that it involves loss of control, and hence a reduction in the incumbent's control benefits. A spin-off increases the chance of loss of control to a potential rival in two ways. First, it increases the probability that passive investors will vote with the rival in a contest for the control of at least one division. In the joint firm, the incumbent's inferior ability (compared to the rival) in managing one division could be neutralized by superior ability in managing the other division. Second, it reduces the ability of the incumbent to use firm size strategically against the rival in a control contest. We will analyze the first effect of spin-offs in detail in our formal model, and will provide an intuitive discussion of the second effect in Section 3.3. Even though it is possible to introduce these two effects together in our model, we choose not to do so to minimize modelling complexity and to simplify the exposition.

This increased chance of loss of control following a spin-off, in turn, motivates the incumbent to make one of two possible choices. One alternative is to work harder in running the firm (even when doing so requires the incumbent to incur a personal cost of exerting effort) in an attempt to minimize the probability of losing control. The second alternative is to relinquish control of one of the two spun-off firms, either immediately following the spin-off to a division manager, or subsequently to a rival in a control contest. While the incumbent's choice between these two alternatives depends on the magnitude of his control benefits, his management ability relative to the division manager or potential rivals, and his personal cost of diligent effort, either of the above choices leads to an increase in the combined equity value of the two firms resulting from the spin-off.

Other rationales for the positive announcement effects of spin-offs are proposed in the literature. Aron (1991) argues that spin-offs benefit the firm since, after the spin-off, the equity values of the securities traded provide a much cleaner signal of managerial productivity than when the two divisions were part of a combined firm. The argument is that this enables the firm to provide better incentives for firm management based on the stock price of the individual firms. However, this argument requires the somewhat strong assumption that equivalent incentive contracts cannot be written based on the profitability of the individual divisions when they are part of a combined firm. Habib, Johnsen, and Naik (1997) argue that spin-offs

improve the quality of the information managers and uninformed investors can infer from the prices of the firm's traded securities, therefore leading to an increase in the expected price of the firm's equity. Nanda and Narayanan (1999) suggest that the firm may be undervalued if the market cannot observe the cash flows of each individual division in that firm. Therefore, the firm that needs external financing could resort to divestures such as spin-offs in order to raise capital at a fair market price after the divestiture. These information-based rationales, however, clearly do not incorporate the important role that corporate control contests seem to play in the efficiency improvements from spin-offs. Neither are they able to explain the longer-term performance and value gains from spin-offs.<sup>1</sup>

There is a large empirical literature on spin-offs. A number of studies show a positive equity market reaction to spin-off announcements (see, e.g., Hite and Owers, 1983; Miles and Rosenfeld, 1983; Schipper and Smith, 1983; and Allen et al., 1985). Krishnaswami and Subramaniam (1999) test the hypothesis that such positive market reactions to spin-offs are due to a reduction in the information asymmetry existing in the market for the equity of the parent firm. Two recent papers, Desai and Jain (1999) and Daley, Mehrotra, and Sivakumar (1997), show that both the market reaction to spin-off announcements and the long-term abnormal returns and operating performance are significantly greater in unrelated spin-offs (where the spun-off subsidiary operates in an industry unrelated to the parent firm) than in related spin-offs. Other studies show that the magnitude of the market reaction to spin-off announcements is increasing in the size of the spun-off division as a fraction of the combined firm existing prior to the spin-off. Our model explains much of the above evidence, while providing many other hypotheses, as yet untested, for further empirical work.

The rest of the paper is organized as follows. Section 2 describes the essential features of our model. Section 3 characterizes the equilibria of our model and develops results. Section 4 characterizes the announcement effects and the long-term stock and operating performance of firms following spin-offs. Section 5 characterizes the equilibrium-debt allocation between parent and subsidiary firms following spin-offs. Section 6 describes the testable implications of our model. Section 7 concludes. The proofs of all propositions

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<sup>1</sup> Chemmanur and John (1996) study the optimal financial and corporate structure chosen by an incumbent with access to multiple projects when the incumbent always wishes to maintain control. John (1993) develops another model of spin-offs. The literature on internal capital markets (e.g., Rajan, Servaes, and Zingales, 2000; Scharfstein and Stein, 2000) is also indirectly related to our paper.

are confined to the Appendix.

## 2. The model

The model has four dates ( $t = 0, 1, 2, 3$ ) and the following agents: the board, the incumbent, the division manager, the rival, and atomistic passive investors, all of whom are risk-neutral. Consider a firm with two divisions (division or firm 1, and division or firm 2, respectively, hereafter) initially set up by an entrepreneur (the incumbent management,  $I$ ) as an all-equity firm. (In Section 5, we relax this assumption and allow the joint firm to have debt as well as equity in its capital structure prior to the spin-off.) The incumbent invests all his wealth,  $W_I$ , in the equity of the firm and thus controls a fraction  $f$  of the firm's equity, with the remaining equity held by passive investors.

At time 0, the firm's board decides whether or not to spin off one of the divisions. The incumbent comes to know this decision privately from the board, based on which he decides on the level of effort to exert in managing the two divisions. The incumbent also decides whether to maintain control of both firms subsequent to the spin-off or to relinquish control of one firm to a division manager or executive in the joint firm (if a suitable division manager is available). At time 1, the decision to spin off (or not) is made public, along with the spin-off plan (in the case of a spin-off). The spin-off plan specifies the incumbent's equity holdings in the two new firms and the management in control of the two firms. Subsequent to the spin-off, shareholders in the original (joint) firm, including both the incumbent and passive investors, control the same fraction of equity in each firm resulting from the spin-off as they had in the joint firm. (In Section 5, where we study the equilibrium debt allocation in spin-offs, we also allow the incumbent to strategically allocate his wealth across the equity of the two firms resulting from the spin-off.) At time 2, a rival appears (with a certain probability) or does not appear. The rival invests his wealth strategically in the equity of one or both the firms resulting from the spin-off (or in the equity of the joint firm if there is no spin-off), in an attempt to take over control of the firm(s) from the incumbent (or the division manager, if the incumbent has relinquished control of the firm to her). If a rival has arrived at time 2, a proxy contest takes place at time 3, with the incumbent, the rival, and the passive investors voting in this control contest. The outcome

of the control contest becomes public immediately thereafter. The sequence of events described above is depicted in Fig. 1. For simplicity, we normalize the risk-free rate of return to zero.

### 2.1. The incumbent

The incumbent, who initially runs both divisions of the firm, obtains both security benefits and private benefits of control from the firm(s) under his management.<sup>2</sup> The security benefits arise from the cash flows accruing to the firm's equity held by the incumbent and are captured by the market value of this equity. Clearly, such security benefits accrue to all equity holders. In contrast, the control benefits, which are noncontractible, accrue only to the management team in control and are not reflected in the market value of any of the securities issued by the firm. We use  $F_I^i$ ,  $i \in \{1, 2, q\}$ , to denote the expected value of the security benefits accruing to the incumbent ( $I$ ) from firm 1 or firm 2 (in the case of a spin-off) or from the joint firm,  $q$  (when there is no spin-off). We use  $P_I^i$ ,  $i \in \{1, 2, q\}$ , to denote the expected value of the control benefits accruing to the incumbent;  $P_I^q = P_I^1 + P_I^2$ . We assume that  $P_I^1$  is large enough that the incumbent never wants to lose control of firm 1 in the case of a spin-off, or of the joint firm in the case where there is no spin-off.

The incumbent can exert two possible effort levels ( $e_i$ ) in firm  $i$ : normal ( $n_i$ ) or diligent ( $d_i$ ). If the incumbent works diligently, he can increase managerial efficiency, and thus the market value of the firm, in a manner we will characterize in detail later. However, the incumbent incurs a personal cost  $C(e_i)$  of exerting effort, with  $C(e_i)$  increasing in the level of effort. For simplicity, we assume  $C(e_i = n_i) = 0$ , i.e., the effort cost is zero when the incumbent works normally, and  $C(e_i = d_i) = c > 0$ , i.e., the effort cost is positive when the incumbent works diligently, where  $i \in \{1, 2\}$ .  $C(e_q) = C(e_1) + C(e_2)$ , i.e., the incumbent's effort costs are additive across the two divisions. We also assume that the incumbent's effort level is not observable to outsiders and is thus noncontractible.

In summary, the objective of the incumbent in making various choices after learning about the board's spin-off decision is to maximize the expected value of the sum of his long-term (time 3) control benefits and

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<sup>2</sup> This assumption has now become standard in the corporate control literature. See, for instance, Grossman and Hart (1988) or Harris and Raviv (1988).

security benefits, net of any effort costs incurred by him. In this objective function, the incumbent's private benefits are those which arise from the firms controlled by him, and his security benefits are the values of the equity held by him in firms 1 and 2 in the case of a spin-off and that in the joint firm  $q$  in absence of a spin-off. In any control contest, the incumbent will vote for that management team (the incumbent, the rival, or the division manager) which will maximize the above objective. We will characterize the incumbent's objective mathematically in the Appendix in the proofs of various propositions.

## 2.2. The rival

Before a rival appears, all other agents (the incumbent, the board, and passive investors) are uncertain about the existence of such a rival for control of the firm(s) set up by the incumbent. However, they observe a prior probability distribution about the rival. They believe that with probability  $\phi$ , a rival will appear, and with probability  $1 - \phi$ , no rival will appear.

The rival's objective in investing his wealth  $W_R$  in the equity of the firm(s) set up by the incumbent, and in determining whether to take over control and manage these firm(s) himself, is to maximize the sum of his personal private benefits. We assume that the rival does not have enough wealth to take over control of any firm after the spin-off merely by buying a majority equity stake in that firm, i.e.,  $W_R < \frac{1}{2} \text{Min}(n_1 v_1, n_2 v_2)$ , where  $n_1 v_1$  and  $n_2 v_2$  are the values of divisions 1 and 2 respectively when the incumbent manages these divisions, while exerting normal effort (we discuss firm valuation in detail in Section 2.4).<sup>3</sup> To keep our analysis simple, we assume that the rival has a constant effort level.<sup>4</sup> Since the investors get to know all the features of the rival immediately after his arrival and investors have rational expectations, the rival has to pay a fair market price for the equity bought from passive investors. This market price will depend, among other things, on the expected outcome of the control contest.

In summary, the rival's objective in deciding on the allocation of his own wealth between the equity of

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<sup>3</sup> The initial wealth  $W_I$  of the incumbent and the wealth  $W_R$  of the rival include any amount borrowed by these agents in addition to their personal wealth. Similar to several other papers in the corporate control literature (e.g., Harris and Raviv, 1988), we assume in the basic model that neither the incumbent nor the rival can borrow unlimited amounts on their personal account, or equivalently, that borrowing beyond a certain level will involve paying prohibitively high interest rates. However, we will relax the financial constraint on the rival to some extent in section 5.

<sup>4</sup> These assumptions, made to prevent the analysis from being unduly complicated, do not detract from the generality of our results, since the model can be generalized to allow the rival to have different effort levels as well.

the firm(s) set up by the incumbent is to maximize the expected value of his private benefits of control from all the firms that he succeeds in taking over in equilibrium. For concreteness, we assume that the rival's private benefits from any firm are similar in magnitude to those of the incumbent. Given his objective, the rival always votes for himself in any control contest.

### 2.3. The division manager

With some probability, a division manager who has the ability to manage division 2 better than the incumbent (if the incumbent exerts only normal effort) is available within the joint firm. At the time when the spin-off decision is made (time 0), the board and the incumbent know whether or not such a manager is available. However, before the public announcement of the spin-off (and the spin-off plan) at time 1, outsiders know only the prior probability  $\beta$  of the existence of such a division manager. For simplicity, we assume that the division manager has no wealth. Thus, after the spin-off, she owns no equity in either firm. We also assume that the division manager derives significant private benefits from managing the firm, so that the manager is willing to take over control of a firm if the position is offered.

### 2.4. Firm valuation

Initially, the firm is set up as an all-equity firm, so that the equity value equals the market value of the firm. In the case of a spin-off, the equity value of firm  $i$  under the incumbent's control,  $V_I^i$ ,  $i \in \{1, 2\}$ , is  $n_i v_i$  when the incumbent works normally, and is  $d_i v_i$  when the incumbent works diligently,  $d_i > n_i$ . On the other hand, in the case of no spin-off, the equity value of the joint firm is  $V_I^q = V_I^1 + V_I^2 + S$  under the incumbent's management, where  $S$  represents the operating synergy arising from the conglomeration of two divisions. Note that, through  $V_I^i$ ,  $V_I^q$  is also a function of the incumbent's effort. Here, we assume  $f(d_i - n_i)v_i < c$ , where  $i \in \{1, 2\}$ . This assumption implies that the incremental cost of effort to the incumbent if he works diligently is greater than the incremental security benefits derived from working diligently, so that the incumbent will not work diligently merely to pursue security benefits.

If firm  $i$  is taken over and managed by a rival, its equity value becomes  $h v_i$ . Thus, the equity value of the joint firm if it is taken over and managed by the rival is  $h(v_1 + v_2) + S$ . Further, if the incumbent relinquishes

control of firm  $i$  to the division manager so that it is managed by her, the firm value becomes  $lv_i$ .

We assume that when the incumbent works normally, the incumbent is a better manager than the rival or the division manager in firm 1, but worse than either in firm 2. Further, the rival has better management ability than the division manager. Thus,  $n_1 > h > l > n_2$ . We also assume that the management skill of the incumbent in division 1 is so superior to the rival that it makes up for the incumbent's inferior management skill in division 2 if the incumbent works normally, i.e.,  $n_1v_1 + n_2v_2 \geq h(v_1 + v_2)$ . This means that, in a joint firm, the incumbent would not face any challenge in a control contest, and thus would not be motivated to work diligently in managing either division. Finally, we assume that the synergy between the two divisions in a joint firm is positive but small,  $S < [Max(l, d_2) - n_2]v_2$ , so that any increase in the efficiency with which the firm is managed (over the efficiency level corresponding to the incumbent's normal effort) would exceed the value of this synergy. (We will, however, relax this assumption in Section 3.3.)

### 2.5. The board

The board's objective in choosing whether or not to spin off a division is to maximize the combined firm's long-term (i.e., time 3) equity value (i.e., the equity value of the joint firm in the absence of a spin-off, or the sum of the equity values of the two spun-off firms in the event of a spin-off).<sup>5</sup> We assume that asymmetric information exists between the board and the equity market about the total amount of the incumbent's wealth ( $W_I$ ). More specifically, while the board (as well as the incumbent) knows the exact amount of  $W_I$  before the announcement of a spin-off, the market observes only the prior probability distribution over the incumbent's wealth. At this date, with probability  $\gamma$ , the market believes that the wealth is large and equal to  $W_H$ . With probability  $1 - \gamma$ , it believes that the wealth is small and equal to  $W_L$ .

We use the above assumption of asymmetric information about the incumbent's wealth to capture the notion that the equity market has less information compared to the board regarding the ability of the

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<sup>5</sup> We recognize that, in many cases, the board's decision regarding whether or not to spin off a division could be partially influenced by the CEO and the other members of the incumbent management team. This means that the board's action may not be solely driven by considerations of equity value maximization. Our results go through even in this case: all we require here is that the board places more weight on equity value maximization than the incumbent. Consistent with this, in practice, many spin-off decisions are made at the urging of independent board members, institutional investors, or other large shareholders who are concerned about increasing the joint firm's share price.

incumbent to prevail in a control contest. For example, a considerable number of the passive investors could be totally committed to voting for the incumbent regardless of management ability. Thus, the incumbent's wealth  $W_I$  in our model can be thought of as including not only the personal wealth of the incumbent, but also the collective wealth of such passive investors who are committed to voting for the incumbent (e.g., personal friends of the members of the current management team, and those tied to the members of the team through their financial or business interests outside the firm). Therefore, even when the direct personal wealth of the incumbent is known to the market, the board could have private information about the extent of equity held by the incumbent's committed supporters, resulting in the asymmetric information about  $W_I$  between the board and the equity market. Further, we do not require that the asymmetric information between the board and the market necessarily be about the incumbent's wealth; the key assumption we require is that the board has better information relative to the equity market regarding some variable which affects either the incumbent's incentive to resist takeover by a rival or his ability to prevail in a control contest against such a rival. Examples of two such variables which affect the incumbent's incentive to resist a takeover are the extent of the incumbent's private benefits from maintaining control (of one or both firms) and his incremental cost of working diligently. In contrast, the wealth level of the incumbent is a variable which affects the ability of the incumbent to prevail in the control contest. While, in practice, the board could have better information than the market regarding some, or all, of these variables, we choose to assume asymmetric information about the incumbent's wealth alone to maintain analytical simplicity.

We also assume  $W_H > \frac{1}{2}(n_1v_1 + n_2v_2)$ , and  $W_L < \frac{1}{2}Min(n_1v_1, n_2v_2)$ . These assumptions imply that, when the incumbent's wealth is large, the incumbent can maintain control of both firms by relying only on the voting power of the equity in a personal account. On the other hand, when his wealth is small, the incumbent will not be able to ensure control of any firm in the above manner, so that the incumbent has to rely at least partially on the passive investors' votes to maintain control.

## 2.6. *Passive investors and the control contest*

In the control contest, all shareholders vote regarding the identity of the management team (incumbent

or division manager versus rival) which should manage the firm whose control is contested. The management team which obtains a majority of votes from a combination of their own equity holding in the firm and passive investors' votes wins control of the firm. We now characterize the voting behavior of passive investors in the contest. We assume that in a control contest for the  $i^{th}$  firm, where  $i \in \{1, 2, q\}$ , all the passive investors vote for the better manager. Thus, given our earlier assumption that  $n_1 > h > l > n_2$ , the incumbent exerting normal effort will obtain zero votes from passive investors against a rival in firm 2. In contrast, in firm 1, the incumbent exerting even normal effort will obtain all of the passive investors' votes against the rival. In the case where the division manager is in control of firm 2 at the time of the control contest, the rival will obtain all the votes from both the passive investors and the incumbent in the control contest, since the rival is better at managing firm 2 than the division manager ( $h > l$ ).

### 3. Equilibrium

In this section, we discuss the trade-offs facing the various agents and the resulting equilibrium outcomes when the incumbent's wealth is small (so that  $W_I = W_L$ ) and a division manager capable of managing firm 2 better than the incumbent (exerting normal effort) is available. In order to arrive at these, we begin with the analysis of the model backwards, starting from the rival's problem and the incumbent's problem, followed by the board's problem. We will briefly discuss the equilibrium outcomes when the incumbent's wealth is large ( $W_I = W_H$ ), or when there is no suitable division manager available, in Section 3.3.

#### 3.1. Analysis of the model

At time 2, given a spin-off, the rival determines whether or not to acquire one firm, and if the rival decides to do so, which firm to acquire. Note that since the rival always has to pay the fair share price in the equity market, his security transactions are zero net present value transactions. Therefore, acquiring a firm is always beneficial for the rival since it generates private benefits from controlling that firm without incurring any additional costs. When the rival is financially constrained, the rival has to rely on passive investors' votes to take over control of any firm. Therefore, given the voting behavior of passive investors discussed before, and given that  $n_1 > h > l > n_2$ , the rival can never win control of firm 1 after a spin-off,

but can win control of firm 2 if it is managed by the incumbent working normally or by the division manager. In other words, firm 2 is more vulnerable to a takeover by the rival than firm 1, and consequently, the rival invests his wealth in the equity of firm 2 in an attempt to take over control of that firm.

Between time 0 and time 1, after privately knowing the board's decision to spin off, the incumbent maximizes his objective, given his beliefs about the outcome of the control contest that will take place at time 3. The incumbent has two choices to make: (1) whether to relinquish control of firm 2 to a division manager immediately after the spin-off; and (2) if he chooses not to relinquish control of firm 2, the level of effort he should exert in managing each firm. Note that the incumbent is never willing to relinquish control of firm 1 to the division manager, given that the magnitude of his control benefits from that firm is large and given that he is a better manager of firm 1 than a division manager ( $n_1 > l$ ). Further, the incumbent can always retain control of firm 1 against a rival, since the incumbent is a superior manager in managing firm 1 compared to the rival even when working normally ( $n_1 > h$ ). In the following, we will discuss the trade-offs driving the above two choices.

If the incumbent chooses to retain control of firm 2 (together with control of firm 1), then the incumbent enjoys private benefits from controlling firm 2 with a certain probability. This probability depends on whether or not a rival appears at time 2 and whether or not the incumbent's diligent effort is enough to win votes from passive investors. On the other hand, if the incumbent chooses to relinquish control of firm 2 to the division manager, the incumbent loses his private benefits from controlling firm 2 with probability 1, but his security benefits (i.e., the value of his equity holding) in firm 2 would increase, since, in this case, firm 2 would be managed by a better management team. Thus, the incumbent's choice on whether or not to relinquish control of firm 2 immediately after the spin-off depends on the trade-off between his private benefits from controlling firm 2 and increases in his security benefits from increases in the value of equity he holds in firm 2.

Of course, if the incumbent relinquishes control of firm 2 immediately following the spin-off, he need not be concerned about his effort choice in firm 2. However, if the incumbent chooses not to relinquish control of firm 2, the incumbent must decide on his effort level in firm 2. In this case, there are two possibilities.

First consider the case where the incumbent is a worse manager for firm 2 compared to the rival even after exerting diligent effort, i.e.,  $d_2 < h$ . In this case the incumbent would choose to work normally and would not win the control contest. Recall that the incumbent has to rely on passive investors' votes to maintain control. The second possibility is that the incumbent can be better at managing firm 2 than the rival by working diligently, i.e.,  $d_2 > h$ . In this case, the incumbent will consider working diligently in order to win all the votes from passive investors and defeat the rival in the control contest. By doing so, the incumbent enjoys the private benefits from controlling firm 2, but would incur a personal cost of working diligently. Thus, the incumbent's decision regarding whether or not to work diligently depends on the trade-off between the private benefits from controlling firm 2 and the cost of working diligently in firm 2.

At time 0, the board chooses whether or not to spin off one division by comparing the cost and the benefit associated with the spin-off to shareholders in terms of long-term equity value. The cost of the spin-off is the loss of operating synergies. The benefit of the spin-off is the potential increase in the long-term value of the combined firm's equity. This potential value increase results from the increased threat of a takeover that follows a spin-off. In particular, facing a credible takeover threat, the incumbent can make one of two possible choices: (1) he may be motivated to work harder to win the support of passive investors in a control contest in order to maintain control of the firms currently managed by him (the discipline effect); or (2) he may give up control of firm 2 to a superior manager (the change of control effect) either by relinquishing control at the time of the spin-off to a division manager, or by giving up control subsequently to a rival in a control contest. Both effects increase the market value of the firms resulting from the spin-off, thus increasing the combined equity values of these firms as well.

A spin-off can help to increase the takeover pressure on the incumbent, since it enables passive investors to vote with the rival in a contest for control of firm 2. In a joint firm, the incumbent can compensate for his inferior management ability in one division (division 2) through his superior management ability in the other division (division 1). But when the two divisions in the joint firm are separated in a spin-off, the spun-off firm where the incumbent has inferior management ability is more vulnerable to a takeover. Thus, when the board realizes that the extent of takeover pressure (which can mitigate the incumbent's opportunistic

behavior) is not strong enough in the case of a joint firm, it will choose to restructure the firm through a spin-off, provided that the loss of synergies from breaking up the joint firm is smaller than the above gain in firm value arising from a spin-off.

### *3.2. Equilibrium financial structure*

The definition of equilibrium we use is based on the Perfect Bayesian Equilibrium (PBE) concept, first formally defined for dynamic games with incomplete information by Fudenberg and Tirole (1991). In equilibrium: (1) the corporate structure (joint firm or spin-off) chosen by the board at time 0 maximizes the expected value of the combined long-term equity value (time 3), of the firm(s) created as a result of this decision; (2) the effort level chosen by the incumbent, and his decision regarding whether or not to relinquish control to a division manager, maximize his objective; (3) the investments made by the rival in the equity of the firm(s) set up by the incumbent maximize his objective; and (4) the market value of the equity in the firms set up by the incumbent rationally incorporates all the information publicly available (e.g., the beliefs about the incumbent's wealth, the arrival of the rival, the effort level of the incumbent, etc.) at various points in time and also incorporates shareholders' equilibrium inference about the behavior of various agents and the outcome of the control contest.

We will characterize below three different equilibrium outcomes that arise in our model and the situations in which they arise. In the first equilibrium, the incumbent relinquishes control of one firm to the division manager, who later loses control of the firm to a rival when the rival appears. In the second equilibrium, the incumbent chooses not to relinquish control of any firm to the division manager, but loses control of one firm to a rival when the rival appears. In the third equilibrium, the incumbent chooses not to relinquish control of any firm to the division manager, and continues to maintain control of both firms even if a rival appears, by winning the control contest. Wruck and Wruck (2002) show that, in a majority (56.4%) of spin-offs, a division head or other executive of the parent (joint) firm assumes the top management position of the spun-off firm. This is consistent with the first equilibrium we discuss below. Wruck and Wruck (2002) also show that, in a minority (33.7%) of spin-offs, the top management of the parent firm (defined as the chairman, or

CEO, or both) continues to be part of the top management of the spun-off firm. This is consistent with the second and third equilibria characterized below.

In characterizing each equilibrium below, we will discuss the spin-off decision taken by the board (i.e., spin-off or no spin-off), the incumbent's choice of effort level, his choice regarding whether or not to relinquish control of firm 2 to the division manager, and the outcome of the control contest (if a rival appears at time 2). Clearly, if a rival does not appear at time 2, there is no control contest.

**Proposition 1. Spin-off where the incumbent relinquishes control of firm 2.** *Let the private benefits that the incumbent can enjoy from division (firm) 2 be small, such that  $P_1^2 < \underline{p}$ . Then, the equilibrium behavior of various agents is as follows:*<sup>6</sup>

- (i) *The board chooses to spin off firm 2.*
- (ii) *The incumbent chooses to maintain control of firm 1 following the spin-off and work normally in managing that firm. The incumbent relinquishes control of firm 2 to the division manager.*
- (iii) *If a rival appears subsequent to the spin-off, the incumbent invests all his wealth in the equity of firm 2, and a control contest takes place for that firm. In the control contest, both the passive investors and the incumbent vote for the rival so that the rival wins control of firm 2. If a rival does not appear, the incumbent and division manager maintain control of firm 1 and firm 2, respectively.*

In this equilibrium, the board chooses to spin off one division since the takeover pressure on the incumbent when he manages the joint firm is not enough to motivate him to work diligently. Before the spin-off, the incumbent's superior management skill in managing firm 1 neutralizes his inferior management skill in managing firm 2. As a result, the incumbent is a better manager at managing the joint firm compared to the rival and maintains control of the joint firm even if he works normally. However, after a spin-off, the incumbent's inferior management skill in firm 2 would be exposed to the market, and a better management team will have the opportunity to take over firm 2. Therefore, the board chooses to spin off one division, since doing so will increase the takeover pressure on the incumbent.

Given the spin-off decision, the incumbent will choose to relinquish control of firm 2 to the division manager and retain control of only firm 1, if a division manager with suitable management ability is available to manage firm 2. By doing so, the incumbent loses the private benefits that he could have enjoyed from managing firm 2, but enjoys an increase in his security benefits arising from the increase in the value of the

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<sup>6</sup> The threshold value  $\underline{p}$  of the incumbent's private benefits, as well as those of other parameter values in various propositions, are characterized in the Appendix.

equity he holds in firm 2 under the superior management of the division manager. Further, if the incumbent were to retain control of firm 2 after the spin-off, the incumbent would have to incur the personal cost of working diligently, in order to obtain passive investors' votes and thereby prevail in future control contests for firm 2. Thus, when the incumbent's private benefits from controlling firm 2 are small, this trade-off induces the incumbent to relinquish control of firm 2 to the division manager. After the spin-off, if a rival appears at time 2, a control contest for firm 2 takes place. Since the rival is better at managing firm 2 compared to the division manager, both the incumbent and passive investors vote for the rival in this control contest, so that the rival succeeds in taking over control of firm 2.

Note that it is better for the incumbent to give up control of firm 2 to the division manager at the time of the spin-off rather than relinquishing control to a rival in a subsequent control contest, even if the rival has better management ability for firm 2 than the division manager. By letting the division manager take control of firm 2 at the time of the spin-off, the incumbent enjoys an increase in his security benefits arising from the better management skills of the division manager, which he would otherwise not obtain in the scenario where no rival appears. The spin-off increases the combined value of firm 1 and firm 2 in this equilibrium. This increase in value arises from the change of control from the incumbent to the more able division manager at the time of the spin-off, and subsequently, from the division manager to a rival with even better ability for managing firm 2 (if such a rival appears).

We now study the situation where the incumbent's private benefits from managing firm 2 are large enough that the incumbent prefers to maintain control of firm 2 even after the spin-off. There are two possible scenarios in this situation. Proposition 2 characterizes the scenario where, even though the incumbent maintains control of both firms at the time of the spin-off, the incumbent subsequently loses control to a rival with better management ability through a takeover. Proposition 3, on the other hand, characterizes the scenario where the incumbent chooses to maintain control of both firms after the spin-off, and is able to continue in control even if a rival appears, by defeating the rival in the control contest.

**Proposition 2. Spin-off where the incumbent maintains control of both firms.** *Let the private benefits that the incumbent can enjoy from division (firm) 2 be large, such that  $P_I^2 \geq \underline{p}$ . Then, if the incumbent, working diligently, is poorer at managing firm 2 than the rival, the equilibrium behavior of various*

agents is as follows:

- (i) The board chooses to spin off division 2.
- (ii) The incumbent maintains control of both firms following the spin-off and works normally in managing both firms.
- (iii) If a rival appears subsequent to the spin-off, the rival invests all his wealth in the equity of firm 2, and a control contest takes place for that firm. In the control contest, all the passive investors vote for the rival, so that the rival wins control of firm 2. If no rival appears, the incumbent maintains control of both firms.

In this equilibrium, the board chooses to spin off one division since it knows that, after the spin-off, the rival (with better management ability than the incumbent) will be able to take over firm 2, even in a situation where such a rival would be unable to take over the joint firm. Given the large private benefits from controlling firm 2, the incumbent prefers to retain control of both firms after the spin-off, rather than relinquishing control of firm 2 to a division manager at the time of the spin-off, or losing control to a rival in a subsequent control contest. However, the incumbent has no ability to resist a takeover of firm 2 if a rival for control appears subsequent to the spin-off. Since the incumbent is worse at managing firm 2 compared to the rival even if he works diligently, the incumbent loses the control contest for that firm. The incumbent therefore exerts only normal effort in managing both firms subsequent to the spin-off. The spin-off is nevertheless value-increasing in this equilibrium. The increase in firm value arises from the increase in the probability of a change in control from the incumbent to the rival that results from the spin-off.

**Proposition 3. Spin-off followed by no take-over.** *Let the private benefits that the incumbent enjoys from division (firm) 2 be large, such that  $P_I^2 \geq \bar{p}$ . Then, if the incumbent, working diligently, is better at managing firm 2 than the rival, the equilibrium behavior of various agents is as follows:*

- (1) The board chooses to spin off firm 2.
- (2) The incumbent maintains control of both firms following the spin-off. He works normally in managing firm 1, and diligently in managing firm 2.
- (3) If a rival appears subsequent to the spin-off, the rival invests all his wealth in the equity of firm 2, and a control contest takes place for that firm.<sup>7</sup> In the control contest, all the passive investors vote for the incumbent, so that the incumbent maintains control of firm 2. The incumbent therefore maintains control of both firms regardless of the appearance of the rival.

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<sup>7</sup> Given that a takeover attempt is costless to him, the rival is indifferent between mounting a takeover attempt and not doing so, even when he is aware that he is unlikely to prevail.

In this equilibrium, the board decides to spin off one division, since, after the spin-off, the incumbent will face greater takeover pressure in firm 2 and will be motivated to work diligently in managing that firm. Given the spin-off, the incumbent prefers to resist a takeover and retain control of both firms, in order to enjoy his large private benefits from controlling these firms. The incumbent has the ability to do so, since, if the incumbent works diligently in managing firm 2, the incumbent is a better manager than the rival, and thus can win support from all passive investors in a future control contest. However, by working diligently in firm 2, the incumbent has to incur a larger personal cost of effort compared to the case where he works normally. When the incumbent's private benefits are large, or the cost of his exerting diligent effort is small, the private benefits from controlling firm 2 exceed the personal cost of working diligently, so that the incumbent does so and maintains control of both firms.<sup>8</sup> Note that, even though the incumbent continues to maintain control of both firms after the spin-off in this equilibrium, the spin-off is value-increasing, since it has a disciplining effect on incumbent firm management.

### *3.3 Other equilibrium scenarios*

In the above, we have characterized three equilibrium scenarios with important implications for corporate spin-offs. However, there are several other interesting equilibrium scenarios in our setting. While, due to space limitation, we will not characterize these scenarios in detail here, we will provide brief and intuitive discussions of each of these scenarios below, with some characterization of the situations under which they arise. Explicit characterizations of each of these equilibrium scenarios, with detailed analyses of the situations in which they occur, are presented in Chemmanur and Yan (2001).

#### *3.3.1 Spin-off versus no spin-off*

In the above three equilibria, the board decides to spin off one division of the joint firm, since the synergy between the two divisions is small (i.e., the additional cash flows arising from operating these two divisions under a joint corporate umbrella is small), and further, the takeover pressure on the incumbent when he

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<sup>8</sup> Our assumption here is that the incumbent's effort level, once chosen, remains unchanged, even in the absence of a rival appearing at time 2. This is realistic, since, in practice, the incumbent would face the takeover threat into the indefinite future, so that any reduction in his effort level would again make him more vulnerable to a takeover.

manages the joint firm is not enough to motivate the incumbent to work diligently. However, if we relax our assumptions regarding the magnitude of the synergy between the two divisions, and (or) the lack of takeover pressure discussed above, an equilibrium arises where the board chooses not to spin off any division. There are two important trade-offs driving the board's decision regarding whether or not to spin off a division. First, the spin-off decision made by the board is partially determined by the trade-off between the immediate loss of synergy to the firm versus the potential increase in the firm's long-term equity value. Thus, the board will choose not to spin-off if the operating synergy is large. Second, the board's spin-off decision is also determined by whether the market for corporate control imposes enough takeover pressure on the joint firm. Therefore, if the takeover pressure on the joint firm is sufficient to either force the incumbent to work diligently or induce an actual takeover, then it is unnecessary for the board to spin off one division, and again there will be no spin-off. Such heightened takeover pressure on the joint firm will exist, for instance, when the incumbent's superior management ability in division 1 is not sufficient to make up for his inferior management ability in division 2, i.e., when  $n_1v_1 + n_2v_2 < h(v_1 + v_2)$ .

### 3.3.2. *Friendly versus hostile takeovers*

In the following, we define a friendly takeover as one where the incumbent does not wish to resist the rival taking over control, and therefore votes for the rival in the control contest. In contrast, a hostile takeover is one where the incumbent resists the rival's takeover attempt, and votes for himself in the control contest. While it is possible to characterize each situation where a takeover occurs in our setting as friendly or hostile (depending on model parameters), we will not do so for the sake of brevity. However, for illustrative purposes, we discuss below the conditions under which the takeover in proposition 2 (if a rival appears) is either hostile or friendly.

When the private benefits to the incumbent from controlling firm 2 are large, so that  $P_I^2 \geq f(h - n_2)v_2$ , the incumbent would like to maintain control of firm 2 and enjoy private benefits from controlling that firm. The incumbent therefore votes for himself in the control contest for that firm. However, if the incumbent's management ability is worse than that of the rival (even when the incumbent works diligently), the incumbent

does not win any votes from passive investors, and thus will lose control of firm 2 in a hostile takeover. On the other hand, when the private benefits to the incumbent from controlling firm 2 are small such that  $P_I^2 < f(h - n_2)v_2$ , losing his private benefits from firm 2 is not prohibitively costly to the incumbent. In this case, the incumbent chooses to relinquish control of firm 2 to the rival and enjoy the increase in his security benefits arising from the increase in that firm's value under the rival's management. As a result, the incumbent votes for the rival in this case, so that the takeover by the rival is friendly.

### 3.3.3. *Related and unrelated spin-offs*

In the equilibria characterized above, spin-offs occur when the two divisions of the joint firm are operating in unrelated businesses, and thus the incumbent's management abilities in these two divisions are significantly different from each other. However, spin-offs can arise in our setting even when the incumbent's management ability across divisions in the joint firm are similar (i.e., even when both divisions of the firm are operating in the same or related industries). To see intuitively how this can occur, consider a generalized version of our control contest where the better management team (incumbent or rival) wins a majority of votes (and not all the votes, as assumed for analytical simplicity in our analysis above). In this case, spinning off division 2 can increase the takeover pressure on the incumbent even when his management abilities across the two divisions are the same. This happens because, in the joint firm, the incumbent can use firm size strategically to maintain control in a contest against a rival even when the rival has better management ability, provided that the rival is financially constrained and therefore unable to acquire a large enough equity stake in the joint firm. Consequently, the incumbent is able to combine the votes obtained by virtue of his equity stake in the firm with the votes obtained from (a minority of) passive investors to defeat the rival in the contest for control of the joint firm. In contrast, after a spin-off, the same rival could wrest control of one of the spun-off firms from the incumbent. By investing his wealth in the equity of one of these two spun-off firms, the rival can acquire a larger equity stake than that he can acquire in the joint firm, and thereby prevail in the control contest. In other words, a spin-off increases the takeover pressure on the incumbent even when his management abilities are similar across the divisions of the joint firm. The board will therefore choose to

spin off one division even when both divisions of the firm are operating in related industries, provided that the potential value increase from this increased takeover pressure outweighs the cost of a spin-off, namely, the loss of operating synergies.

#### *3.3.4. The case where the incumbent's wealth is large*

In the above analysis, we have characterized the equilibrium financial structure in the case where the incumbent's wealth is small. We now discuss the equilibrium when the incumbent's wealth is large ( $W = W_H$ ). When the incumbent's wealth is large, a change of control happens only if the incumbent is willing to relinquish control of a firm to a division manager or a rival, since, in this case, the incumbent can maintain control of firm 2 simply by acquiring a majority of equity in firm 2 (i.e., without relying on any votes from passive investors). Therefore, two possible scenarios emerge here, depending on whether or not the incumbent's private benefits are large or small. If the incumbent's private benefits from firm 2 are large, so that any increase in his security benefits from firm 2 under a rival with better management ability is significantly smaller than these private benefits, there will be no spin-off. This is because the board realizes that a spin-off would only reduce firm value, since the operating synergies between the two firm divisions will be lost, without any increase in the takeover pressure on the incumbent. On the other hand, when the incumbent's private benefits from firm 2 are small, the board would spin off firm 2, knowing that this would lead to an increase in combined equity value, due to the incumbent relinquishing control of firm 2 either to a division manager at the time of the spin-off, or to a rival with better management ability in a subsequent control contest.

#### *3.3.5. The case where no suitable division manager is available*

If no suitable division manager (with management ability for firm 2 superior to the incumbent) is available, the incumbent is unable to relinquish control of firm 2 to a division manager at the time of the spin-off. In this case, the equilibrium is somewhat similar to those characterized in propositions 2 and 3, where the incumbent maintains control of firm 2 even when a division manager is available. In particular, here also, when the incumbent's private benefits from controlling firm 2 are large relative to the potential increase in his

security benefits under the rival's management, or when the cost of working diligently is small, the incumbent chooses to work diligently and resist a potential takeover. The difference here is that the incumbent maintains control of both firms following the spin-off even when his private benefits are small, or his cost of diligent effort is large, since there is no division manager available to take control of firm 2 at this time. In this case, the incumbent chooses to work normally in managing both firms under his control. If a rival for control of firm 2 appears subsequent to the spin-off, the incumbent gives up control of firm 2 to that rival in the control contest.

#### 4. Market reaction to the spin-off decision

In this section, we will investigate the impact of a spin-off on the equity market value of the joint firm. We will first study the announcement effect of a spin-off and then go on to study the impact of a spin-off on the long-term equity value of the joint firm and the operating performance of the two firms resulting from a spin-off. In the following discussion, we refer to firm 1 as the parent firm after the spin-off and firm 2 as the subsidiary.

##### 4.1. Stock returns upon spin-off announcements

We define the announcement effect of a spin-off as the abnormal stock return to an investor who buys the joint firm's stock on the day before the spin-off announcement and sells it right after the announcement.

#### **Proposition 4. Announcement effect.**

- (i) *When the incumbent can derive either large private benefits from controlling firm 2 ( $P_I^2 \geq \bar{p}$ ) or when the incumbent relinquishes control of one firm to a division manager following the spin-off, the announcement of a spin-off results in a positive announcement effect for the joint firm.*
- (ii) *When the incumbent can derive large private benefits from controlling firm 2 ( $P_I^2 \geq \bar{p}$ ), the magnitude of the above announcement effect is increasing in the potential rival's ability and in the probability of the rival's arrival.*
- (iii) *When the incumbent relinquishes control of one firm to a division manager at the time of the spin-off, the magnitude of the announcement effect is increasing in the division manager's ability.*
- (iv) *Keeping joint firm size constant, the magnitude of the announcement effect is increasing in the difference in the incumbent's management abilities across the two divisions,  $n_1 - n_2$ .*
- (v) *Keeping the joint firm's size constant, the announcement effect is increasing in the size of the subsidiary (firm 2) as a fraction of the size of the joint firm.*

In discussing the intuition underlying the above proposition, we first discuss the case where the incumbent's private benefits of control are large, and then the case where these private benefits are small. When the incumbent's private benefits of control are large, the board takes different corporate structuring decisions depending on the incumbent's ability to resist a potential takeover. In particular, when the incumbent's wealth is large, the board chooses not to spin-off. When the incumbent's wealth is small, the board chooses to spin-off. Since the market is uncertain about the wealth of the incumbent, before time 0, it values the firm by incorporating the average outcome across these two cases. Then, when a spin-off is announced, outside equity investors can infer that the incumbent is of small wealth. They therefore adjust their valuation of the firm upward since they expect that, after the spin-off, the resulting firms would be managed better (either due to the disciplining effect of the spin-off on existing management, or because of the greater chance of a subsequent change of control to a better management team), resulting in a positive announcement effect.

When the incumbent's private benefits of control are small, he chooses to relinquish control of a firm to a capable division manager upon spin-off, if such a division manager is available. Recall that the market is uncertain about the availability of such a division manager before the spin-off. Thus, when outside investors observe a change of control of firm 2 from the incumbent to the division manager, they expect the value of firm's future cash flows to increase, since they become aware that at least one division of the original joint firm, namely, firm 2, will be managed better (by the division manager) compared to the scenario where it is managed by the incumbent. In addition, they also expect a change of control of firm 2 from the division manager to a rival to occur (should such a rival appear at a later date). Both effects together lead to the positive announcement effect following the spin-off in this case.

Part (ii) and (iii) state that the size of the announcement effect is increasing in the probability of the existence of a better management team (which can be either the rival or the division manager), and the management ability of such a team. This is because, when a better management team is more likely to exist, so that a change of control effect is more likely to occur. Further, if the ability of this new management team is greater, the magnitude of the value increase due to a change of control will be greater. Both these effects result in a larger announcement effect. Part (iv) implies that if the two divisions in a joint firm are

more unrelated, so that the incumbent's management abilities across these two divisions are more lopsided, the announcement effect is greater. Recall that, after a spin-off, firm 1 (the parent) is managed by the incumbent exerting the same effort (i.e., his normal effort) as that exerted in managing the joint firm before the spin-off, and firm 2 (the subsidiary) is managed better since it is managed by a division manager, a rival, or the incumbent but with diligent effort). Thus, if the difference in the incumbent's abilities across the two divisions is greater, the increase in the effectiveness with which the subsidiary is managed after the spin-off is greater, which leads to a greater announcement effect. Finally, part (v) states that the announcement effect is positively related to the size of the subsidiary relative to that of the joint firm, since both the discipline effect and the change of control effect affect only the value of the subsidiary, and are therefore increasing in its size.

#### *4.2. Long-term equity value and operating performance changes following spin-offs*

We now characterize the impact of a spin-off on the long-term equity value and the operating performance of a firm. For the purposes of measuring long-term equity value changes, we take the equity value of the joint firm right after the spin-off is announced as the base (time 1 in our model), and compare it to the combined equity value (of firm 1 and firm 2) prevailing at time 3. In other words, consistent with the empirical literature, we define long-term equity value changes as those occurring subsequent to the changes in equity value associated with the spin-off announcement.

#### **Proposition 5. Long-term equity value changes.**

- (i) There is a long-term increase in the combined equity value, provided that any one of the two firms resulting from the spin-off experiences a takeover.*
- (ii) If neither firm resulting from a spin-off experiences a takeover, the long-term changes in the combined equity value are nonpositive (i.e., zero or negative).*
- (iii) Keeping joint firm size constant, the magnitude of long-term equity value changes is increasing in the difference in the incumbent's management abilities across the two divisions, provided that any one of the two firms resulting from the spin-off experiences a takeover.*

The change in the long-term equity value following a spin-off arises from the uncertainty of the equity market about the arrival of a rival. Because of this uncertainty, the announcement effect only incorporates noisy information regarding the rival, which is reflected in the firm's equity value. After the spin-off, however,

the market receives additional information which enables it to assess the firm's future value more accurately. In particular, a takeover conveys an important piece of information by signaling the arrival of the rival and the success of the acquisition. Since the rival can succeed in taking over a firm only if his management ability is superior to that of the incumbent and the division manager, the rival will enhance the firm's value when a takeover occurs. Thus, the equity market responds positively to those firms experiencing a takeover. On the other hand, the market responds negatively or has a neutral response to those firms not experiencing a takeover, since the absence of a takeover arises from either the absence of a rival (leading to a negative long-term value change) or from the incumbent working hard and thereby successfully maintaining control of both firms against the rival (leading to a zero long-term value change). Part (iii) implies that the long-term increase in the combined equity value of firms resulting from a spin-off is greater when the incumbent's management abilities across the two divisions are more lopsided. The intuition here is similar to that deriving the relation between the magnitude of the announcement effect and the incumbent's management ability across the two divisions, discussed earlier.

Under the conditions characterized in proposition 4, spin-offs also lead to a long-term increase in the operating performance of a firm (on average), regardless of whether or not the firm experiences a takeover. The intuition underlying this result is somewhat similar to that underlying the positive announcement effect of spin-offs: Such an increase in average operating performance arises from a combination of the discipline effect (which improves the performance of firms even when the incumbent continues to maintain control after the spin-off) and the change of control effect (which improves the performance of firms when either the incumbent relinquishes control to a division manager at the time of the spin-off, or loses control subsequent to the spin-off through a takeover by a rival).

## **5. Debt allocation in spin-offs**

In this section, we will study the allocation of the joint firm's outstanding debt between the two firms resulting from a spin-off. In order to do so, we relax three of our assumptions from previous sections. First, in the previous sections, we assumed that the joint firm is set up as an all-equity firm. Instead, we now allow

the joint firm to have debt in its capital structure prior to the spin-off, and analyze how this debt is allocated in the event of a spin-off. Second, unlike in previous sections, we allow for the incumbent to strategically allocate his wealth  $W_I$  between the two firms resulting from a spin-off. The incumbent makes the above two allocation decisions along with the other two decisions analyzed before, namely, his effort level and whether or not to relinquish control of firm 2. The capital structures of the two spun-off firms subsequent to the spin-off (which result from the debt allocation), and the equity that will be controlled by the incumbent in the two firms are announced in the spin-off plan at time 1, together with the announcement of the spin-off itself. Third, we relax our assumption that the rival is financially constrained. Instead, we now allow (in the analysis of proposition 6) the rival to have enough financial capacity to take over one of the firms resulting from a spin-off simply by acquiring a majority of the outstanding equity in that firm. However, as in previous sections, we continue to assume throughout that the rival does not have enough wealth to acquire a majority of the equity in the joint firm. All other assumptions in this section remain the same as those in previous sections.

Let  $D$  be the market value of the debt outstanding in the joint firm prior to the spin-off.<sup>9</sup> The debt does not mature before time 3, and for simplicity, we allow no additional debt to be issued at the time of the spin-off. Thus, at time 0, the equity value of the joint firm will be the total firm value minus the value of the outstanding debt,  $D$ . Further, denote by  $D_1$  and  $D_2$ , the market values of debt allocated to firms 1 and 2, respectively, at the time of the spin-off:  $D_1 + D_2 = D$ . If the incumbent relinquishes control of firm 2 to a division manager and works normally in managing firm 1, the equity values of firms 1 and 2 will be  $n_1v_1 - D_1$ , and  $lv_2 - D_2$ , respectively. If, however, both firms are still managed by the incumbent with normal effort, the equity values of these two firms will be  $n_1v_1 - D_1$ , and  $n_2v_2 - D_2$ , respectively

Having debt issued against any firm controlled by him is costly to the incumbent. We assume that the expected value of the incumbent's private benefits from controlling any firm is decreasing in the market value of the debt against that firm. This can arise from the reduction in managerial discretion due to the restrictiveness of additional debt covenants, the increase in the intensity of monitoring, the increase in the

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<sup>9</sup> For analytical simplicity, we characterize the debt allocation in terms of market values rather than face values.

probability of bankruptcy, and the decrease in the amount of free cash flow, which accompany a higher level of debt. We use  $P_I^i(D_i)$ ,  $i \in \{1, 2\}$ , to denote the expected value of the control benefits accruing to the management from a firm  $i$  which is supporting an amount of debt  $D_i$  against its cash flows;  $\frac{\partial P_I^i(D_i)}{\partial D_i} < 0$ .

It is useful to note that, in our setting, debt allocation has no effect on the firm's investment policy. Neither has it any direct effect on total firm value, although it can have an indirect effect by affecting the probability of a takeover, with the resulting effect on firm value (either by affecting the identity of the management team in control, or through affecting the effort level of the incumbent). In particular, we assume that  $D \geq n_i v_i - 2W_I$ ,  $i \in \{1, 2\}$ , so that if the incumbent allocates all the debt  $D$  to any one firm after the spin-off, the incumbent can ensure control of that firm (in this case, even if the rival acquires all the equity held by the passive investors, he will not be able to obtain a majority of the votes in the control contest).

We now characterize the equilibrium debt allocation following a spin-off. We will study the allocation of debt in the case where the incumbent relinquishes control of firm 2 to a division manager following the spin-off and also the case where the incumbent maintains control of both firms after the spin-off.

**Proposition 6. Debt allocation in a spin-off where the incumbent relinquishes control of firm 2.** *Let the wealth of the rival be sufficiently large such that  $W_R \geq \frac{1}{2} \text{Max}(n_1 v_1, n_2 v_2)$ , and let the equilibrium conditions in proposition 1 be satisfied. Then:*

- (i) *The equilibrium behavior of all agents is similar to that characterized in proposition 1.*
- (ii) *The allocation of the joint firm's debt between firm 1 and firm 2 is such that the incumbent allocates to firm 1 the minimum amount of debt  $D_1^*$  required to maintain control of that firm, and the remaining debt  $D_2^*$  to firm 2.*

The above equilibrium is very similar to that in proposition 1, with the board spinning off one division, and the incumbent attempting to maintain control of firm 1, while relinquishing control of firm 2 to a division manager. Unlike in proposition 1, however, here the rival's wealth is large enough that he can potentially wrest control of firm 1 from the incumbent simply by buying up a large enough equity stake in the firm (i.e., without relying on any votes from passive investors). This, in turn, means that the incumbent himself cannot rely on passive investors' votes to maintain control of firm 1, even when his management ability is superior to the rival in that firm. The incumbent therefore allocates just enough debt to firm 1 to ensure control of that firm, while allocating all the remaining debt of the joint firm to firm 2. Note that the incumbent will

not allocate any debt to firm 1 beyond the minimum required to maintain control against a rival. Doing so would unnecessarily reduce his private benefits from controlling that firm, and is therefore not optimal. In contrast, the incumbent does not enjoy any private benefits from firm 2 regardless of debt level (since the incumbent relinquishes control of that firm at the time of the spin-off). Thus, the incumbent allocates all the remaining debt of the joint firm to firm 2 in equilibrium.

**Proposition 7. Debt allocation in a spin-off where the incumbent maintains control of both firms.** *Let the equilibrium conditions in proposition 3 hold, and further, let the rate of decline of the incumbent's private benefits from firm 2 with debt be large enough that  $\left| \frac{\partial P_1^2(D_2)}{\partial D_2} \right| > \eta$  for any debt level  $D_2$ . Then:*

- (i) *The equilibrium behavior of all agents is similar to that characterized in proposition 3.*
- (ii) *The equilibrium allocation of the joint firm's debt between firm 1 and firm 2 is such that the rates of decline of the incumbent's private benefits from these firms with debt are equalized.*
- (iii) *Let the private benefits associated with firm 1 decline faster with debt than those associated with firm 2 for any given debt level, and let the sizes of these two firms be the same. Then, the proportion of the joint firm's debt allocated to firm 2 by the incumbent is greater than that allocated to firm 1.*

In the above setting, the incumbent is a better manager than the rival in firm 1 even when working normally, and better at managing firm 2 when working diligently. Further, the rival's wealth is not too large, so that the incumbent can retain control of both firms by working diligently in managing firm 2 and relying on votes from passive investors. The incumbent therefore does not have to rely on debt and wealth allocation to ensure control. This means that the incumbent can allocate the joint firm's debt in such a way that the sum of his private benefits in firm 1 and firm 2 would be reduced to the least extent. Thus, the equilibrium debt allocation chosen by the incumbent will be such that, at the equilibrium debt levels, the marginal rate of decline in the incumbent's private benefits with debt will be the same across the two firms. Thus, a smaller proportion of the joint firm's debt will be allocated to the spun-off firm which has a greater rate of decline of the incumbent's control benefits for any given level of debt.

In the above equilibrium, the incumbent had the alternative of maintaining control of firm 2 by allocating debt (and wealth) strategically across the two firms, instead of working diligently. However, this would have required an allocation of most of the joint firm's debt to firm 2, which would have caused a substantially larger decrease in private benefits from firm 2. In contrast, if the incumbent relies on diligent effort to

maintain control, the incumbent can allocate debt optimally to reduce the decline in total private benefits, although he has to incur the cost of increased effort in this case. In equilibrium, the incumbent chooses to maintain control by working harder, since this is the cheaper of the above two alternatives.

## 6. Implications of the model

1. *Implications for the likelihood of spin-offs.* Our model has several implications for the likelihood of spin-offs for a given firm. First, our results imply that spin-offs are more likely if a firm operates in an industry with a high degree of takeover activity. This is because, in our setting, the benefits of a spin-off arise from the increase in takeover pressure on incumbent management following the spin-off. Second, our results imply that divisions of a firm which underperform other divisions in the same firm or other firms in the same industry are more likely to be spun off. This is because, if a particular division is underperforming other firms in the same industry, it is more likely that a takeover by another firm in the same industry can improve performance. Further, if the division is underperforming other divisions of the parent firm, then spinning off that division and having the control of that division pass to a better manager (either by the incumbent relinquishing control to a new CEO at the time of the spin-off, or by being taken over by a rival firm subsequent to the spin-off) is more likely to increase long-term equity value. Third, our model implies that divisions of a firm which are more distantly related to the core business of the firm are more likely to be spun off, since (1) incumbent management is likely to have lower management ability for these divisions (so that the increase in long-term equity value from such a spin-off will be greater); (2) the synergy between such a division and the rest of the firm is likely to be low (so that the cost of the spin-off is low); and (3) incumbent management's control benefits from such a division will be lower than that from a division related to the firm's core business (so that the incumbent management is more likely to relinquish control to a new CEO at the time of the spin-off, making the spin-off more value-improving to equity holders). Fourth, firms operating in industries characterized by rapid technological change are more likely to spin off divisions. When the firm experiences rapid technological change (and high growth) in one division, the incumbent will become less capable at managing that division, so that the incumbent's management ability

across divisions is likely to be more lopsided in such a firm. Therefore the board will be more motivated to spin off that division since both the discipline effect and the change of control effect will be greater in this case. The second, third, and fourth implications above are consistent with the evidence of Krishnaswami and Subramaniam (1999), who show that a division of a firm is more likely to be spun off if it underperforms, its business is unrelated to the firm's core business, or if it operates in a high-growth industry.

*2. Implications for the stock market reaction to spin-off announcements.* Our model has a wide variety of implications for the market reaction to spin-off announcements (i.e., the announcement effect). First, our model predicts that the announcement effect of spin-offs will be positive on average (i.e., equity holders in the joint firm will enjoy a positive abnormal return on the day of the announcement of the impending spin-off). Second, the magnitude of this announcement effect is increasing in the size of the subsidiary as a fraction of the size of the joint firm (see Schipper and Smith, 1983, for supporting evidence). Third, the magnitude of the announcement effect will be greater in the case of unrelated spin-offs than in related spin-offs. Desai and Jain (1999) and Daley, Mehrotra, and Sivakumar (1997) provide evidence consistent with this prediction. Fourth, the magnitude of this announcement effect is increasing in the extent of takeover activity in the industry the joint firm is operating in (for a related spin-off), or the spun-off division is operating in (for an unrelated spin-off). Fifth, the announcement effect will be decreasing in the fraction of equity in the spun-off subsidiary held by the incumbent management of the parent firm (either on their personal account, or through the parent firm).

As mentioned above, some of these predictions are supported by the existing empirical literature on spin-offs. However, one prediction regarding which there has been no empirical work so far is the fifth prediction above. An indirect way to test this prediction is to compare the announcement effects of spin-offs and equity carve-outs. The testable prediction here is that, on average, the announcement effect in equity carve-outs will be smaller than that in spin-offs (since the parent firm typically holds a large fraction of equity in the subsidiary in an equity carve-out, while this is not the case for spin-offs).

*3. Implications for the long-term firm performance and value changes following spin-offs.* Our model has several implications for the long-term performance and value changes of firms following spin-offs. First, our

model implies that spin-offs will be followed, on average, by increases in the long-term operating performance (as measured by accounting numbers) of the subsidiary. Second, if one of the two firms resulting from a spin-off is taken over subsequently, equity holders (those who hold equity in the two firms resulting from the spin-off) will enjoy long-term positive abnormal returns. These long-term abnormal returns will be greater in unrelated spin-offs than in related spin-offs. Third, there will be no such positive long-term equity returns for spin-off-parent combinations not reporting takeover activity. Finally, if the incumbent management or the parent firm holds enough equity to essentially guarantee control (so that no takeovers take place), our model predicts that this long-term abnormal return will be zero. Thus, we would expect the long-term abnormal returns following spin-offs to be larger than those in equity carve-outs, for the reasons we discussed under implication 2 above.

4. *Implications for the debt allocation in spin-offs.* Our model predicts that, of the two firms resulting from a spin-off, a smaller fraction of the debt originally associated with the joint firm will be allocated to the firm which has private benefits declining at a faster rate with an increase in debt. This implies that, other things remaining the same, of the two firms resulting from a spin-off, the firm which has a lower base level of private benefits (i.e., private benefits associated with zero debt issued) will be allocated a disproportionately large fraction of the parent firm's outstanding debt in relation to its size.<sup>10</sup> Two good proxies for a firm's base level of private benefits are the extent of managerial discretion (higher degrees of managerial discretion confer greater private benefits) and the extent of regulatory scrutiny (greater the regulatory scrutiny, smaller the private benefits). The extent of free cash flow and cash flow growth can also serve as useful proxies.

The above implication of our model is consistent with the debt distribution in the 1993 Marriott spin-off discussed in Parrino (1997). Parrino shows that, in the spin-off plan, Marriott distributed a disproportionate fraction of debt to Host Marriott, the parent firm in the spin-off. He also points out that the growth rate of Host Marriott was lower than Marriott International, the firm being spun off, which implies that the rate of decline in private benefits with debt would be smaller for Host Marriott than for Marriott International.

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<sup>10</sup> This second prediction regarding debt allocation follows from the first if (and only if) the decline in the expected private benefits from any firm with debt results only from the increase in the bankruptcy-probability of the firm with an increase in the amount of debt issued against it.

Thus, the debt allocation in the Marriott case seems to have minimized the loss in private benefits to the Marriott family, which maintained control of both firms even after the spin-off.<sup>11</sup>

## 7. Conclusion

This paper develops a new rationale for corporate spin-offs, and for the performance and value improvements following them. We study a setting where, while the incumbent-firm management benefits from an increase in its equity value, it also derives private benefits from control. The firm has two divisions, and current management has differing abilities for managing these two divisions. Giving up control to a rival management team, while it could benefit equity holders (including the incumbent management) by increasing firm value, is costly to the incumbent in that it involves loss of control (and hence the private benefits the current management derives from control). A spin-off increases the chance of loss of control to a potential rival in two ways. First, it increases the probability that passive investors will vote with the rival in a contest for the control of at least one division: in the joint firm, the incumbent's inferior ability compared to the rival in managing one division could be neutralized by his superior ability in managing the other division. Second, it reduces the ability of the incumbent to use firm size strategically against the rival in a control contest. This increased chance of loss of control following a spin-off, in turn, motivates the incumbent to make one of two possible choices. One alternative is to work harder in running the firm in equilibrium (even when doing so requires a larger personal cost of exerting effort) in an attempt to minimize the probability of losing control. The second alternative is to relinquish control of one of the two spun-off firms, either immediately following the spin-off to a division manager, or subsequently to a rival in a control contest. While the incumbent's choice between these two alternatives depends on the magnitude of his control benefits, his management ability relative to the division manager or potential rivals, and his personal cost of diligent effort, either of the above choices leads to an increase in the combined equity value of the two firms resulting from the spin-off.

Our model demonstrates that, in many situations, incumbent management is better off relinquishing

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<sup>11</sup> However, the debt allocation in the above case may also have been driven by the desire of shareholders to transfer wealth from bondholders, which is not a driving factor in our model.

control of the spun-off firm to a capable division manager at the time of the spin-off. We also demonstrate that spin-offs can increase the probability of a takeover by the right kind of management team. Further, we show that such spin-offs can enhance the level of firm performance even in the absence of such a value-improving takeover by serving to discipline firm management. In addition, our analysis demonstrates that in addition to positive abnormal stock-price returns on the announcement day, spin-offs also lead to positive long-term abnormal stock returns (on average) for parent-spin-off combinations reporting subsequent takeover activity. We also explain a wide variety of other empirical regularities, and provide hypotheses for further empirical research.

## Appendix

**Proof of Proposition 1.** At time 1, the incumbent has three possible choices. The first option is to relinquish control of firm 2 to a suitable division manager and work normally in both firm 1 and firm 2. Second, the incumbent can choose to maintain control of both firms upon spin-off, work normally in firm 1 and diligently in firm 2. Third, the incumbent can choose to maintain control of both firms after the spin-off and work normally in both firms. In the following, we will calculate the payoffs to the incumbent following each choice, and then derive the conditions under which the incumbent makes the first choice in equilibrium.

Under the first choice, the incumbent expects that firm 2 will be taken over by the rival, if such a rival appears at time 2. Thus, the incumbent's expected payoff at time 1 following the first choice is

$$U_R = P_I^1 + f[n_1v_1 + (1 - \phi)lv_2 + \phi hv_2], \quad (\text{A1})$$

where  $f \equiv \frac{W_I}{n_1v_1 + n_2v_2 + S}$  is the fraction of equity held by the incumbent in the joint firm and the two firms resulting from the spin-off. On the other hand, following the second choice, the incumbent's expected payoff is

$$U_{MD}^1 = P_I^1 + P_I^2 - c + f[n_1v_1 + d_2v_2], \quad (\text{A2})$$

if  $d_2 > h$  (so that the incumbent will win the control contest for firm 2 against the rival). The expected payoff is

$$U_{MD}^2 = P_I^1 + (1 - \phi)P_I^2 - c + f[n_1v_1 + (1 - \phi)d_2v_2 + \phi hv_2], \quad (\text{A3})$$

if  $d_2 < h$  (so that the incumbent will lose the control contest for firm 2). Finally, in the case where the incumbent makes the third choice, his expected payoff is

$$U_{MN} = P_I^1 + (1 - \phi)P_I^2 + f[n_1v_1 + (1 - \phi)n_2v_2 + \phi hv_2], \quad (\text{A4})$$

since the incumbent expects firm 2 to be taken over at time 3 if a rival appears.

It is easy to show that  $U_{MN} > U_{MD}^2$  since  $c > f(d_2 - n_2)v_2$ . Further,  $U_R > U_{MN}$  if  $P_I^2 < f(l - n_2)v_2$ ; and  $U_R > U_{MD}^1$  if  $P_I^2 < c + f[(1 - \phi)l + \phi h - d_2]v_2$ . Finally,  $c + f[(1 - \phi)l + \phi h - d_2]v_2 > f[(1 - \phi)l + \phi h - n_2]v_2 > f(l - n_2)v_2$ . Define  $\underline{p} \equiv f(l - n_2)v_2$ . Thus, if  $P_I^2 < \underline{p}$ , the incumbent makes the first choice. In this case, the

value of the board's objective in the event of a spin-off is  $n_1v_1 + (1 - \phi)lv_2 + \phi hv_2$ , which is greater than the value of its objective in the absence of a spin-off,  $n_1v_1 + n_2v_2 + S$  if  $S < [(1 - \phi)l + \phi h - n_2]v_2$ . ■

**Proof of Proposition 2.** In this proof, we derive the conditions under which the equilibrium choice of the incumbent is the third choice we discussed in the proof of proposition 1. Given  $d_2 < h$ , the incumbent makes the third choice if and only if  $U_{MN} \geq U_{MD}^2$ , and  $U_{MN} \geq U_R$ . The first inequality is satisfied automatically, and the second equality is satisfied if  $P_I^2 \geq \underline{p}$ . In this case, the long-term combined equity value is  $n_1v_1 + (1 - \phi)n_2v_2 + \phi hv_2$  in the case of a spin-off. Thus, when  $S < \phi(h - n_2)v_2$ , the board spins off one division. ■

**Proof of Proposition 3.** Given  $d_2 > h$ , the incumbent makes the second choice if and only if  $U_{MD}^1 > U_{MN}$  and  $U_{MD}^1 > U_R$ . From the first inequality, we have

$$P_I^2 > p_1 \equiv \frac{1}{\phi}[c + ((1 - \phi)n_2 + \phi h - d_2)v_2]; \quad (\text{A5})$$

and from the second inequality, we have

$$P_I^2 > p_2 \equiv c + f[(1 - \phi)l + \phi h - d_2]v_2. \quad (\text{A6})$$

It can be shown that

$$p_1 - p_2 = \frac{1 - \phi}{\phi}[c + ((1 - \phi)n_2 + \phi h - d_2)fv_2] + (1 - \phi)(n_2 - l)fv_2 > (1 - \phi)(h - l)fv_2 > 0, \quad (\text{A7})$$

since  $c > (d_2 - n_2)fv_2$ . Define  $\bar{p} \equiv p_1$ . Thus, when  $d_2 > h$  and  $P_I^2 \geq \bar{p}$ , the incumbent's equilibrium choice is the second one characterized in the proof of proposition 1, since, in this case, the long-term combined equity value is  $n_1v_1 + d_2v_2$ , which is greater than the equity value of the joint firm when  $S < (d_2 - n_2)v_2$ . ■

**Proof of Proposition 4.** (i) Given  $P_I^2 \geq \bar{p}$ , the equilibrium will be that characterized in proposition 2 if  $d_2 < h$ , or that characterized in proposition 3 if  $d_2 > h$ . In the first case, the market value of equity of the joint firm is

$$\gamma(n_1v_1 + n_2v_2 + S) + (1 - \gamma)[n_1v_1 + (1 - \phi)n_2v_2 + \phi hv_2] \quad (\text{A8})$$

before the announcement, while the combined equity value changes to  $n_1v_1 + (1 - \phi)n_2v_2 + \phi hv_2$  upon the spin-off announcement. Thus, the combined equity value increases by  $\gamma[\phi(h - n_2)v_2 - S]$ . In the second case,

the combined equity values before and after the announcement are  $\gamma(n_1v_1+n_2v_2+S)+(1-\gamma)(n_1v_1+d_2v_2)$  and  $n_1v_1+d_2v_2$  respectively. Thus, the increase in the combined equity value is  $\gamma[(d_2-n_2)v_2-S]$ . On the other hand, when the incumbent relinquishes control of firm 2 to the division manager, the equilibrium is the one characterized in proposition 1. In this case, the combined equity values before and after the announcement are  $\beta[n_1v_1+(1-\phi)lv_2+\phi hv_2]+(1-\beta)[n_1v_1+(1-\phi)n_2v_2+\phi hv_2]$  and  $n_1v_1+(1-\phi)lv_2+\phi hv_2$  respectively. Thus, the increase of the combined equity value is  $\beta[(1-\phi)(l-n_2)v_2]$ .

(ii) It is easy to show that  $\gamma[\phi(h-n_2)v_2-S]$  is increasing in  $\phi$  and  $h$ .

(iii) It is easy to show that  $\beta[(1-\phi)(l-n_2)v_2]$  is increasing in  $\beta$  and  $l$ .

(iv) If we hold  $n_1v_1+n_2v_2+S$  constant, then  $\frac{\partial n_1}{\partial n_2} = -\frac{v_2}{v_1}$ , which implies that  $\frac{\partial(n_1-n_2)}{\partial n_2} = -\frac{v_2}{v_1} - 1$ . Thus,

$$\frac{\partial AR}{\partial(n_1-n_2)} = \frac{\partial AR/\partial n_2}{\partial(n_1-n_2)/\partial n_2} = -\frac{v_1+v_2}{v_1} \frac{\partial AR}{\partial n_2}, \quad (\text{A9})$$

where  $AR$  stands for the change in the combined equity value upon the spin-off announcement. The value of  $AR$  in each equilibrium has been derived in part (i) of this proof. It is easy to show that  $\frac{\partial AR}{\partial n_2} < 0$ , which implies  $\frac{\partial AR}{\partial(n_1-n_2)} > 0$ .

(v) If we hold  $v_1+v_2$  constant, then  $\frac{\partial \frac{v_2}{v_1+v_2}}{\partial v_2} = \frac{1}{v_1+v_2}$ . Thus,  $\frac{\partial AR}{\partial \frac{v_2}{v_1+v_2}} = \frac{1}{v_1+v_2} \frac{\partial AR}{\partial v_2}$ . It is easy to show that  $\frac{\partial AR}{\partial v_2} > 0$ , which implies  $\frac{\partial AR}{\partial \frac{v_2}{v_1+v_2}} > 0$ . ■

**Proof of Proposition 5.** (i) The combined equity value of the two firms resulting from the spin-off is  $n_1v_1+(1-\phi)lv_2+\phi hv_2$  and  $n_1v_1+(1-\phi)n_2v_2+\phi hv_2$  in propositions 1 and 2 respectively. If firm 2 is taken over by the rival at time 3, then the combined equity value of these two firms become  $n_1v_1+lv_2$ . Thus, the value increases are either  $(1-\phi)(h-l)v_2$  or  $(1-\phi)(h-n_2)v_2$ .

(ii) If firm 2 is not taken over, it can be one of two scenarios. First, the rival does not appear in the equilibria characterized in propositions 1 and 2. Or second, the equilibrium is that characterized in proposition 3. In the first scenario, the combined equity value of firms 1 and 2 reduces to  $n_1v_1+lv_2$  or  $n_1v_1+n_2v_2$ . In the second scenario, there is no change in the combined equity value. ■

**Proof of Proposition 6.** In this case, the incumbent can only retain control of firm 1. His problem is:

$$\begin{aligned}
& \underset{D_1, D_2, f_1, f_2}{Max} \quad U = f_1(n_1v_1 - D_1) + f_2[(1 - \phi)lv_2 + \phi hv_2 - D_2] + P_I^1(D_1) \\
& \text{S.t.} \quad f_1 \geq \frac{1}{2}, \text{ and } f_1(n_1v_1 - D_1) + f_2[(1 - \phi)lv_2 + \phi hv_2 - D_2] = f[n_1v_1 + (1 - \phi)lv_2 + \phi hv_2 - D],
\end{aligned} \tag{A10}$$

where  $D_1 + D_2 = D$ ,  $f_1$  and  $f_2$  are the fractions of equity held by the incumbent in firms 1 and 2 respectively, after the allocation of his wealth, and  $f$  is the incumbent's equity stake in the joint firm prior to the spin-off,  $f \equiv \frac{W_I}{n_1v_1 + n_2v_2 - D + S}$ . Here, the first inequality ensures the incumbent controls a majority of the equity of firm 1. The second inequality ensures that the incumbent's wealth allocation is a zero-NPV activity.

In equilibrium,  $f_2^* = 0$ , since otherwise if  $f_2$  is positive, the incumbent can marginally reduce  $f_2$  and can also reduce  $D_1$  to increase payoff  $U$ . Also, under the same rationale,  $f_1^* = \frac{1}{2}$ . Thus,  $D_1^* = n_1v_1 - 2f[n_1v_1 + (1 - \phi)lv_2 + \phi hv_2 - D]$ , and  $D_2^* = D - D_1^*$ . ■

**Proof of Proposition 7.** Consider first the incumbent's problem if he retains control of both firms by working diligently in firm 2:

$$\begin{aligned}
& \underset{D_1, D_2, f_1, f_2}{Max} \quad U = f_1(n_1v_1 - D_1) + f_2(d_2v_2 - D_2) + P_I^1(D_1) + P_I^2(D_2) - c, \\
& \text{S.t.} \quad f_1(n_1v_1 - D_1) + f_2(d_2v_2 - D_2) = f(n_1v_1 + d_2v_2 - D).
\end{aligned} \tag{A11}$$

Here, the incumbent's problem has captured the consideration that the incumbent can win the control contests in both firms by working diligently in firm 2, and  $D_1 + D_2 = D$ . In equilibrium, since wealth allocation is a zero-NPV activity,  $f_1^*$  and  $f_2^*$  can be any combination as long as they satisfy the first constraint. Then, based on the first order conditions on  $D_1$  and  $D_2$ ,  $D_1^*$  and  $D_2^*$  are such that they satisfy the following two equations:  $\frac{\partial P_I^1(D_1)}{\partial D_1} = \frac{\partial P_I^2(D_2)}{\partial D_2}$  and  $D_1 + D_2 = D$ . In this case, the equilibrium payoff to the incumbent is  $U_1 = f(n_1v_1 + d_2v_2 - D) + P_I^1(D - D'') + P_I^2(D'') - c$ , where  $D'' = D_2^*$ .

Consider next a second scenario where the incumbent chooses to work normally at firm 1, relinquishing control of firm 2 to the division manager. In this case, the problem is

$$\begin{aligned}
& \underset{D_1, D_2, f_1, f_2}{Max} \quad U = f_1(n_1v_1 - D_1) + f_2[(1 - \phi)lv_2 + \phi hv_2 - D_2] + P_I^1(D_1) \\
& \text{S.t.} \quad f_1(n_1v_1 - D_1) + f_2[(1 - \phi)lv_2 + \phi hv_2 - D_2] = f[n_1v_1 + (1 - \phi)lv_2 + \phi hv_2 - D].
\end{aligned} \tag{A12}$$

As before, here  $D_1 + D_2 = D$ . It is easy to derive that, in equilibrium,  $f_1^*$  and  $f_2^*$  can be any combination as long as they satisfy the constraint in (A12),  $D_1^* = 0$  and  $D_2^* = D$ , and the optimal payoff to the incumbent is  $U_2 = f(n_1v_1 + (1 - \phi)lv_2 + \phi hv_2 - D) + P_I^1$ . When  $P_I^2 \geq \bar{p}$ ,  $U_1 > U_2$ .

Finally, consider a (third) scenario where the incumbent chooses to work normally in both firms, and allocate debt and wealth so that the incumbent can ensure control of both firms. In this case, the problem is

$$\begin{aligned} \underset{D_1, D_2, f_1, f_2}{Max} \quad & U = f_1(n_1v_1 - D_1) + f_2(n_2v_2 - D_2) + P_I^1(D_1) + P_I^2(D_2) \\ \text{S.t.} \quad & f_2 \geq \frac{1}{2}, \text{ and} \end{aligned} \tag{A13}$$

$$f_1(n_1v_1 - D_1) + f_2(n_2v_2 - D_2) = f(n_1v_1 + n_2v_2 - D),$$

where  $D_1 + D_2 = D$ . Define  $\eta_1 \equiv \left| \frac{P_I^1(D)}{\partial D'} \right|$  where  $D' = D - [n_2v_2 - 2f(n_1v_1 + n_2v_2 - D)]$ . Thus, if  $\left| \frac{P_I^2(D_2)}{\partial D_2} \right| > \eta_1$ , the second constraint in (A13) cannot be satisfied at the optimal debt levels derived in the first scenario. This implies that  $D' > D''$ , i.e., the optimal debt level of firm 2 in this scenario is greater than that derived in the first scenario, and further implies that the dissipation of the total private benefits is greater in this third scenario. Further, in this scenario,  $f_2^* = \frac{1}{2}$ ,  $f_1^* = 0$ ,  $D_1^* = D - D'$ , and  $D_2^* = D'$ . The expected payoff to the incumbent in this case is  $U_3 = f(n_1v_1 + n_2v_2 - D) + P_I^1(D - D') + P_I^2(D')$ . Define  $\eta_2 \equiv \frac{P_I^1(D - D') - P_I^1(D - D'') + c}{D' - D''}$ . Then, if  $\left| \frac{P_I^2(D_2)}{\partial D_2} \right| > \eta_2$ ,  $U_1 > U_3$ . Thus, if  $\left| \frac{P_I^2(D_2)}{\partial D_2} \right| > \eta \equiv \text{Max}(\eta_1, \eta_2)$ ,  $U_1$  gives the global optimum, and the incumbent prefers to work hard to retain control of both firms, with the equilibrium debt allocation characterized in the first scenario above. ■

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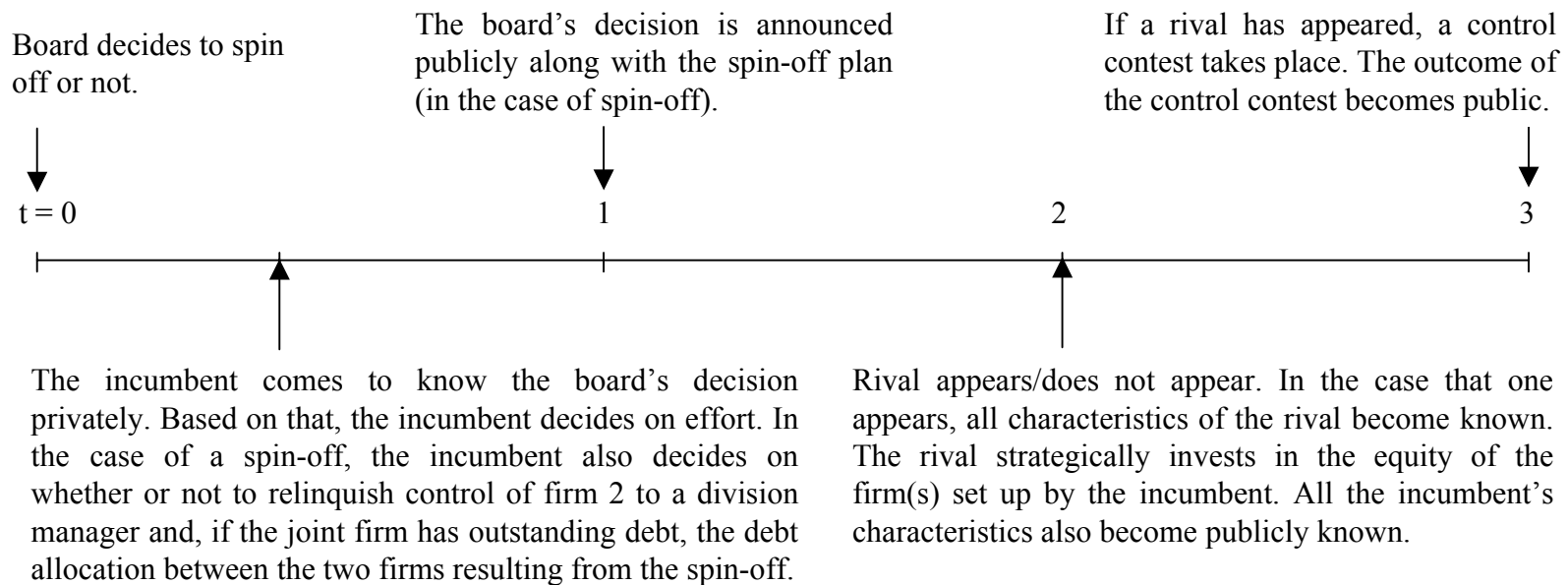


Fig. 1. Sequence of events in a spin-off.