

UNLOCKING VALUE BY IMPROVING TRANSPARENCY: THE CASE OF SPIN-OFFS

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Abstract

A spin-off is a type of divestiture where a conglomerate separates one or more of its divisions by distributing shares with equity claims specific to those divisions. These shares are not sold, but simply issued to the current shareholders of the conglomerate, similar to a stock dividend distribution. We present a formal model that shows that under information asymmetry, spin-offs are the optimal method to divest divisions of a firm. When firms operate in very different industries, analysts and other market participants sometimes fail to understand or recognize sources of value clearly. Thus, a divestiture by an undervalued firm could allow for improved valuation due to the market being able to discern value more clearly. Our model demonstrates that unlike other modes of divestiture such as asset sales and equity carve-outs, spin-offs are uniquely optimal for eliminating such undervaluation. The intuition lies in the fact that mitigating information asymmetry requires that the individual divisions of a conglomerate trade as separate entities in the market, allowing for analyst-following by analysts with industry-specific expertise. There is also more credible disclosure of operational and financial details of the now separated independent entities. These improvements in firm transparency lead to better recognition of value by the market. Although there is such separation of entities in asset sales and equity carve-outs, these are costly modes of divestiture for the firm since they involve the valuation and sale of undervalued assets *prior* to separation of divisions and correction of undervaluation. Spin-offs do not impose this cost because there is no sale of assets prior to separation. Our formal model shows that conglomerates needing to raise capital, but undervalued because of information asymmetry, will find it optimal to separate their divisions through a spin-off, eliminate the undervaluation, and then raise capital once the undervaluation is corrected.

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1 Introduction

Firms use assets sales, equity carve-outs, or spin-offs to divest assets and refocus their operations. In an asset sale, the assets of the firm that are to be divested are parceled off and sold to the highest bidder. This mode of divestiture generates cash, and the divested assets become part of another firm. In an equity carve-out, a new division is created with the assets to be divested, and equity stakes in the new division are sold to the public through a divisional IPO. This creates a new stand-alone firm and also brings in capital to the firm from the sale of equity. In a spin-off, the firm creates a new division with the assets to be divested, and then distributes shares of equity in the division to the shareholders of the firm. The shares are not sold to the shareholders, but simply distributed to them as in a stock dividend distribution. The difference between the distribution of stock in a spin-off and in a stock dividend is that in a spin-off the

distributed shares represent ownership only in the spun-off division of the firm. It is a stock distribution which creates a separate firm, but it generates no new capital for the parent firm. In this paper, we present a formal model that shows why a spin-off is unlike any other divestiture in that it is uniquely equipped to mitigate undervaluation due to information asymmetry.

Research documents a positive stock price reaction to the announcement of divestiture transactions.¹ The evidence in the literature supports three main explanations for the announcement gains around divestitures: focus improvement and elimination of negative synergy through the divestiture (Hite and Owers, 1983; Schipper and

¹ See Hite and Owers (1983), Schipper and Smith (1983), Miles and Rosenfeld (1983), Rosenfeld (1984), Jain (1985), Bhagat, Shleifer, and Vishny (1990), for early evidence on stock price reaction to divestiture announcements.

Smith, 1983; Comment and Jarrell, 1995; John and Ofek, 1995; Daley, Mehrotra, and Sivakumar, 1997; Desai and Jain, 1999), improvement in information transparency and attenuation of information asymmetry (Habib, Johnson, and Naik, 1997; Krishnaswami and Subramaniam, 1999; Nanda and Narayanan, 1999), and improved incentives and governance from the establishment of a separate firm (Aron, 1991; Seward and Walsh, 1996; Fulghieri and Sevilir, 2011).

The focus improvement reasoning argues that when a firm becomes too disparate in its operations, it results in negative synergies that erode shareholder value. A divestiture is a way for a firm to refocus its operations on its core competencies and eliminate the negative synergies. The information transparency motivation for divestitures argues that firms that operate as conglomerates suffer from lack of transparency in their divisional operations, and therefore, suffer mis-valuation in the market. By creating a separate firm through a divestiture, undervalued firms are able to reveal the sources of value in their individual operations more clearly to the market, thereby eliminating undervaluation. The incentive improvement and improved governance reasoning argues that divisional managers of conglomerates suffer from distorted incentives and the firm suffers from sub-optimal resource allocation. Since stock-based compensation is based on overall equity value of the firm, divisional managers have the mis-incentives of engaging in free-riding and costly lobbying of the headquarters for favorable resource allocation. This results in discounted valuation due to agency and influence costs and inefficient resource allocation. A divestiture mitigates this dysfunction by creating a separate firm with well-aligned managerial incentives and targeted governance.

The focus improvement and the incentive and governance improvement arguments apply to all divestitures. Any breakup of a conglomerate operating inefficiently results in elimination of negative synergies, and improved managerial incentives and firm governance, leading to increased firm value. However, undervaluation that arises due to lack of transparency in a conglomerate can only be eliminated after a conglomerate trades as separated entities and the market is able to discern true value through improved transparency and credible disclosure in the now individual operations. Thus, a conglomerate suffering from undervaluation due to information opacity will not be able to realize full value of their assets if they undertook a divestiture through an asset sale or an equity carve-out. This is because, at the time of the asset sale or equity carve-out, the firm is still a conglomerate covered in the fog of opaque information, preventing assessment of true value, which results in reduced proceeds for the divisions that are being sold. A spin-off circumvents this problem because it ensures the separation of the divisions of the firm without a sale of the undervalued

assets. A spin-off is uniquely different from any other type of divestiture because the stock distribution in a spin-off provides the shareholders with separated claims on the assets of the divested divisions without an actual sale of these assets for cash. Thus, any undervaluation of assets is not costly for the firm.

In this paper, we develop a formal, yet simple, model where we show that a high growth firm needing capital, but suffering from undervaluation due to high information asymmetry, will engage in a spin-off to improve its value. In our model, the information asymmetry is about the operating costs and efficiency of the different divisions of the firm. In this framework, we utilize the idea that operating costs of a division are determined by the productivity of the division's durable assets, the efficiency of the divisional managers, and industry-wide cost shocks in that division's industry. An estimate of these costs is important since the market value of a division's current and future investment opportunities depends in part on its operating costs and efficiency. When the divisions are part of a combined firm, we assume that the investors use a signal extraction rule to estimate the operating costs of individual divisions from a total combined cost parameter that they observe. This signal extraction results in imperfect estimation of the true costs of the divisions of a firm and leading to undervaluation of some of these firms. We show that spin-offs are optimal in these instances.

We consider a firm that is made up of two divisions P (Parent) and S (Subsidiary) which operate, possibly, in two different industries. We assume a multi-period model where both divisions have profitable projects that are in progress. At the end of each period, the *total* operating costs of the entire firm for that period is known to the outside investors from the total profits of the firm reported in consolidated financial statements. However, the operating costs of the *individual* divisions are not known to the outside investors, and can only be inferred from the total costs. After observing the total costs, outside investors update their beliefs about the costs of the individual divisions in a Bayesian fashion. Depending on the cost uncertainty of the individual divisions, the cost estimate of a given division will be an over or under estimate of the true cost.

If the share price of the firm is dependent only on the operating costs and profits of the firm as a whole, knowledge of the individual divisions' efficiency and profitability will not matter. However, this may not always be the case. Suppose that divisions P and S have differential growth opportunities, and P has a new investment opportunity (besides its ongoing projects) that requires an investment of \$I one period from today. If the firm has to raise external capital to finance this project, the value of the securities issued will depend on the investors' *perception* about the profitability of this project. Since the model is one of imperfect information, the outside investors use their estimate about P's cost and efficiency to determine the

profitability of the project that P pursues. If the estimate of the cost is higher than P's true cost, the securities issued to raise capital will be undervalued. The firm can mitigate its loss due to this undervaluation, by engaging in a spin-off that dissociates the two divisions P and S, before the capital is raised for the new investment.

A spin-off is followed by disclosure of individual profit and cost information that obviates the need for a noisy estimation of these costs by the market from the total combined costs. So, if investors overestimate division P's costs due to its association with S, a spin-off will result in a correction in the estimate of the costs, and P's securities will be correctly valued. Simply disclosing division-specific information without separating the divisions through a spin-off will not correct the undervaluation. An ordinary disclosure of this information by a combined firm will not be credible because the firm can manipulate shared costs (that are unobservable by the market) across divisions, to maximize the proceeds from the new security issue.² A spin-off, on the other hand, formally separates the operations and assets of the divisions, and manipulation of costs is no longer possible since there are no shared costs post-spin-off.

If P's cost was overestimated by the market before a spin-off, then it also implies that S's cost was underestimated. Thus a spin-off would result in a revision in valuation of P and S that could offset each other. So, it is important to study whether a spin-off creates value to the shareholders of the combined firm P+S. Observe that due to the differential growth opportunities for P and S, the overvaluation of S before a spin-off stems from an overvaluation of its current cash flows, while the undervaluation of P stems from the undervaluation of both its current operations and its future opportunities. Thus the undervaluation of P, the high-growth division, is more severe than the overvaluation of S.³ The spin-off creates value by reducing the under-valuation of P's securities.

Our model of information asymmetry has some similarities to the models presented in Habib, Johnson, and Naik (1997), Nanda and Narayanan (1999), and Matsusaka and Nanda (2002). Habib, Johnson, and Naik (1997) argue from a security design perspective that the price of traded securities transmits information about the value of the various assets of the firm. By separating multiple divisions of a firm into separate firms with traded securities, a spin-off makes the price more informative, reduces uncertainty about asset values, and improves the quality of investment decisions made by managers, thereby increasing firm

value. Their model assumes that informed investors in the market are better able to extract information about the value of firms' assets than are the managers of the firm. After a spin-off, the managers learn about their own values, and are able to then make more efficient investment decisions. Although the authors do not directly address it, the nature of their model is such that their results may just as well be achieved through an equity carve-out, since equity carve-outs result in separately traded shares and with informed investor information being impounded into the prices. There is nothing unique about spin-offs in their model. Our model is different from theirs in that we utilize the idea that market price of a stock reflects the markets' *perception* of costs and efficiency of the firm, which in turn can be different from the *true* costs and efficiency known to the managers. Managers can only convey the true costs and efficiency to the market through a credible action like a spin-off which eliminates any cost opacity due to manipulation of transfer pricing. Our model also explains why equity carve-outs do not serve this purpose in our context.

Nanda and Narayanan (1999) model the information asymmetry that arises through the unobservability of divisional cash flows in a firm, leading to imperfect valuation of the firm. Overvalued firms issue external equity to finance future investment, while undervalued firms trade-off the expected benefits of staying diversified (lower cost of internal capital) against the expected costs of a divestiture. They arrive at an equilibrium in which overvalued firms issue external equity, some undervalued firms continue to remain diversified in order to capitalize on internal capital available, and other undervalued firms undertake a divestiture. Matsusaka and Nanda (2002) model the trade-off between the benefits of internal capital versus the costs of the agency problem of overinvestment in a diversified firm in the framework of information asymmetry. They derive conditions under which the firm will remain integrated versus refocus through a divestiture. These models, while more holistic in their approach of presenting both diversification and divestiture in a continuum, do not differentiate between the different methods of divestiture/refocusing. Thus, these models do not explain why some firms choose to divest through spin-offs while others do so through carve-outs or asset sales. In our model, we focus on the information opacity of operating costs across divisions of a diversified firm and derive conditions under which only a spin-off is efficient.

The rest of the paper is organized as follows. In Section 2, we present a model of information asymmetry where the outside investors observe only the total costs of the firm and *estimate* the individual division costs in order to value the firm's current and future investment opportunities. We derive conditions under which this information asymmetry leads to a spin-off which improves information transparency of

² Emmanuel and Mehafdi (1994) provide evidence of such manipulation in transfer pricing and management fees in firms.

³ We show that this net undervaluation result does not require that the profits from the current projects of P and S be equal, it only requires that the sensitivity of these profits to costs be similar.

the separated divisions, leading to an increase in the value of the combined firm following the spin-off. In Section 3, we provide the empirical implications of our model. We also discuss the research in the extant literature that provides empirical support for the implications of our model. Section 4 concludes.

2 Information asymmetry and the spin-off decision

2.1. Model and assumptions

Consider a corporation that is made up of two divisions P (Parent) and S (Subsidiary) which operate, possibly, in two different industries. We assume a multi-period model where both these divisions have projects that were initiated at time $t = 0$, and are in progress. For division P, we denote by Π_1^P the profits generated at time $t = 1$, and by Π^P the discounted value at $t = 1$ of all profits generated from the second period onwards from its current project. Π_1^S and Π^S are defined analogously for division S. These profits are decreasing in the operating costs C^P and C^S respectively, of the individual divisions P and S. We assume that there is information asymmetry, about the operating costs of the divisions, between the managers and the outside investors of the firm. Here the operating costs of a division may be viewed as being influenced by the productivity of the division's durable assets, the efficiency of the divisional managers, and industry-wide cost or demand shocks in that division's industry.

At the beginning of each period, the managers learn privately and completely about the total operating costs, C , of the corporation, and about the operating costs of the individual divisions. The outside investors, on the other hand, have only an expectation \bar{c} , about the total operating costs. We allow the outside investors to also have an *expectation* about the +costs that separately affect each division, and the *costs* that are common to both. In other words, $\bar{c} = \alpha + \beta + \delta$, where, α , β , and δ represent the outside investors' expectation of the costs that affect only division P, only division S, and costs that are common to both. At the end of each period, the true *total* operating costs of the entire corporation for that period is known to the outside investors from the total profits of the corporation reported in consolidated financial statements. From this total cost, the outside investors update their beliefs in a Bayesian fashion about the costs of the *individual* divisions. Depending on the cost uncertainty of the individual divisions, the cost estimate of a given division will be an over or under estimate of its true cost.

We write C as the sum of a , b , d , and three normally distributed random variables, each with mean zero and finite variance.

$$C = \alpha + \beta + \delta + \tilde{a} + \tilde{b} + \tilde{d} \quad (1)$$

These random variables \tilde{a} , \tilde{b} , and \tilde{d} capture the outside investors' beliefs about the costs that are not known to them, but are known to the managers. Cost \tilde{a} captures the unknown component of the efficiency of division P's managers, productivity of the durable assets of P, industry-wide cost and demand shocks in P's industry, and costs due to other characteristics that are specific to P, such as its location, etc. Cost \tilde{b} is defined analogously for division S. Cost \tilde{d} captures the unknown component of the costs that are common to both P and S. This includes costs (benefits) due to any negative (positive) synergies from operating together, and also includes costs or benefits from a single top management controlling both divisions P and S. Examples of positive synergies, i.e., negative costs, include gains due to non-replication of operations, and other economies of scope. Negative synergies may arise not only due to the costs associated with managing unrelated lines of business, and due to other diseconomies of scope, but also indirectly from the product market. A case in point is that of Humana Inc., whose HMO operations impeded its hospital operations because the rival HMOs stopped referring patients to Humana Hospitals.⁴ Let a , b , and d denote the realizations of the three random variables, which are individually unobserved by the outside investors. Also the variance of the random variables are denoted by σ_a^2 , σ_b^2 , and σ_d^2 , respectively. Although \tilde{a} , \tilde{b} , and \tilde{d} are independent random variables, each is assumed to be positively serially correlated across time. Thus at the end of each period, the investors revise their beliefs about the profits in the *subsequent* periods using their estimate of the operating costs of the individual divisions this period.

The divisions P and S are assumed to have different *future* growth opportunities that are independent of their projects that are in progress. Without loss of generality, we assume that P has a new investment opportunity that requires an investment of \$I at time $t = 1$, which generates profits from $t = 2$ onwards. The discounted value of these cash inflows at $t = 1$ is denoted by $g(C^P, I)$ where C^P is the true operating cost of P. g satisfies the following conditions:

$$g_1 < 0, \quad g_2 > 0, \quad g_{21} < 0, \quad g_{22} < 0 \quad \text{and} \quad g(\alpha+a, I) - I > 0 \quad (2)$$

⁴ See "Humana Inc.: Managing in a Changing Industry," Harvard Business School Case, March 1994. A related problem was also a source of negative synergies for the telecommunications equipment division of AT&T, which lost potential customers who would not do business with the equipment division since they viewed AT&T as their product market rival.

where, subscripts 1 and 2 denote partial derivatives with respect to C^P and I respectively. The first and the second conditions indicate that cash inflows are decreasing in operating costs and increasing in investment. The third and the fourth conditions assume that the marginal returns to investment are decreasing in investment and costs. The final inequality states that based on the true operating costs and efficiency of P, the new project of P is a positive NPV project. We also assume that as the negative synergies between P and S increase, the cashflows from the new project decrease to zero, if the divisions P and S remain together. This is formally stated below.

$$\lim_{\delta + d \rightarrow \infty} g(\alpha + \delta / 2 + a + d / 2, I) = 0 \quad (3)$$

Observe that knowledge of C^P is required in order to value the new project at $t = 1$. At time $t = 1$, the outside investors observe only the total operating costs of the entire firm, and from this they revise their beliefs about the operating costs of division P, which is then used to value the new project.

Recall that at $t = 1$, the existing projects for P and S generate a total discounted present value of perceived profits Π^P and Π^S . These profits are assumed to be linear and decreasing at the same rate in the costs of the individual divisions. This implies that $\frac{\partial \Pi^P}{\partial C^P} = \frac{\partial \Pi^S}{\partial C^S}$. Hence, we can define another linear function Π which is similar in functional form to Π^P and Π^S , such that

$$\Pi^P(C^P) + \Pi^S(C^S) = \Pi(C^P + C^S). \quad (4)$$

We assume that as the operating costs of the firm increase, the perceived profits Π decrease to zero. The stock price of the corporation at any point in time depends on the expected cash flow from its existing projects and the expected cash flows from the new (yet to be undertaken) investment opportunities. We assume that the firm is cash constrained and must therefore raise external capital if it decides to undertake the new project. The value of the securities issued to finance P's new project will depend on investors' perception about the profitability of this new project. Since the model is one of imperfect information, and since costs are correlated across time, the outside investors use their *estimate* about P's cost and efficiency at $t = 1$ to determine the profitability of the project. Thus if the estimate of the cost is higher than P's true cost, the securities issued to raise capital will be undervalued. The firm can mitigate its loss due to this undervaluation, by engaging in a spin-off that dissociates the two divisions P and S, before the

first period profits are revealed (which is also before the capital is raised for the new investment).

The time sequence of decisions and events in the model is as follows. At $t = 0$ the firm is made up of two divisions P and S each with projects in progress. At $t = 1$ there are four stages. In the first stage, before the first period profits are realized, the firm decides on the spin-off decision. If the firm engages in a spin-off, the two divisions (now two separate firms) operate independently and are monitored separately by the capital markets. In the second stage at $t = 1$ profits of P and S are observed separately. On the other hand, if there is no spin-off in the first stage (at $t = 1$) then in the second stage only the combined firm profits are observed. In the third stage, either the independent firm P or the combined firm P+S (if there is no spin-off) decides on whether to issue equity and undertake the new project. If it decides to raise capital, then in the final stage the firm makes the investment of $\$I$ in the new project.

2.2. The spin-off decision

Let C_s^P represent the $t = 1$ estimate of C^P if the firm undertakes a spin-off. However, if the firm does not engage in a spin-off, let C_{NS}^P represent the estimate of C^P obtained from the total cost of the combined firm. C_s^S and C_{NS}^S are defined analogously. We assume that the managers act to maximize current shareholder value. We also assume that the firm is cash constrained and is therefore forced to issue equity to raise a fixed amount of $\$I$ in order to finance the new investment opportunity of P.⁵ Investors who buy the new equity, price the new equity based on their information set. In particular, if the firm does not spin-off S, then the investors' estimate of C^P is C_{NS}^P , and they use this to value both the new investment opportunity of P and to revise their beliefs about the profitability of the existing projects of P. However, if the firm undertakes a spin-off then the investors' estimate of C^P is C_s^P .

Let y be the fraction of the total firm that must be offered to the new equity holders in order to raise $\$I$. Of course, y depends on whether or not the firm has undertaken a spin-off, since the perceived costs and hence cash flows depend on whether the firm has dissociated S. Also y is set so that the new shareholders receive their required rate of return. We assume that investors are risk neutral, and without loss of generality set the interest rate to be zero.

In the following propositions, we develop conditions on the role of information asymmetry about

⁵ The firm may also issue debt to finance the new project, and the results are similar to the equity issuance case. We provide a discussion of this case in a footnote later in the paper.

the true cost parameter of P and S in determining the optimality of a spin-off.

Proposition 1: $C_S^P < C_{NS}^P$ if

$$\frac{a - \delta / 2}{a + b + d} < \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2}$$

if $(a + b + d) > 0$

$$\frac{a - \delta / 2}{a + b + d} > \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2}$$

if $(a + b + d) < 0$.

Proof: If there is no spin-off in the first stage of $t = 1$, then the investors observe the total cost C and obtain $(a+b+d)$ using their knowledge of $(\alpha+\beta+\delta)$. The individual division costs of P and S are estimated from $(a+b+d)$ by solving a signal-extraction problem. The outside investors' estimate of the cost associated with division P is

$$C_{NS}^P = (\alpha + \delta / 2) + \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} (a + b + d) \quad (5)$$

If there is a spin-off, then the investors observe a and hence

$$C_S^P = \alpha + a .$$

And, $C_S^P < C_{NS}^P$ if

$$a < \delta / 2 + \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} (a + b + d)$$

$$\Rightarrow \frac{a - \delta / 2}{a + b + d} < \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} \quad \text{if } (a+b+d) > 0$$

$$F = \text{Firm Value of P} + \text{Firm Value of S} = \{g(C_S^P, I) + \Pi^P(C_S^P)\} + \{\Pi^S(C_S^S)\}$$

where $C_S^P = \alpha + a$ and $C_S^S = \beta + b$.

Since P is a separate firm after the spin-off, and it issues shares to finance the investment, we have

$$y_1 \{g(C_S^P, I) + \Pi^P(C_S^P)\} = I$$

$$(1 - y_1) \{g(C_S^P, I) + \Pi^P(C_S^P)\} + \Pi^S(C_S^S) = g(C_S^P, I) + \Pi^P(C_S^P) + \Pi^S(C_S^S) - I$$

and using (4) the above may be simplified to

$$= g(\alpha + a, I) + \Pi(\alpha + \beta + a + b) - I . \quad (W)$$

$$\frac{a - \delta / 2}{a + b + d} > \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} \quad \text{if } (a+b+d) < 0.$$

The intuition behind the above proposition is straightforward. When the combined firm's cost is high ($a+b+d > 0$), a spin-off will result in a lower estimated cost for division P if its true division-specific cost, a , that is unobservable to the outside investors is small, or if there are negative synergies in being associated with division S ($\delta > 0$). Alternatively, the spin-off will result in a lower estimated cost for division P if the "blame" for the high total cost is predominantly assigned either to P or to the cost component that is common to P and S (i.e., $\sigma_a^2 + \sigma_d^2 / 2$ is large). On the other hand, if the combined firm's cost is low ($a+b+d < 0$), a spin-off will result in a lower estimated cost for division P if its true division-specific cost, a , is even smaller than $a+b+d$, or if there are negative synergies in being associated with division S ($\delta > 0$). Also the spin-off will result in a lower estimated cost for division P if the "credit" for the low total cost is predominantly assigned to S (i.e., σ_b^2 is large).

Proposition 2: There exists an $M > 0$ such that a spin-off is optimal to the shareholders of the firm if $(\delta+d) > M$. In other words, the existence of sufficiently large negative synergies between P and S ensures the optimality of a spin-off.

Proof: The firm faces the following four options. (i) Spin-off S and then finance the new project, (ii) Spin-off S but not undertake the new project, (iii) Not spin-off S and not undertake the new project, and (iv) Not spin-off S but undertake the new project. Let the shareholder value of the firm under each of these four options be denoted by W, X, Y, and Z respectively. The value to the existing shareholders in each of those four cases is

(i) Spin-off and then finance the new project.

where y_1 = fraction of P given to new shareholders.

$$\Rightarrow y_1 = \frac{I}{\{g(C_S^P, I) + \Pi^P(C_S^P)\}} .$$

The current shareholder value is then,

(ii) If the firm spins-off S but decides not to undertake the new project, then

$$P = \Pi^P(C_S^P) \quad \text{and} \quad S = \Pi^S(C_S^S) \quad \text{and} \quad \Pi(C_S^P + C_S^S) = \Pi(\alpha + \beta + a + b).$$

$$P + S = \Pi^P(C_S^P) + \Pi^S(C_S^S). \quad (X)$$

The current shareholder value is

(iii) If the firm decides not to spin-off and decides not to undertake the new project, then the value of the current shareholders is

$$\Pi^P(C_{NS}^P) + \Pi^S(C_{NS}^S) = \Pi(C_{NS}^P + C_{NS}^S)$$

$$\text{where } C_{NS}^P = \alpha + \delta / 2 + \frac{\sigma_a^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} (a + b + d)$$

$$\text{and } C_{NS}^S = \beta + \delta / 2 + \frac{\sigma_b^2 + \sigma_d^2 / 2}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2} (a + b + d) \quad \text{using (5).}$$

The current shareholder value is then

$$\Pi(\alpha + \beta + \delta + (\sigma_a^2 + \sigma_b^2 + \sigma_d^2) V) \quad \text{where } V = \frac{a + b + d}{\sigma_a^2 + \sigma_b^2 + \sigma_d^2}.$$

$$= \Pi(\alpha + \beta + \delta + a + b + d). \quad (Y)$$

(iv) Finally, if the firm decides not to spin-off S but issues new equity (possibly mispriced) to finance the new investment then

y_2 = Fraction of total firm (P+S) given to new shareholders is such that

$$y_2 \{g(C_{NS}^P, I) + \Pi^P(C_{NS}^P) + \Pi^S(C_{NS}^S)\} = I.$$

But old shareholder value is $(1 - y_2)$ times the discounted present value of the *true cashflows* to the firm.

$$= (1 - y_2) \{g(\alpha + \delta / 2 + a + d / 2, I)\} +$$

$$(1 - y_2) \{\Pi^P(\alpha + \delta / 2 + a + d / 2) + \Pi^S(\beta + \delta / 2 + b + d / 2)\}$$

$$= (1 - y_2) \{g(\alpha + \delta / 2 + a + d / 2, I) + \Pi(\alpha + \beta + \delta + a + b + d)\}$$

(Z)

Observe that a spin-off is optimal if and only if either

$$\{W > Y \text{ and } W > Z\} \text{ or } \{X > Y \text{ and } X > Z\} \text{ holds.}$$

From (2) and (3), and from the fact that Π decreases to zero as costs increase, we know that

$$g(a+a, I) - I > 0,$$

$$\text{Lt}_{\delta + d \rightarrow \infty} g(\alpha + \delta / 2 + a + d / 2, I) = 0,$$

$$\text{Lt}_{\delta + d \rightarrow \infty} \Pi(\alpha + \beta + \delta + a + b + d) = 0,$$

Finally, using the conditions above, we know that for every $W \in \mathfrak{R}$, there exists $M > 0$ such that $(\delta+d) > M$ implies that $W > Z$. Also, if $(\delta+d) > 0$ then $W > Y$. Hence, there exists an $M > 0$ such that $W > Y$ and $W > Z$ if $(\delta+d) > M$. ♦

This proposition may be understood as follows. If the firm has large negative synergies when the divisions P and S operate together, whether or not this is perceived by the market, it is optimal to engage in a spin-off. Since the new project has a positive NPV

when P operates alone, and since the synergies between P and S are negative, dissociating the divisions and taking up the project is better than not separating and not undertaking the new project. However, if the divisions stay together and the firm now issues equity to finance the new project, the current shareholders may gain from issuing overpriced equity. Equivalently the fraction of the firm that must be sold to raise the investment of \$I is small and the current shareholders retain a larger portion of the firm.

On the other hand, due to the negative synergies the true cashflows to the shareholders are significantly lower when the divisions are together. When the negative synergies are sufficiently large the loss in value from the divisions P and S operating together is greater than the gains from issuing overpriced securities.

Suppose negative synergies are present but are not sufficiently large, and if the higher total cost due to the negative synergies is blamed on division S, then the firm may be able to issue overpriced equity when the divisions remain together. Observe that the shares issued will reflect in part the value of the new project. And since the value of the new project depends only on the operating costs of division P, which is now underestimated, the securities will be overpriced. This gain could dominate the loss from the depressed true cash flows to the stockholders due to the negative synergies. Now a spin-off is optimal only if the gains from issuing overpriced securities is not large. A sufficient condition for this to obtain is that division P also be blamed for the higher cost. We establish

$$\text{Also, } Z = \frac{g(\alpha + \delta / 2 + a + d / 2, I) + \Pi(\alpha + \beta + \delta + a + b + d)}{g(\alpha + \delta / 2 + \sigma_a^2 V + (\sigma_d^2 / 2) V, I) + \Pi(\alpha + \beta + \delta + a + b + d)} I$$

The first two terms of W are greater than the first two terms of Z since $(\delta + d) > 0$. Also, the last term of Z is greater than I because $(\delta + \sigma_a^2 V) > (\delta + d)$, $\sigma_a^2 V > a$, and g and Π are decreasing in costs. Therefore, $W > Z$. ♦

The above corollary shows that if the negative synergies are not high then a spin-off is optimal *only if there is an adverse effect due to information asymmetry*.

$$g(\alpha + a, I) + \Pi(\alpha + \beta + a + b) - I \tag{W1}$$

$$\Pi(\alpha + \beta + a + b) \tag{X1}$$

$$\Pi(\alpha + \beta + a + b) \tag{Y1}$$

$$g(\alpha + a, I) + \Pi(\alpha + \beta + a + b) - \frac{g(\alpha + a, I) + \Pi(\alpha + \beta + a + b)}{g(\alpha + \sigma_a^2 V, I) + \Pi(\alpha + \beta + a + b)} I \tag{Z1}$$

A sufficient condition for the spin-off to be optimal is $W1 > Y1$ and $W1 > Z1$. Using (2), $W1 > Y1$. The first two terms of W1 and Z1 are identical, however, the last term of Z1 is less than I if $\sigma_a^2 V > a$. Thus a spin-off is optimal if $\sigma_a^2 V > a$. ♦

Abstracting from synergies, a spin-off decision is driven by considerations relating to the under or over valuation of securities issued to raise capital. If the perceived cost of division P is greater than its true cost then the value of its new project is underestimated,

below that if the perceived negative synergies are greater than the true synergies, and if the perceived division-specific cost of P is greater than its true cost then the gains due to overpricing are small.

Corollary 1: Let $K = \inf\{M: \text{Spin-off is optimal}\}$. If $K > (\delta + \sigma_d^2 V)$, $(\delta + d) > 0$, then a sufficient condition for the optimality of a spin-off is that $(\delta + \sigma_a^2 V) > (\delta + d)$ and $\sigma_a^2 V > a$. In other words, if the negative synergies between P and S are not high, then a sufficient condition for the optimality of a spin-off is (i) the perceived negative synergies be higher than the true negative synergies, and (ii) the perceived division-specific cost of P be higher than its true cost.

Proof: For a spin-off to be optimal, we must establish that $W > Y$ and $W > Z$. Observe that since $(\delta + \sigma_d^2 V) + (\delta + d) > 0$, $g(\alpha + a, I) - I > 0$, and Π is decreasing in costs, $W > Y$.

Proposition 3: Ignoring synergies (both negative and positive) between the divisions P and S, a sufficient condition for the optimality of the spin-off decision is that $\sigma_a^2 V > a$.

Proof: Ignoring synergies W, X, Y, and Z may be redefined as follows:

leading to the undervaluation of the securities issued to finance the project. Through a spin-off, division P dissociates itself from S, which enables the market to accurately estimate the costs of P, and thus mitigates the undervaluation. However, the spin-off will also reveal the true high cost of division S and will result in the market revising the projects of S downward. Thus a spin-off may result in a revision in valuation of P and S that could potentially offset each other. Why then is it optimal for the shareholders to engage in a spin-off? Observe that by assuming differential

investment opportunities for P and S, the overvaluation of S before a spin-off stems from an overvaluation of its current cash flows, while the undervaluation of P stems from the undervaluation of both its current operations *and* its future opportunities. Thus the undervaluation of division P is more severe than the overvaluation of S. Hence, a spin-off creates value by reducing the undervaluation of securities issued by P.⁶

The model demonstrates that a dissociation of the two divisions of a firm improves the perceived costs and efficiency, and therefore increases the value of the securities issued by the high-growth division of the firm. If dissociation is the primary reason for increase in value, any other mode of divestiture should work just as well as spin-offs. However, in contrast to spin-offs, other methods of dissociation such as asset sales and equity carve-outs all involve raising cash for the assets or division sold. Since, in each of these cases, market valuation of the asset is undertaken *before* dissociation (i.e., before information asymmetry is reduced), the under-valuation due to information asymmetry is not eliminated. In fact, this problem is identical to the one faced by the firm in our model. The primary motivation for dissociation is the undervaluation of equity and that problem remains unresolved in an equity carve-out or an asset sale. Thus, for firms subject to information asymmetry, a divestiture in exchange for cash is a costly mode of dissociation, and is inferior to spin-offs.

3 Discussion and empirical implications

There are several empirical implications that are generated by our model. One implication of the model is that undervalued multi-divisional firms are more likely to engage in spin-offs. In our model, a spin-off is an action that reveals the true value of the firm. By dissociating the divisions through a spin-off, the individual divisions' operating costs and efficiency

are revealed to the market. So, firms undertaking spin-offs should show higher levels of information asymmetry prior to the spin-off relative to similar, multi-division firms that do not undertake spin-offs, and the information asymmetry should decrease post spin-off. Krishnaswami and Subramaniam (1999) empirically test precisely this implication, and find strong support for it. They find that prior to the spin-offs, information asymmetry levels, as measured by precision of analyst forecasts, are higher in firms that undertake spin-offs compared to similar firms that do not undertake spin-offs. Information asymmetry levels decrease in the parent firms after the spin-off. Furthermore, using logistic regressions, Krishnaswami and Subramaniam (1999) also find that the degree of information asymmetry affects the likelihood of these firms undertaking spin-offs.

Another implication that falls out of our model is that the share price reaction to the announcement of a spin-off will be positive. This is because a spin-off is a voluntary divestiture transaction that is undertaken by firms that want to reveal their true value. There is wide support in the literature for this implication. Hite and Owers (1983), Miles and Rosenfeld (1983), Allen, Lummer, McConnell and Reed (1995), Desai and Jain (1999), Krishnaswami and Subramaniam (1999), Mulherin and Boone (2000), Veld and Veld-Merkoulova (2004) are just a few researchers that document positive announcement period gains around spin-off announcements for U.S. and international firms. They record average abnormal returns that range from 1.7% to 5.6% in various windows around spin-off announcements. A related implication of our model is that if information asymmetry motivates firms to undertake spin-offs, and the positive announcement period gains are a consequence of the anticipated improvement in information transparency, then the abnormal returns should be related to the level of information asymmetry. Krishnaswami and Subramaniam (1999) find strong support for this implication.

Our model also predicts that firms that have divisions with differential growth opportunities and that are in need of external capital will engage in spin-offs that separate a high-growth division from a low-growth division. Thus, a prediction of the theory is that the parent and the spun-off subsidiary will have differential growth prospects. Consistent with this implication, Gertner, Powers, and Scharfstein (2002) document that the spun-off subsidiaries and their parent firms have significantly different growth opportunities (as measured by the ratio of market value to book value of assets) in the year of the spin-off. Specifically, they find that the spun-off subsidiaries have lower growth opportunities than their parents. A related implication of our model is that prior to the spin-off, high growth divisions of these firms have lower levels of investment relative to their stand-alone counterparts because they are capital constrained. Ahn and Denis (2004) document that

⁶ The information asymmetry motivation for a spin-off disappears in our model if the firm could issue riskless debt. This is because the value of riskless debt does not depend on the value of the firm's projects. However, if the firm has to choose between *risky* debt and equity, and opts for risky debt, then all our results remain essentially unchanged. With risky debt, it must be noted that the true price of debt will be higher when the combined firm P+S issues debt, than when the separated division P issues debt. This is due to the coinsurance effect of the combined "collateral" of P+S. The lower price for debt after the separation is not undervaluation, nor is it due to information asymmetry. The debt is correctly priced given the underlying collateral in the two cases. In the presence of information asymmetry, debt of the combined firm will be undervalued. We show that the undervaluation is eliminated when the two divisions are separated. Therefore, after the spin-off, in the valuation equation in a model with debt issues there are two terms - one representing the correction of undervaluation, and the other representing the change in price due to the change in collateral base. This complicates the model but does not alter the results or provide any additional insights. Hence, we focus only on equity issues.

prior to a spin-off, investment in high-q divisions of these firms is significantly lower than in corresponding single segment firms in the industry. After the spin-off the relative investment levels and investment efficiency of the high-q segments increase.

Finally, in our model, capital constrained firms with high growth opportunities that suffer from undervaluation due to information asymmetry, undertake spin-offs in order to improve the transparency of information so that the undervaluation is mitigated. This allows these firms to raise fairly-priced external capital post-spin-off. We should therefore expect to see higher frequency and magnitude of capital raising activities in these firm post spin-off. Krishnaswami and Subramaniam (1999) study the frequency of equity and debt issues by these firms in a three year period prior to and following spin-offs. They document that firms that engage in spin-offs raise significantly more capital (both debt and equity) after the spin-off relative to the corresponding levels prior to the spin-off. Moreover, these firms show lower external issues of capital prior to the spin-off, measured relative to their industry counterparts. The external capital raising frequency and magnitude both increase significantly post spin-off, relative to the levels of their industry peers.

4 Conclusion

In this study, we formally model the role of information asymmetry in motivating corporate spin-offs. When firms operate in very different industries, analysts and other market participants sometimes fail to understand or recognize sources of value clearly. A divestiture by an undervalued conglomerate could improve valuation because it increases information disclosure and transparency, allowing the market to discern value more clearly. We argue that although there are many different modes of divestitures, such as asset sales and equity carve-outs, when there is undervaluation due to information asymmetry, spin-offs are the uniquely optimal mode of divestiture. The intuition lies in the fact that mitigating information asymmetry requires that the individual divisions of a conglomerate trade as separate entities in the market, thereby allowing for following by analysts with industry-specific expertise. There is also more credible disclosure of operational and financial details of the now separated independent entities. These improvements in firm transparency allow for better recognition of value sources by the market. Although there is such separation of entities in asset sales and equity carve-outs, these are costly modes of divestiture for the firm since they involve the valuation and sale of undervalued assets *prior* to separation of divisions and correction of undervaluation. Spin-offs do not impose this cost because there is no sale of assets prior to separation. Our formal model shows that conglomerates needing to raise capital, but undervalued because of

information asymmetry, will find it optimal to separate their divisions through a spin-off, eliminate the undervaluation, and then issue equity once the undervaluation is corrected.

Our paper develops a theoretical model of information asymmetry between the managers and the outside investors, where the information asymmetry is about the operating costs and efficiency of the individual divisions of a firm with multiple divisions and with differential growth opportunities across the divisions. In our model, investors use a signal extraction rule to estimate the efficiency of the individual divisions from the total cost of the combined firm. In this framework, we show that if investors overestimate the cost of the high-growth division, the securities issued by the firm to finance new investments of its high-growth division are undervalued. This undervaluation can be mitigated by dissociating the divisions through a spin-off. A spin-off improves the information transparency of each of the dissociated divisions, thereby mitigating the undervaluation of the divisions, and resulting in an overall better market valuation of the separated divisions compared to that of the combined firm.

We also highlight the different empirical implications that fall out of our model. There is substantial support in the literature for each of our testable implications. We thus provide a theoretical framework for analyzing spin-offs, where we present conditions under which a spin-off has a comparative advantage over other methods of divestiture, and show that there is empirical support for the model in the extant literature.

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