INFORMATION ASYMMETRY, VALUATION, AND THE CORPORATE SPIN-OFF DECISION

A Dissertation

by

SUDHA KRISHNASWAMI

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 1996

Major Subject: Finance

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ABSTRACT

Information Asymmetry, Valuation, and the Corporate

Spin-off Decision. (August 1996)

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I analyze the information hypothesis to explain why firms divest divisions through spin-offs. A spin-off is a pro-rata distribution of shares of a subsidiary of a firm to the shareholders of the firm. The operations and management of the subsidiary are then separated from those of the parent. The information hypothesis argues that a spin-off improves market valuation of the separated divisions by reducing the information asymmetry about the firm.

I construct a theoretical model of information asymmetry between the managers and the outside investors of a multi-division firm, where the investors use a signal extraction rule to estimate the cost and efficiency of the individual divisions from the total cost of the combined firm. I show that 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. Thus, even in the absence of negative synergies, information asymmetry about a firm's operating costs and efficiency is by itself a sufficient motive for firms to engage in spin-offs.

Using analysts' earnings forecast errors, the standard deviation of the forecasts, and the fraction of intangible assets of a firm as measures of information asymmetry, I find that sample firms have higher information dissemination problems than their industry and size matched controls. I also find that information problems decrease after the spin-off. The gains around spin-offs are positively related to earnings forecast errors. This relation is more pronounced for firms which spin-off related subsidiaries, i.e., for firms that should have lower negative synergies between divisions. This finding is consistent with the notion that while negative synergies may play a role in explaining spin-off gains, mitigation of information problems is also an important factor. The results are robust to other measures of information asymmetry. Finally, consistent with the predictions of the model, I find that firms that have larger growth opportunities, but are cash-constrained (firms that have a pressing need for external capital), show a higher propensity to engage in spin-offs.

To my Parents

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I am truly indebted to Scott Lee, the chair of my dissertation committee, who gave so generously of his time, ideas, and guidance, not only during the dissertation phase but also through the rest of my graduate program at Texas A&M. But for Scott, this thesis would be a chaos of ideas with no momentum, and I would still be in the ranks of the dissertation challenged.

Finally, without the help of my husband Venkat, this dissertation would have taken twice the time to complete, and would have only been half as much fun.

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I. INTRODUCTION

Over the last decade, mergers, acquisitions, and other forms of expansion in operations have declined sharply, and most conglomerates have resorted to downsizing and focusing their businesses to their core competencies.[1] Corporate spin-offs are a widely used mechanism for restructuring firms' financial and real assets. A spin-off is a pro-rata distribution of shares of a subsidiary of a firm to the shareholders of the firm. The operations and management of the subsidiary are then separated from those of the parent. There is neither a dilution of equity, nor a transfer of ownership from the current shareholders. Spin-offs constitute a unique and interesting mode of divesting assets since they do not involve any cash transactions. Thus, they cannot be motivated by a desire to generate cash to pay off debt, as is often the case with other modes of divestitures. The popularity of spin-offs as a mode of divestiture can be seen from the fact that the number of spin-offs in the 1980s was more than double the number in the previous decades.

Extant literature documents a positive stock price reaction around announcements of spin-offs. These abnormal returns are in the order of 2.4% to 4.3% as documented in different time periods and in different studies.[2] More recently, Cusatis, Miles, and Woolridge (1993) document that even long-term performance of firms involved in spin-offs is abnormally positive. Various reasons have been provided by academicians to explain these gains, foremost among them being improvement in focus and the elimination of negative synergies, transfer of wealth from

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This dissertation follows the style of the *Journal of Finance*.

[1] This phenomenon has been comprehensively documented in Comment and Jarrell (1995), John and Ofek (1995), Hoskisson and Hitt (1994), and Bhagat, Shleifer, and Vishny (1990).

[2] See Hite and Owers (1983), Schipper and Smith (1983), Miles and Rosenfeld (1983), and Rosenfeld (1984) among others.

bondholders to shareholders, tax and regulatory advantages, and improved incentives from recontracting. On the other hand, practitioners and the popular press usually propose an information related motivation for spin-offs. For instance, CEOs of most firms involved in spin-offs claim that the spin-off improves the *perceived* market value of both the parent and the subsidiary. They argue that as separate entities, the consequence of a (temporary) low in the performance of one entity does not spill over and adversely affect the other.[3]

If improvement in focus, elimination of negative synergies, or tax and regulatory considerations are the only motivations behind the separation of a parent from its subsidiary, then any other type of divestiture would have done just as well as a spin-off. These motivations explain divestitures in general, but do not offer specific insights into the comparative advantage of divesting through a spin-off. Spin-offs differ from other modes of divestitures such as asset sales and equity carve-outs in that there is neither a valuation of assets, nor a cash inflow to the firm from a spin-off transaction. If the firm is currently undervalued, as the CEOs and practitioners contend, then a spin-off is a particularly appropriate mode of separation because other types of divestitures require valuation of the subsidiary, which leads to costly underpricing. Further, if the separation of an undervalued firm into individually operated units, with separately traded shares, improves the accuracy of information processing about the firm, then the sum of the separated parts may be greater than the market value of the combined firm. This would obtain even if there are no negative synergies or tax and regulatory considerations. In this paper, I explore this

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[3] The following quotes in the popular press about two recent spin-off proposals emphasize this reasoning.
"... independently traded shares of the engineering unit would produce a higher overall valuation for Raytheon." (Dennis J. Picard, CEO of Raytheon, WSJ, March 6, 1995) and "... Wall Street was undervaluing the food unit and would give it a juicy premium as a stand alone unit." (WSJ on the Nabisco Spin-off, March 17, 1995).

"information hypothesis" to explain why firms may sometimes find it optimal to divest only through spin-offs.

The information hypothesis argues that valuation gains in a spin-off arise from the overall better market valuation of the separated units compared to valuation of units that are part of a large combined firm. Such an improvement in market valuation will arise if the divisions are better able to convey information about their future prospects when they are separate entities than when they are a combined unit. This would especially apply to a firm that suffers from undervaluation due to information asymmetry about the operating costs of its different divisions. I construct a simple model which shows that even in the absence of negative synergies, undervaluation due to information asymmetry about a firm's operating costs is by itself a sufficient motive for firms to engage in spin-offs. I also provide empirical evidence that supports this information hypothesis.

In the model developed in this paper, I assume that there is information asymmetry between the managers and the outside investors, about the operating costs and efficiency of the individual divisions of a firm. Here 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, I 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.

Consider a firm that is made up of two divisions P (Parent) and S (Subsidiary) which operate, possibly, in two different industries. I assume a multiperiod 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 is not known to the outside investors, and can only be inferred from the total costs. After observing the total costs, the 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, why should the knowledge of the individual divisions' efficiency and profitability matter? To justify this, I assume that P and S have differential growth opportunities, and that 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. 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).

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. Thus if investors overestimate division P's costs due to its association with S, a spin-off will result in a correct estimation of the costs, and P's securities will be correctly valued. Why not just disclose the division specific information without separating the divisions? 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.[4] A spin-off, on the other hand, formally separates the operations and assets of the divisions and no manipulation of costs is possible since there are no shared costs.

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 offset each other. Hence, 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.[5] The spin-off creates value by reducing the undervaluation of P's securities.

I also analyze the empirical significance of information asymmetry in explaining the incidence of, and the gains associated with spin-offs. I find that firms that engage in spin-offs have higher information dissemination problems than their industry and size matched control firms. In particular, the analysts' earnings forecast errors and the standard deviation of the earnings forecasts for the sample of firms that divest through spin-offs are significantly higher than that of their control firms. I also find that the forecast errors of the sample firms decrease after the spin-off, indicating that the spin-off may mitigate information problems.

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[4] For evidence of manipulation in transfer pricing and management fees, see Emmanuel and Mehafdi (1994).

[5] 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 average two-day abnormal return around the announcement of spin-offs is larger for firms with higher earnings forecast errors. This result is robust to other measures of information asymmetry. I find that firms where valuation is particularly difficult, such as those with a higher fraction of intangible assets, earn higher abnormal returns in the event of a spin-off. I also find that for firms which spin-off related subsidiaries, i.e., firms that should have lower negative synergies, information asymmetry variables are a more important explanator of the abnormal returns. This supports the theory that while negative synergies may play a role in explaining spin-off gains, mitigation of information problems is also an important factor. Finally, consistent with the predictions of the model, I find that firms that have larger growth opportunities, but are cash-constrained (firms that have a pressing need for external capital), show a higher propensity to engage in spin-offs.

The rest of the paper is organized as follows. In Section II, I review the prior evidence and discuss some motivations for spin-offs. In Section III, I 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. I derive conditions under which this information asymmetry leads to a spin-off. This section also presents the main empirical implications tested in this paper. In Section IV, I describe the sample selection procedure, the sample characteristics, and the measures of information asymmetry used in the paper. The results of both the univariate and regression analyses are discussed in Section V. Section VI provides some extensions and concluding comments.

II. PRIOR EVIDENCE ON SPIN-OFFS

Evidence from the stock market as documented in studies by Hite and Owers (1983), Miles and Rosenfeld (1983), and Schipper and Smith (1983) shows that there are significant positive abnormal returns around spin-off announcements. More recently, Cusatis, Miles, and Woolridge (1993) document that even long-term performance of firms involved in spin-offs is abnormally positive. Several reasons have been provided in the literature to explain these gains, and in what follows I describe some of these briefly.

Hite and Owers (1983), Schipper and Smith (1983), and Daley, Mehrotra, and Sivakumar (1995) argue that gains from spin-off announcements could arise from the improvement in focus, and the anticipated elimination of negative synergies between the parent and the subsidiary. Cross-subsidization and lack of focus are likely to be particularly high for firms whose subsidiaries are operating in unrelated lines of business. Schipper and Smith (1983) use two different measures to classify spin-offs that involve dissimilar units. Their first measure uses SIC codes to classify firms, while their second measure uses structural shifts in the time-series behavior of the stock returns of the firm around the event. Consistent with the focus argument, they find that over one-third of their sample did involve separation of diverse units. Hite and Owers (1983) classify firms based on the reasons given by the firms for the spin-off, and find that the subsample where the motivation was improvement in focus exhibits the largest abnormal returns in the interval (-50, Completion date). Daley, Mehrotra, and Sivakumar (1995) also document significantly larger positive abnormal returns in the year *after* the event, for spin-offs that separate divisions that operate in different industries. These cross-industry spin-offs are also followed by improvement in accounting-based performance measures in the parent in the year after the spin-off.

The transfer of wealth hypothesis argues that during a spin-off, the assets and liabilities are restructured in a manner that involves a transfer of wealth from the bondholders and other stakeholders to the shareholders of the firm. Parrino (1994) in a case study of the Marriott spin-off finds that the firm created a subsidiary (Marriott International) which contained more than 50% of the assets of the firm with little or no debt, while the parent (Host Marriott) retained the remainder of the assets and virtually all of the long-term debt. Thus the spin-off not only reduced the size of the collateral on Marriott's existing debt, but also reduced the bondholder claims on cashflows from the business. This resulted in a significantly large stock price increase and an associated decrease in the value of its debt and other senior securities.[6] However, studies by Hite and Owers (1983) and Schipper and Smith (1983) find no evidence of wealth transfers on average in a large sample of spin-offs, even though it can occur in isolated cases. Schipper and Smith (1983) examine 93 spin-offs and find that the announcement period bond returns are not significantly different from zero. Further they find that there is a decline in bond rating after the spin-off in only two cases. The evidence in Hite and Owers (1983) which shows that the bond returns around the spin-off announcement are insignificant, also fails to support the wealth transfer hypothesis.

Aron (1991) demonstrates that managerial compensation that is based on their individual division's productivity and efficiency improve managers' current incentives. Her conclusion stems from the fact that the stock value of an independent product line is a cleaner signal of managerial productivity than when the product line is part of a larger, diverse firm. The recontracting effectiveness hypothesis is based on a similar

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[6] Although lawsuits by the bondholders resulted in subsequent modifications to the spin-off which reduced their losses, the value of the debt remained about $185 million below its value before the

reasoning, and argues that the gains from spin-offs arise from unique contracts after the restructuring that improve the incentives of the different stakeholders of the firm. Seward and Walsh (1995) in a study of 78 spin-offs find that after the spin-off both the boards of directors and the compensation committees are comprised of a majority of outside directors, suggesting the implementation of efficient internal governance and control mechanisms. They also find that the compensation of the CEO of the spun-off subsidiary is typically performance-contingent. However, they find that the gains around spin-offs are not statistically related to these improvements in contracting efficiency.

Allen, Lummer, McConnell, and Reed (1995) examine whether the abnormal returns generated at the announcement of spin-offs is a consequence of the correction of a prior mistake. They argue that a spin-off is the result of an acquirer divesting an unwise acquisition made in the past. The positive abnormal return at the announcement of the spin-off represents the re-creation of value that was destroyed at the time of the earlier acquisition. Allen, *et al.*, in their analysis of a sample of spin-offs that originated as previous acquisitions, document negative abnormal returns around the announcement of the original acquisition, and positive abnormal returns around the announcement of the subsequent spin-off. Further, they find that these two abnormal returns are negatively correlated, from which they conclude that their "correction-of-a-mistake" conjecture is a viable explanation of the value gains surrounding their sample of spin-offs.

Schipper and Smith (1983) explore tax and regulatory motives for spin-offs. They argue that a regulated firm may be able to spin-off a subsidiary in a fashion that results in one of either the parent or the subsidiary escaping the external constraint of regulation. Also, a firm may be able to spin-off an overseas subsidiary to avoid paying

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announcement of the spin-off.

U.S. taxes on the income from that division. Although the benefits to individual firms from such motivations do exist, on average the authors do not find any evidence to support these hypotheses.

Summarizing the empirical evidence, it appears that benefits in a spin-off arise predominantly from the separation of diverse units, which improves focus and eliminates negative synergies between divisions. Cusatis, Miles, and Woolridge (1993) document significant long-term abnormal returns following spin-offs, but find that these returns are confined to the subsample of firms that are acquired after the spin-off. They conclude that spin-offs facilitate takeovers by isolating specific divisions, which increases their value to the bidders. This increase in value may arise from two distinct sources. It may be due to the elimination of negative synergies between the parent and the subsidiary. In this case, the spin-off is valuable since it creates a pure play which is more attractive to the bidder. An alternative explanation is that since the two entities are separate after a spin-off, the bidder is able to value the separate entities better, and thus the standard adverse selection problem that arises under information asymmetry is mitigated. I explore this "information hypothesis," that gains in a spin-off arise from the overall better valuation of the separated units by the market compared to valuation of units that are part of a large combined firm. I not only explain the value gains around spin-off announcements, but also discuss conditions under which firms will divest only through spin-offs. I argue that a spin-off is the consequence of undervaluation of the firm by the market, so that the optimal method of divestiture here has to involve a separation without valuation. In the next section, I demonstrate that even in the absence of negative synergies between divisions, information asymmetry about a firm's operating costs is by itself a sufficient motivation for corporations to engage in spin-offs.

III. INFORMATION ASYMMETRY AND THE SPIN-OFF DECISION

A. *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. I assume a multiperiod model where both these divisions have projects that were initiated at time t = 0, and are currently in progress. For division P, I 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. I 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. I 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.

I write C as the sum of α, β, δ, and three normally distributed random variables, each with mean zero and finite variance.

$$C = \alpha + \beta + \delta + \tilde{a} + \tilde{b} + \tilde{d} \tag{1}$$

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.[7] Let a, b, and d

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[7] 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.

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 currently in progress. Without loss of generality, I 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:

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

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. I 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.

$$\underset{\delta + d \to \infty}{\text{Lt}} \; g(\alpha + \delta / 2 + a + d / 2, \, I) \; = \; 0 \tag{3}$$

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, I can define another linear function Π which is similar in functional form to Π^P and Π^S, such that

$$\Pi^P(C^P) + \Pi^S(C^S) = \Pi(C^P + C^S). \tag{4}$$

I assume that as the operating costs (either true or perceived) 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. I 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 currently 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.

B. 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. I assume that the managers act to maximize current shareholder value. I 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.[8] 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 equityholders in order to raise $I. Of course, y depends on whether or not the firm has

[8] The firm may also issue debt to finance the new project, and the results are similar to the equity issuance case. See also footnote 9.

undertaken a spin-off, since the perceived costs and hence cashflows depend on whether the firm has dissociated S. Also y is set so that the new shareholders receive their required rate of return. I assume that investors are risk neutral, and without loss of generality set the interest rate to be zero.

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

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

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

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

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

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

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

=>

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

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

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 (δ+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.

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

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

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

where y_1 = fraction of P given to new shareholders.

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

The current shareholder value is then,

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

$$= g(C_S^P,\ I) + \Pi^P(C_S^P) + \Pi^S(C_S^S) - I$$

and using (4) the above may be simplified to

$$= g(\alpha + a,\ I) + \Pi(\alpha + \beta + a + b) - I. \qquad \text{...............(W)}$$

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

$$P = \Pi^P(C_S^P) \text{ and } S = \Pi^S(C_S^S)$$

and

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

The current shareholder value is $\Pi(C_S^P + C_S^S) = \Pi(\alpha + \beta + a + b)$. ....(X)

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

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

where

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

and

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

The current shareholder value is then

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

$$= \Pi(\alpha + \beta + \delta + a + b + d). \qquad \text{...............(Y)}$$

(4) 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

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

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

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

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

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

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

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

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

$$\underset{\delta+d\to\infty}{Lt}\ \Pi(\alpha+\beta+\delta+a+b+d)\ =\ 0,$$

Finally, using the conditions above, we know that for every $W \in \Re$, 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. I establish 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 $(\delta + \sigma_d^2 V) > (\delta + d)$ 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.

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

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 $(\delta+\sigma_d^2 V) > (\delta+d)$, $\sigma_a^2 V > a$, 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.*

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:

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

$$\Pi(\alpha+\beta+a+b) \quad \text{...........(X1)}$$

$$\Pi(\alpha+\beta+a+b) \quad \text{...........(Y1)}$$

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

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. This results in 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.[9]

C. *Discussion and Some Empirical Implications*

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

[9] 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. I 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.

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 my 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.

The theory can also be adapted to discuss why spin-off stock price reactions are positive even though they presage equity offerings in our model, which prior studies have documented to be bad news. Equity issues convey bad news in a Myers and Majluf (1984) information asymmetry framework. In Myers and Majluf, all firms are subject to information asymmetry about firm value. However, in my model information asymmetry arises because the outside investors are unable to isolate the individual performance of two divisions that operate as part of one firm. Thus if we incorporate the Myers-Majluf framework in my model, then there will be two distinct types of information asymmetry, one that arises due to many divisions operating together, and the other that is common to all firms even if they are single-division entities. The elimination of the first type of information asymmetry through a spin-off generates a positive market reaction. However, this market reaction will be dampened to the extent that the market anticipates the subsequent raising of external capital (equity or risky debt). Which of the two effects will dominate will depend on which of the two information asymmetries is more influential.

There are several empirical implications of the model and of the information hypothesis in general. One implication of the model is that multi-division firms that operate under information asymmetry are more likely to engage in spin-offs. In the model, a spin-off decision is not a "signal" of value or quality to the uninformed outside investors, but 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. Thus the model not only predicts a positive share price reaction but it also predicts that the information asymmetry will decrease for these firms after the completion of the spin-off.

The model also predicts that firms that have divisions with differential growth opportunities and that are in need of external capital will engage in a spin-off that separates the high-growth division from the low-growth division. The model suggests that the consequent reduction in information asymmetry will lower the financing costs for the firm. Thus a prediction of the theory is that the parent and the spun-off subsidiary will have differential growth prospects. If the parent and the subsidiary are in different industries, then a difference in growth prospects may arise from industry specific characteristics. Therefore, a high incidence of cross-industry spin-offs (spin-offs where the parent and the subsidiary are in different industries) may actually be driven by differences in industry growth opportunities. Prior studies, on the other hand, have argued that cross-industry spin-offs are predominantly motivated by a need to eliminate negative synergies in operations. Evidence that the sample firms are more cash constrained than their industry counterparts, and evidence that the spin-off decision is followed by either the parent or the subsidiary raising external capital, will be supportive of the information hypothesis. Of course, this does not exclude the benefits that arise from the elimination of negative synergies.

III. DATA

A. *Data Selection*

The sample of spin-off distributions are identified from the following sources, (i) stock distributions by firms trading on the New York Stock Exchange (NYSE), American Stock Exchange (ASE), and NASDAQ, which the *Center for Research in Security Prices* (CRSP) identifies as spin-offs, (ii) firms in the *National Automated Accounting Research System* (NAARS) whose annual reports disclose spin-offs, and (iii) newswires and articles on the *Lexis-Nexis* and *Wall Street Journal* that report spin-off transactions by firms. I confirm the nature and tax-status of the transactions from the Commerce Clearing House's *Capital Changes Reporter.* The stock distributions that CRSP identifies as spin-offs include new issues of another class of shares by a firm. Also, the other sources sometimes include stock sales such as equity carve-outs, and distributions of common stock in other publicly traded firms that are not subsidiaries of the firm. Since these transactions do not constitute spin-offs, I delete these from the sample. I also discard return of capital distributions since they are predominantly distributions of income by Real Estate Investment Trusts, and do not represent dissociation of divisions within a firm. Finally, my sample also excludes non-voluntary spin-offs. This procedure yields an initial sample of 212 voluntary corporate spin-offs that were completed between the periods January 1979 - December 1993.

The subsidiaries distributed in the spin-off transactions are identified by cross-checking the transactions with the details in *Moody's Dividend Records*, and in newswires and Wall Street Journal articles on the *Lexis-Nexis*. The declaration date, ex-date, record date, and pay dates are identified from CRSP, and *Moody's Dividend*

Record. Of the 212 spin-offs, 137 are by firms listed on the NYSE, 24 are by firms on the ASE, and 51 are by firms on NASDAQ. The frequency of spin-offs in each of the sample years along with their exchange listings is specified in Table 1. Nearly 90% of the spin-offs are spread almost evenly between 1982 and 1993.

CRSP identifies a declaration date for these transactions as that date when the firm makes a formal declaration of the spin-off, or when the shareholders approve the spin-off. I go back at least two years from this declaration date to identify the announcement date. The announcement dates for the spin-offs are obtained by searching the *Lexis-Nexis* database and *Wall Street Journal* articles at least two years before the CRSP-identified declaration date, for the earliest mention of the spin-off. When an announcement is encountered, I search back another year from this date to confirm that there are no earlier announcements.

In testing the information hypothesis, I use the errors in analysts' earnings forecasts published by the Institutional Brokers Estimate System (I/B/E/S), as one of the measures of information asymmetry between the firm and the outside investors. I therefore require that the sample of firms that engage in spin-offs have earnings data reported on I/B/E/S. Of the initial sample of 212 firms, 118 have data available on I/B/E/S, which then constitutes my sample for all subsequent analysis.

To control for firm specific characteristics such as size and industry classification in the empirical tests, I select a control firm for each parent firm in the spin-off sample. For each sample firm, the control firm is selected by searching through the list of all firms for which data is available on the CRSP Daily Master file, on the COMPUSTAT tapes, and on the I/B/E/S tapes over a three-year period before the announcement date. The control firms are restricted to exclude all the parents and their subsidiaries in the spin-off sample. From this list of possible controls, I choose

Table 1

Distribution of the Sample of Firms That Completed a Spin-off, by Announcement Year and Exchange Listing

Observations by Announcement Year		Observations by Exchange Listing on the Announcement Date		
Year	Announcements	NYSE	ASE	NASDAQ
1978	4	2	1	1
1979	3	1	0	2
1980	9	5	1	3
1981	7	5	0	2
1982	16	12	2	2
1983	18	11	3	4
1984	21	12	2	7
1985	18	14	3	1
1986	21	12	3	6
1987	13	8	0	5
1988	30	17	2	11
1989	13	10	3	0
1990	11	8	1	2
1991	5	4	0	1
1992	17	11	3	3
1993	6	5	0	1
Total	212	137	24	51

the firm which is in the same four-digit SIC code as the sample firm, and is closest in market value. Year-end market values for the sample firms and the control firms are computed in the year preceding the spin-off announcement year. Market value of a firm is defined as total assets of the firm minus the book value of its equity plus the market value of its equity. In order to obtain a reasonable trade-off between industry and size matching, I impose the condition that the market value of the control firm be within 25% of the market value of the sample firm within the four-digit SIC code. If such a match is not found, I search for a match at the three-digit SIC level, then at the two-digit level, and finally at the one-digit level. 70 firms have control firms matched at the four-digit level, 14 firms at the three-digit level, 31 firms at the two-digit level, and 3 firms at the one-digit level.

B. Data Characteristics

The industry affiliations of the 118 parent firms that engaged in spin-offs and the 126 subsidiaries that were spun-off, are obtained from COMPUSTAT, and are listed in Table 2. The distribution of subsidiaries across industries is very similar to that of the parent firms. Industries such as Oil & Gas Extraction, Chemicals & Allied Products, Electric Machinery, and Electric, Gas & Sanitation are the most frequent among the sample of parent firms, and among their spun-off subsidiaries. On the other hand, firms in industries such as Agricultural Services, Coal Mining, Paper & Allied products, and Water Transportation did not engage in a spin-off, but had firms in other industries spin-off subsidiaries that operate in these industries. The distribution of sample firms across the different industries does not exhibit any perceivable systematic pattern, suggesting that while regulatory tensions, and tax advantages could have been reasons for some of the spin-offs, they may not be the only motivations.

Table 2

Industry Affiliations of the Parent Firms That Engaged in Spin-offs, and of the Subsidiaries That were Spun-off

SIC codes and Industry names are compiled from COMPUSTAT.

2-Digit SIC	Industry Name	Parent	Subsidiary
0100	Agriculture Production - Crops	0	1
0700	Agricultural Services	0	1
1000	Metal Mining	1	2
1200	Coal Mining	0	1
1300	Oil and Gas Extraction	8	13
1400	Quarry Nonmetal Minerals	2	0
1500	Building Construction	1	2
2000	Food Products	3	1
2100	Tobacco Products	2	0
2200	Textile Mill Products	0	1
2300	Apparel & Other Finished Products	1	0
2400	Lumber & Wood Products	1	0
2500	Furniture & Fixtures	0	1
2600	Paper & Allied Products	0	1
2700	Printing & Publishing	1	0
2800	Chemicals & Allied Products	11	8
2900	Petroleum Refining	3	0
3000	Rubber & Misc. Plastics	1	2
3200	Stone, Clay, & Glass Products	2	2
3300	Primary Metal Industries	3	8
3400	Fabricated Metal	7	1
3500	Commercial Machinery	4	5
3600	Electric Machinery & Supplies	8	9
3700	Transportation Equipment	3	0
3800	Measuring Instruments	4	4
3900	Misc. Manufacturing Industries	0	1
4000	Railroad Transportation	2	0
4200	Motor Freight Transportation	0	1
4400	Water Transportation	0	3
4500	Air Transportation	1	1
4800	Communications	3	4
4900	Electric, Gas, & Sanitation	7	7

Table 2 - Continued

SIC codes and Industry names are compiled from COMPUSTAT.

2-Digit SIC	Industry Name	Parent	Subsidiary
5000	Durable Goods - Wholesale	2	6
5100	Nondurable Goods - Wholesale	2	0
5200	Building Hardware & Garden	0	1
5300	General Merchandise Stores	2	1
5400	Food Stores	2	0
5600	Apparel & Accessory Stores	1	2
5700	Home Furniture & Equipment	1	1
5800	Eating & Drinking Places	0	1
5900	Misc. Retail	0	2
6000	Depository Institutions	1	3
6100	NonDepository Credit Institutions	1	6
6200	Security & Commodity Brokers	1	1
6300	Insurance Carriers	1	3
6500	Real Estate	0	2
6700	Holding & Investment Offices	12	8
7000	Hotels	1	0
7300	Business Services	6	4
7500	Auto Repair & Service	1	0
7800	Motion Pictures	1	1
8000	Health Services	4	4

Although I do not list the reasons stated by firms for divesting through spin-offs, I do obtain these reasons from proxy statements, annual reports, and from WSJ articles for use in subsequent analysis. The motives most often cited are improvement of business focus by separation of dissimilar business lines, improved access to capital markets, and improvement of the market valuation of the separate entities. Other motives include basing operational strategy and compensation on division-specific characteristics, and the facilitation of a merger or takeover.

The average equity capitalization of the combined firm before the announcement of the spin-off is $1435 million, as can be seen from Table 3. To the extent that the value gains from a divestiture is related to the fraction of a firm's operations that is dissociated, I also examine the size of the divested unit. The average market capitalization of the spun-off subsidiaries, measured in the month of the completion of the spin-off, is $301 million. The mean relative size of the spun-off divisions, measured relative to the size of the combined firm *before* the announcement, is just under 31%. This is consistent with the 29% relative size documented in Vijh (1994), for his sample of 113 spin-offs that were completed between 1962-1990. This relative size measure however, may be an inflated estimate of the true relative size because the size of each subsidiary is computed after the spin-off, and so includes the effect of the spin-off event, while the capitalization of the combined firm does not reflect the impact of the event. In order to improve this proxy for relative size, I also compute the relative size after the completion of the spin-off, measured as the ratio of the capitalization of the subsidiary to the sum of the capitalizations of the parent and subsidiary *after* the completion of the spin-off. This measure of relative size indicates that on average about 22% of the combined firm is divested through a spin-off.

The financial characteristics for the sample and control firms are listed in Table 4. Even though each control firm was selected based on the *market* value of the

Table 3

Descriptive Statistics for Market Capitalization

Variable	Mean	Min.	25 %	Median	75 %	Max.
Market Capitalization[a] of Combined Firm	1434.77	12.22	136.85	474.53	1987.95	15735.90
Market Capitalization[b] of Parent	1411.16	3.06	107.90	444.65	1770.52	18551.08
Market Capitalization[c] of Subsidiary	301.11	1.08	32.41	111.59	211.54	5907.02
Relative Size -Before[d]	0.3065	0.0059	0.0649	0.1365	0.3958	1.93875
Relative Size - After[e]	0.2154	0.0067	0.0552	0.1376	0.3168	0.94391

a Market Capitalization of the Combined Firm is the product of the total number of shares outstanding and the closing price per share of the firm measured in the year-end prior to the spin-off announcement year. It is denominated in millions of dollars.

b Market Capitalization of the Parent is measured similarly, in the month of the completion of the spin-off, and is denominated in millions of dollars.

c Market Capitalization of the Subsidiary is also measured in the month of the completion of the spin-off, and is denominated in millions of dollars.

d Relative Size-Before is measured as the ratio of the market capitalization of the subsidiary to the market capitalization of the combined firm.

e Relative Size-After is measured as the ratio of the market capitalization of the subsidiary to the sum of the market capitalizations of the parent and the subsidiary.

Table 4

Descriptive Statistics of the Financial Variables for the Sample and Control Firms

	Sample Firms			Control Firms		
Variable	Mean	Median	Std.Dvn.	Mean	Median	Std.Dvn.
Total Assets[a]	2366.75	731.35	4054.71	2157.97	526.90	4195.98
Cashflow from Operations[b]	0.1044	0.0954	0.0563	0.1366	0.1037	0.3623
Operating Income[c]	0.1312	0.1232	0.0693	0.1648	0.1287	0.3511
Market-to-Book Ratio[d]	1.3410	1.1675	0.5638	1.5219	1.1554	0.8786
Debt Ratio[e]	0.2867	0.2752	0.1740	0.2380	0.2197	0.1704
Entropy[f]	0.5717	0.5909	0.4546	0.3103	0.0000	0.4946

a Total Assets is obtained from Compustat, and is denominated in millions of dollars.
b Cashflow from Operations is measured as a ratio relative to the total assets of the firm. Cashflow is change in cash from all operating activities and includes changes in operating assets and liabilities. It is obtained from Compustat.
c Operating Income is measured as a ratio relative to the total assets of the firm. The Income variable is Sales minus Cost of Goods Sold and other Expenses, before Depreciation and Amortization. It is obtained from Compustat.
d Market-to-Book Ratio is the ratio of (Book Value of Assets - Book Value of Equity + Market Value of Equity) to the Book Value of Assets. All variables are obtained from Compustat.
e Debt Ratio is measured as the ratio of short-term plus long-term debt to the total assets of the firm. Long-term debt and short-term debt are obtained from Compustat.
f Entropy is an index of unrelated diversification of the firm in its operations. Two divisions of a firm are defined as unrelated if they differ in their 2-digit SIC codes. Entropy is the weighted average of the percentage sales of the various distinct 2-digit SIC industry groups. Details of this computation are provided in Appendix A.

corresponding sample firm, even the *book* value of total assets of the sample and the control firms match closely. The average total assets of the sample firms is $2367 million as compared to $2158 million for the control firms. The sample firms appear to possess less internally generated cash flow, about 10.5% of total assets, compared to nearly 14% for the control firms. Also, the typical firm that engages in a spin-off has a total debt ratio of 29% while its size and industry adjusted control is more conservatively financed with a debt ratio of 24%. Perhaps the most striking difference between the firms that undertake spin-offs and those that do not, is in their level of diversification in operations. Following Palepu (1985), and Hoskisson, Johnson, and Moesel (1994), I measure unrelated diversification using the entropy index. Entropy is the weighted average of the percentage sales of the various distinct 2-digit SIC industry groups within a firm. Details of this computation are provided in the Appendix. The sample firms appear to be more diversified, with a mean entropy of 0.572 compared to the control firms which have an average entropy of 0.310. This difference is significantly more pronounced in the medians.

C. Measures of Information Asymmetry

I use three different measures of information asymmetry in my empirical analysis. The first measure is the error in analysts' earnings forecast, measured before the announcement of the spin-off. The second is the dispersion in the forecasts of the firm's earnings. Analysts' earnings forecasts, and other related variables are obtained from the Institutional Brokers Estimate System. I/B/E/S collects earnings forecasts for more than 4000 firms on the NYSE, ASE, and NASDAQ markets, from analysts employed at over 100 brokerage firms. Among other variables, I/B/E/S reports a monthly mean, median, and standard deviation of the forecasts of earnings for each firm, based on the analysts' estimates that are turned in that month. Typically, earnings estimates are available for the current-year earnings, and the following-year earnings.

The first index of information asymmetry, earnings forecast error, is computed as follows. For each firm in the sample (and for its matched control), the fiscal year prior to the announcement date of the spin-off is chosen as the year for observation. The mean monthly earnings forecast provided for the last month of that fiscal year is obtained from I/B/E/S, and is defined as the predicted earnings. Following Christie (1987), the forecast error is measured as the ratio of the absolute difference between the forecast earnings and the actual earnings per share to the price per share at the beginning of the month. This error is one measure of the level of information asymmetry about the firm. Additional measures such as standard deviation of earnings forecasts, and the fraction of intangible assets in a firm are used as alternate proxies for information asymmetry in the empirical analysis. The standard deviation of earnings forecasts is reported every month on I/B/E/S, and represents the dispersion among analysts about a consensus estimate of the forecast. I use this standard deviation to represent the level of uncertainty in the information about a firm. Similarly, the ratio of intangible assets to the total assets of a firm represents assets that are difficult to value by the outside investors. Therefore, I associate a higher fraction of intangibles with higher information asymmetry about the firm.

Several prior studies have used the analysts earnings estimates provided by I/B/E/S in different contexts. Most often analysts' forecasts and their revisions of these forecasts have been used to proxy for the market expectation about a firm's cash flows and future performance. Besides analyzing abnormal announcement period returns, many studies also examine revisions in earnings forecasts when a firm announces a significant transaction, such as a takeover or an acquisition (Pound, 1988; Brous and Kini, 1993), a dividend issue (Yoon and Starks, 1995), a seasoned equity issue

(Brous, 1992; Jain, 1992), a high yield debt offering (Ferreira, 1995), or a share repurchase (Dann, Masulis, and Mayers, 1991). Fried and Givoly (1982), and O'Brien (1988) document that models which use analysts' earnings forecasts are able to predict future earnings more accurately than time series models that use the past earnings of the firm. Fried and Givoly (1982) also find that the broadness of the information set employed by the analysts determines the accuracy of their forecasts. In this context, O'Brien (1988) documents that aggregating several recent forecasts across analysts and using the mean or median forecast eliminates errors that may arise in a single forecast even if it is the most recent forecast.[10]

This study differs from the ones listed above in that I do not use analysts' forecasts to proxy future performance, rather, I use the errors in their forecasts of earnings to measure the level of information asymmetry surrounding a firm. Elton, Gruber, and Gultekin (1984) undertake a detailed analysis of the forecast errors in the earnings of a wide cross-section of firms. They examine the size, pattern and the source of these errors by partitioning them into errors derived from mispredicting economy-wide factors, industry-wide factors, and firm-specific factors. They document that the errors decrease as the predictions get closer to the fiscal year end, and find that nearly 84% of the forecast error in the final month can be attributed to mis-estimation of firm-specific characteristics rather than to mis-estimation of economy or industry factors. This evidence suggests that analysts' forecast errors are a particularly accurate proxy for the level of information asymmetry between the insiders of a firm

[10] Fried and Givoly (1982), O'Brien (1988), and Brous (1992) document that analysts are overly optimistic at the beginning of the fiscal year, and therefore tend to revise their forecasts downward as the year progresses. Thus, forecast errors may include a component due to this "optimism bias" that may confound the use of this measure as a proxy for information asymmetry. This is not a problem in my study because for all firms, the errors are computed in a common month, the last month of the fiscal year, thereby standardizing the impact of this bias. Further, the earnings forecasts in the last month of the fiscal year have also been shown (O'Brien, 1988; and Brous, 1992) to be the most accurate, compared to the forecasts in any of the prior months.

and the outside market. The use of this measure as a proxy for information asymmetry is also supported by Best and Zhang (1993), who show that bank loan announcements play no certification role when analysts' earnings forecasts are accurate, (i.e., when information asymmetry is low).

V. EMPIRICAL RESULTS

A. *Abnormal Returns*

Prior studies have documented positive abnormal returns around the announcement of spin-offs. I reconfirm these announcement period returns by employing the event-time methodology used by Dodd and Warner (1983). I estimate a market model over a 155 day period ending 45 days before the announcement of the spin-off. The CRSP equal-weighted index is used as a proxy for the market portfolio. Table 5 summarizes the cumulative abnormal returns over different time intervals around the announcement date, for the sample of firms that engaged in spin-offs. I obtain a significant standardized 2-day cumulative abnormal return of 3.03% in the window (-1,0), which is consistent with the finding in the earlier studies on spin-offs. Significant abnormal returns of 1.67% and 3.28% are also found on day 0, and in the window (-1,+1), respectively.

B. *Univariate Tests*

I study the forecast errors in analysts' earnings estimates for the sample of firms that divest through spin-offs, and for their control firms. If firms that engage in spin-offs are subject to greater information dissemination problems, then we should observe higher forecast errors for the sample relative to the control. Panel A of Table 6 summarizes the forecast errors for the sample of firms that announced a spin-off, and for their control firms. The results are consistent with the hypothesis that the sample firms are subject to higher levels of information asymmetry than their size-matched

Table 5

Cumulative Abnormal Returns over Selected Intervals for the Sample of Firms That Engaged in Spin-offs

Abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. The abnormal returns are cumulated in the intervals (z-statistic in parentheses). The percentage positive is the ratio of the number of firms with positive abnormal returns to the total number of firms. The generalized sign test is used to test the significance of the percentage of firms with positive abnormal returns.

	Cumulative Abnormal Returns for Sample		
Interval	Mean	Median	Percentage Positive
-30 to -6	1.34 (1.14)	0.50	51
-5 to -1	0.43 (0.48)	0.70	57**
-1 to 0	3.03 (6.68)***	2.04	74***
0	1.67 (4.97)***	0.70	65***
-1 to +1	3.28 (6.58)***	2.11	72***
+1 to +5	0.16 (0.34)	- 0.02	49
+5 to +30	3.12 (2.23)**	0.37	53

*** Significant at 1% ** Significant at 5% * Significant at 10%

Table 6

Summary of Earnings Forecast Errors

Summary of analysts' earnings forecast errors for the sample of 118 firms that completed a spin-off in the period 1979-1993, and the forecast errors of their size and industry matched control firms. The before-event forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. The after-event forecast errors are measured in the last month of the first fiscal year after the completion of the spin-off. The forecast errors are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month. The results of the nonparametric Wilcoxon Signed Rank test for difference in the forecast errors between the relevant groups is specified in the panels.

Panel A: Before-event Forecast Errors for Sample and Control Firms

	Mean	Min	25%	Median	75%	Max
Sample	0.0429	0.0000	0.0034	0.0109	0.0355	0.7301
Control	0.0228	0.0000	0.0015	0.0049	0.0108	0.7654
Difference	0.0201**			0.0060**		

Panel B: Before and After-event Forecast Errors for Sample Firms

	Mean	Min	25%	Median	75%	Max
Before-Event	0.0429	0.0000	0.0034	0.0109	0.0355	0.7301
After-Event	0.0095	0.0000	0.0009	0.0023	0.0072	1.6100
Difference	0.0334***			0.0086***		

*** Significant at 1% ** Significant at 5% * Significant at 10%

counterparts. The average forecast error for the sample of spin-offs is 0.0429, which is about twice that of the controls. I perform four tests of difference of means and medians - a parametric pooled t-test, the non-parametric Mann-Whitney rank test, a paired t-test, and the Wilcoxon's Signed rank test. All the tests indicate that the forecast errors of the two groups are significantly different from each other. The results are reported in Table 6.

Further, if spin-offs improve market perception of the firms, then the level of information asymmetry as measured by the forecast errors should decrease after the completion of a spin-off. I use the earnings forecasts in the last month of the first fiscal year after the spin-off is *completed* to measure the after-event forecast errors. As is reported in Panel B of Table 6, the forecast errors decrease significantly (by over 77%) after the event. Parametric and non-parametric tests of the difference between the means and medians of the before-event forecast error and the after-event forecast error are all significant at the 1% level, concurring with our expectations.

Since firms with higher information asymmetries benefit more from events such as spin-offs that mitigate the level of asymmetry, the information hypothesis implies that the announcement period gains are higher for firms with larger forecast errors. To empirically examine this, the sample firms are sorted according to their forecast errors and pooled into groups in three different ways. In the first method, I classify the firms into four quartiles (highest forecast errors to lowest forecast errors) and examine if the abnormal returns are significantly higher in the top pool relative to the bottom pool. The second method classifies the firms in a similar fashion, but into three groups. And finally, I also classify the firms into two unequal groups of above and below average forecast errors. As can be seen from Table 7, in each of these classifications, I find that the abnormal returns are significantly higher for the higher forecast error group than for the lower. For instance, the top quartile two-day standardized CAR is 4.46% as

Table 7

Abnormal Returns for the Sample of Firms That Engaged in Spin-offs, Sorted Based on Analysts' Earnings Forecast Errors

Abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. The abnormal returns are the cumulative abnormal returns measured over the interval (-1, 0). N is the number of observations in each category. The forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. The forecast errors are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month. The results of the nonparametric Mann-Whitney Rank test for difference in the abnormal returns between the relevant groups is specified in the panels.

Panel A: Abnormal Returns for the Firms in each Quartile of Forecast Errors

Forecast Error	Mean	Median	N
Highest 1	4.46	2.75	30
2	3.11	1.73	29
3	2.67	0.89	29
Lowest 4	2.39	1.62	30
Difference (1 - 4)	2.07**	1.13**	

Panel B: Abnormal Returns for the Firms in each Third of Forecast Errors

Forecast Error	Mean	Median	N
Highest 1	4.45	2.75	39
2	2.76	1.73	40
Lowest 3	2.26	0.88	39
Difference (1-3)	2.19***	1.87***	

Panel C: Abnormal Returns for Above and Below Average Forecast Error Subsamples

Forecast Error	Mean	Median	N
Above Average	4.30	2.59	31
Below Average	2.76	1.73	87
Difference	1.54**	0.86**	

*** Significant at 1% ** Significant at 5% * Significant at 10%

opposed to 2.39% for the bottom quartile. This difference is significant at the 5% level. Similarly, the above average group has a CAR of 4.30% compared to 2.76% for the below average group, which are also significantly different from each other at the 5% level. Further, the abnormal returns decrease monotonically going from the group with the highest forecast error to the lowest forecast error.[11]

Schipper and Smith (1983) and Hite and Owers (1983) argue that elimination of negative synergies may be a motivation for corporate spin-offs. Accordingly, Schipper and Smith find that a significant fraction of their sample of spin-offs contain firms where the dissociated subsidiary is in an industry different from that of the parent. Hite and Owers (1983) examine if there is any difference in gains experienced by firms which state that they are divesting units with diverse activities not closely related to their primary business, compared to the gains of firms that do not state such a motive. However, they do not find any significant difference in 2-day abnormal returns around the announcement date between the two groups. I analyze this theory further by classifying the sample of spin-offs into same-industry versus cross-industry spin-offs using a criterion different from the one used by Hite and Owers. I define a cross-industry spin-off as one where the parent dissociates a subsidiary with a 2-digit SIC code that is different from the primary 2-digit SIC code of the parent. The primary SIC code for the parent, and the SIC code of the spun-off subsidiary are obtained from COMPUSTAT and are cross-checked with the information available in Moody's Industrial Manuals.

[11] Lys and Sabino (1992) show that when mean values of a variable in extreme-ranked groups are compared, the power of the difference tests is maximized when the two extreme groups contain 27% of the sample. Since the extreme groups in each of the grouping methods used in my analysis contain at least 25% of the observations, the tests are not without power. More importantly, since I reject the null hypothesis of no difference in the abnormal returns between the extreme groups, my results will only be strengthened by further increasing the power of the tests. These results are later confirmed through regression analysis, which Lys and Sabino show is unambiguously more powerful than grouping.

Stock analysts typically have industry preferences, and tend to track firms in one or a few specific industries. When these analysts encounter firms with divisions in different industries, their valuation of the unfamiliar divisions is likely to be less accurate, leading to higher forecast errors for such firms. Also, if the analysts evaluate a firm based predominantly on its primary industry affiliation, then their earnings forecasts of firms with multiple lines of business will contain larger errors. Therefore, in a random sample of firms, one would expect to see higher forecast errors for firms that operate in many industries than for those which operate in one or very few industries. Surprisingly, my results indicate that the mean forecast error for the same-industry spin-offs is higher than that of the cross-industry spin-offs. The mean forecast error for the same-industry subsample is 0.0528 as compared to 0.0394 for the cross-industry subsample, as can be seen from Panel A of Table 8. However, this difference is not statistically significant. This evidence is nevertheless consistent with the information hypothesis. While we may expect a *random* pool of firms with focused operations to have significantly lower forecast errors, the fact that the pool of same-industry *spin-offs* do not exhibit lower errors, may be an indication that they are subject to higher levels of information asymmetry.

Since same-industry spin-offs can be viewed as being subject to lower levels of negative synergies because the divisions are not diverse, and are not outside of the primary focus of the firm's operations, one would expect the abnormal returns for this group to be lower. However, I find that the abnormal returns generated around the announcement for the same-industry subsample is not significantly different from that of the cross-industry subsample. The results are in Panel B of Table 8. This evidence of no difference indicates that elimination of negative synergies is not the sole explanator of gains around spin-offs.

Table 8

Summary of Earnings Forecast Errors and Abnormal Returns for the Subsamples of Same-industry and Cross-industry Spin-offs

Spin-offs where the parent's primary two-digit SIC code differs from the subsidiary's two-digit SIC code are classified as cross-industry spin-offs. N represents the number of observations in each category. Abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. The abnormal returns are the cumulative abnormal returns measured over the interval (-1, 0). The forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. The forecast errors are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month. The results of the nonparametric Mann-Whitney Rank test for difference in the forecast errors and abnormal returns between the relevant groups is specified in the panels.

Panel A: Forecast Errors for Cross-Industry and Same-Industry Spin-offs

	Mean	Median	N
Cross Industry	0.0394	0.0107	87
Same Industry	0.0528	0.0113	31
Difference	- 0.0134	- 0.0006	

Panel B: Abnormal Returns for Cross-Industry and Same-Industry Spin-offs

	Mean	Median	N
Cross Industry	2.97	2.08	87
Same Industry	3.67	1.94	31
Difference	- 0.70	0.14	

*** Significant at 1% ** Significant at 5% * Significant at 10%

If information asymmetry is a motive for spin-offs, then it is reasonable to expect that firms that spin-off previously existing subsidiaries with a history of operations, will have lower information problems than firms that spin-off a newly created subsidiary. This conjecture stems from the fact that a previously existing subsidiary (with independently trading stocks) is likely to have more information about its cashflows and investment opportunities revealed to the market than a newly created subsidiary. I examine this by classifying the sample firms into two groups, where the first contains firms that create a subsidiary for the sole purpose of the spin-off, and the second contains firms that spin-off a previously existing subsidiary. However, I find no significant difference in the mean forecast error of the two subsamples (See Panel A of Table 9). Further, there is no statistical difference in the abnormal returns generated around the announcement for these two subsamples (Panel B of Table 9).[12]

In order to identify the incremental impact of information asymmetry on the shareholder gains around spin-offs, I examine other factors that may be used as controls in the regression analysis. Cusatis, Miles, and Woolridge (1993) find that abnormal long-term performance of spin-offs after the event is confined to the subsample of firms that were acquired after the spin-off. In this context, I use the motives stated in proxy statements and news articles to classify the sample of spin-offs into two groups, one which contains firms that state the facilitation of a merger or acquisition as a motive, and the other which includes the remaining firms. I expect higher abnormal returns for the subsample with a merger motive. However, contrary to this conjecture, the results in Panel A of Table 10 indicate that the average abnormal

[12] This lack of difference may be a consequence of misclassification into the two groups. There are two types of misclassifications possible. First, firms that spin-off a previously existing subsidiary by adding more assets to that subsidiary and renaming it as a new subsidiary, are classified into the "newly-created" subsample. Second, in many cases, although a subsidiary may be previously existing by my definition, it may be closely held by the parent firm, thus negating my premise of lower information asymmetry for such firms. A more careful classification of the sample firms, based on whether the stocks of the subsidiary *traded* previously, may yield a different result.

Table 9

Summary of Earnings Forecast Errors and Abnormal Returns for the Subsamples of Firms with Newly Formed Subsidiaries and Previously Existing Subsidiaries

A subsidiary is defined as newly formed if the firm created the subsidiary just before the spin-off, for the sole purpose of spinning-off. N represents the number of observations in each category. Abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. The abnormal returns are cumulated over the interval (-1, 0). The forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. The forecast errors are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month. The results of the nonparametric Mann-Whitney Rank test for difference in the forecast errors and abnormal returns between the relevant groups is specified in the panels.

Panel A: Forecast Errors for Newly Formed vs. Previously Existing Subsidiaries.

	Mean	Median	N
Newly Formed	0.0522	0.0132	52
Previously Existing	0.0356	0.0106	66
Difference	0.0166	0.0026	

Panel B: Abnormal Returns for Newly Formed vs. Previously Existing Subsidiaries.

	Mean	Median	N
Newly Formed	3.407	2.110	52
Previously Existing	2.957	1.890	66
Difference	0.450	0.220	

*** Significant at 1% ** Significant at 5% * Significant at 10%

Table 10

Summary of Abnormal Returns for Firms That Engaged in Spin-offs, Sorted Based on Different Characteristics of the Sample Firms

The motives for each spin-off were obtained from proxy statements and from Wall Street Journal articles. An acquisition motive is one where the firm states that the spin-off was intended to facilitate the merger/acquisition of either the parent or the subsidiary with another firm. A regulation motive is said to exist if either the parent or the subsidiary (but not both) is in an unregulated industry after the spin-off. Taxable spin-offs are identified from their distribution codes on CRSP. N represents the number of observations in each category. Abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. The abnormal returns are the cumulative abnormal returns measured over the interval (-1, 0). The results of the nonparametric Mann-Whitney Rank test for difference in the abnormal returns between the relevant groups is specified in the panels.

Panel A: Abnormal Returns for Acquisition / Merger Motive Sub-Samples

	Mean	Median	N
Acquisition/Merger	3.75	2.57	7
No Merger Motive	3.12	2.04	111
Difference	0.63	0.53	

Panel B: Abnormal Returns for Regulation Motive Sub-Samples

	Mean	Median	N
No Regulation Motive	3.10	1.74	90
Regulation Motive	3.32	2.11	28
Difference	- 0.22	- 0.37	

Panel C: Abnormal Returns for Sub-Samples based on Tax Status

	Mean	Median	N
Nontaxable	3.38	2.28	104
Taxable	1.46	0.52	14
Difference	1.92**	1.76**	

*** Significant at 1% ** Significant at 5% * Significant at 10%

returns for the subsample with a merger motive is 3.75% compared to a statistically indistinguishable 3.12% for the other subsample.

Regulated subsidiaries may bring the parent under their regulatory umbrella, which can needlessly restrain the parent in its operations. The separation of a regulated subsidiary (parent) from the parent (subsidiary) through a spin-off eliminates this external constraint and may lead to the gains generated around the spin-off announcements. I classify sample firms as having a regulation motive if either the parent or the subsidiary, but not both, is in an unregulated industry based on four-digit SIC codes. Panel B of Table 10 reveals no difference in the abnormal returns of the subsample of firms with and without a regulation motive. Thus, regulation is not a significant motive for my sample of spin-offs. Finally, I also examine if the tax status of the spin-offs is important in explaining the announcement period gains. I find that taxable spin-offs earn 2-day abnormal returns of 1.46% as compared to 3.38% for the nontaxable group (See Panel C of Table 10). This difference is statistically significant at the 5% level.

Summarizing the univariate analysis, my evidence indicates that forecast errors are higher for the sample of spin-offs than for their size and industry matched control firms. The forecast errors decrease after the spin-off suggesting a mitigation of information asymmetry after the spin-off. Consistent with the information hypothesis, the abnormal returns generated around the announcement of spin-offs bear a positive relation with the forecast errors. The forecast errors and abnormal returns for the same-industry spin-offs are statistically indistinguishable from those of the cross-industry spin-offs. This is consistent with the hypothesis that in addition to the elimination of negative synergies, information factors are also instrumental in motivating spin-offs. I confirm these results through regression analysis in the next section.

C. Regression Results

The univariate analysis provides initial evidence consistent with the information hypothesis. While it documents the individual relations between each factor and the abnormal gains around the spin-off, the interactions between the factors can only be observed through a regression. To further explore the role of information asymmetry in explaining the gains around spin-offs, I analyze several OLS regressions. The independent variables used in the regressions are defined in Table 11. The analysis is in Table 12. The dependent variable is the standardized 2-day cumulative abnormal return generated in the interval (-1,0). Since the primary aim here is to test the information hypothesis, I use three different variables of information asymmetry in the regressions. The first measure, before-event analysts' earnings forecast errors, has been used in the univariate analysis. A positive relation between this variable and the abnormal returns generated around the spin-off will be consistent with the information hypothesis. To see if this relation is robust to other measures of information, I also use the before-event standard deviation of the analysts' earnings forecasts as a second measure. The third measure of information asymmetry is the ratio of intangible assets to the total assets of a firm before the spin-off.

Proposition 2 of the theoretical model on spin-offs demonstrates that firms with sufficiently high negative synergies will divest through spin-offs. Also, the model shows that even in the absence of negative synergies, there is a relation between the abnormal returns and information variables (proposition 3). To examine these predictions, I use a cross-industry dummy variable which is 1 if the spin-off dissociates a subsidiary in a diverse industry, and is 0 otherwise. I also construct the entropy index, an alternative measure of negative synergies within a firm. Entropy measures the level of diversification by a firm into operations in unrelated industries. Unlike the

Table 11

Definitions for the Independent Variables in the Regressions

a The forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. They are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month.

b The forecast standard deviation measures the dispersion in the earnings forecasts in the month in which the forecast errors are computed.

c Entropy is an index of unrelated diversification of the firm in its operations. It is the weighted average of the percentage sales of the various distinct 2-digit SIC industry groups in a firm.

d The Cross-industry SIC dummy is 1 if the parent's primary 2-digit SIC code differs from the subsidiary's 2-digit SIC code, and is zero otherwise.

e Relative Size is the ratio of the market capitalization of the subsidiary to the sum of the market capitalizations of the parent and the subsidiary, measured in the month of the completion of the spin-off.

f The Merger dummy is 1 if the firm states that the spin-off was intended to facilitate the merger/acquisition of either the parent or the subsidiary with another firm, and is zero otherwise.

g The Regulation dummy is 1 if either the parent or the subsidiary (but not both) is in an unregulated industry after the spin-off, and is zero otherwise.

h The Tax dummy is 1 if the spin-off is taxable, and is zero otherwise.

i Intangibles is the ratio of the intangible assets of the firm to the total assets of the firm.

j The Market-to-Book dummy is 1 if the market-to-book ratio of the firm is greater than the median market-to-book ratio of the sample of all firms that engaged in a spin-off, and is zero otherwise. The market-to-book ratio is the ratio of (Book value of assets - Book value of equity + Market value of equity) to the Book value of assets.

k The Entropy dummy is 1 if the entropy of the firm is greater than the median entropy of the sample of all firms that engaged in a spin-off, and is zero otherwise.

Table 12

Ordinary Least Squares Regressions to Explain the Positive Abnormal Returns Generated around the Announcement of Spin-offs

The dependent variable is the 2-day cumulative abnormal return generated over the interval (-1, 0). The abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. (t-statistics of the coefficients are in parentheses). The definitions of the independent variables are given in Table 11.

	Predicted Sign	Regression 1	Regression 2	Regression 3	Regression 4
Intercept		1.7170 (1.575)	3.0528 (3.115)	3.2177 (3.241)	2.0982 (3.140)
Forecast Error	+	4.1019** (2.364)	3.9577** (2.116)		7.7296*** (2.821)
Forecast Standard Deviation	+			2.9858* (1.828)	
Entropy	+	0.4669 (0.393)			
Cross-Industry SIC Dummy	+		- 1.3631 (- 1.280)	- 1.4183 (- 1.331)	
Forecast Error * Cross-Inds. Dummy	-				- 4.4903** (- 2.163)
Relative Size	+	4.0166** (2.134)	4.4932** (2.590)	5.1143*** (2.913)	4.8431** (2.028)
Tax Dummy	-	- 2.1488* (- 1.766)	- 2.6291* (- 1.893)	- 2.5400* (- 1.781)	- 2.4076 (- 1.162)
Merger Dummy	+	- 5.9834 (- 1.346)	- 6.6327 (- 1.464)	- 6.5644 (- 1.446)	
Regulation Dummy	+	0.5638 (0.478)	0.7313 (0.614)	0.7709 (0.637)	
Adjusted R^2		0.0636	0.1203	0.1161	0.0867

Table 12 - Continued

The dependent variable is the 2-day cumulative abnormal return generated over the interval (-1, 0). The abnormal returns are calculated using the market model parameters estimated over a 155-day period ending 45 days before the announcement date. The CRSP equal-weighted index is used in the market model to compute betas. (t-statistics of the coefficients are in parentheses). The definitions of the independent variables are given in Table 11.

	Predicted Sign	Regression 5	Regression 6	Regression 7	Regression 8
Intercept		2.0692 (2.693)	1.8420 (2.641)	2.5538 (3.132)	
Forecast Error	+	21.4899** (2.433)			
Forecast Standard Deviation	+		8.1718** (2.355)	4.7417** (2.160)	
Intangibles * High Mkt./Bk. Dummy	-				2.9518 (0.640)
Intangibles * Low Mkt./Bk. Dummy	+				23.9991** (2.276)
Forecast Error * Entropy Dummy	-	- 17.3747** (- 2.151)			
Standard Deviation * Cross-Inds. Dummy	-		- 5.7492** (- 2.527)		
Standard Deviation * Entropy Dummy	-			- 2.2291* (- 1.901)	
Relative Size	+	3.6809* (1.887)	5.0607*** (3.351)	4.8127** (2.522)	8.3899*** (4.532)
Tax Dummy	-	- 2.0635 (- 1.035)	- 2.0961 (- 1.114)	- 2.1864 (- 1.306)	- 1.6804 (- 0.906)
Adjusted R^2		0.0613	0.1387	0.0745	0.3501

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

cross-industry dummy variable which is qualitative, the entropy index depends on the fraction of sales generated by divisions of the firm that operate in different industries (2-digit SIC code), and is a continuous variable. The model predicts a positive relation between the cross-industry indicator variable and the abnormal returns around the announcement of spin-offs. Similarly, since entropy is high for diversified firms, I expect a positive relation between entropy and the abnormal returns if the announcement period gains around spin-offs are driven by the elimination of negative synergies.

Other factors in the regression control for the other theories that have been proposed in the literature. Hite and Owers (1983), and Miles and Rosenfeld (1983) find that the announcement period gains are larger when a firm divests a larger portion of its assets. I use the market value of equity of the divested subsidiary measured relative to the sum of the equity capitalizations of the parent and the subsidiary (computed in the month of the completion of the spin-off), to control for size related effects. An indicator variable is used to distinguish sample firms that have stated a merger motive. This merger dummy is set to 1 if the firm stated that the spin-off was undertaken to facilitate a merger, and is set to 0 otherwise. From the evidence in Cusatis, Miles, and Woolridge (1993), the coefficient of this merger dummy is expected to be positive. A regulation dummy variable is used to distinguish between firms which I identify to have a regulation motive, and those that do not have such a motive. For each sample firm, the regulation dummy is set to 1 if either the firm or the subsidiary, but not both, is in a regulated industry, and is set to 0 otherwise. If dissociation of two divisions with different regulatory characteristics provides gains to the shareholders, I expect the coefficient of the regulation dummy to be significant and positive. Finally, to account for the tax status of a spin-off, I use a tax dummy which is 1 if the spin-off has been identified as taxable, and 0 otherwise.

The parameter estimates in the different regressions and their heteroscedasticity adjusted t-statistics are reported in Table 12. All the variables in regression 1, with the exception of the merger-motive indicator variable, show the expected signs. The coefficient of the forecast error variable is 4.1019, and is significant at the 5% level, confirming the positive relation between abnormal returns and information asymmetry. The relative size of the divested unit is also significantly positively related to the gains around spin-off announcements. The only other significant factor is the tax dummy which is negative, suggesting that taxable spin-offs have lower abnormal returns than nontaxable spin-offs. This result is consistent with the view that tax imposes a penalty on shareholder value which is reflected in the lowering of the abnormal returns around the event. Another important coefficient in regression 1 is that of the entropy variable. This variable is not significant in explaining the 2-day abnormal returns.

Regression 2, repeats the analysis in regression 1, with the entropy variable replaced by the cross-industry dummy variable. None of the results are affected, and once again the proxy that captures the elimination of negative synergies (cross-industry dummy) is not significantly related to the announcement period gains. Regression 3 is a specification check for the forecast error variable, where the standard deviation in forecasts is used as the proxy for information asymmetry. All the other variables are retained from regression 2. I find that the main results remain unaffected. However, the coefficient of the standard deviation variable is 2.99, which is significant only at the 10% level.

Although the cross-industry dummy is not significant in the regressions so far, it is a useful variable in order to study whether the effect of information asymmetry differs in the cross-industry versus the same-industry spin-off subsamples. The theoretical model shows that both negative synergies and information asymmetry are individually sufficient motives for firms to engage in spin-offs. To the extent that same-industry spin-offs have little negative synergies (or even some positive synergies), the cost imposed by information asymmetry must be sufficiently high to motivate a spin-off. It then follows that the same-industry spin-offs should show a higher positive relation of forecast errors with abnormal returns than cross-industry spin-offs. To study this relation in greater detail, I introduce an interaction term in regression 4, while leaving out all the insignificant variables from the previous regressions. The interaction of forecast error with the cross-industry dummy measures the incremental effect of forecast errors on abnormal returns for the subsample of cross-industry spin-offs. The expected sign of the interaction term is negative. As anticipated, regression 4 indicates that the forecast error variable continues to be significantly positive. Also, the interaction term is significantly negative with a coefficient of -4.4903. Further, the magnitude of the interaction term is smaller than the magnitude of the forecast error term confirming that while the net effect of information asymmetry on the abnormal returns is positive for the general sample of spin-offs, it is smaller for the cross-industry subsample.

Regression 5 replaces the interaction term in regression 4, with one that is constructed using the entropy index. For each firm, the entropy dummy is 1 if the entropy of the firm is greater than the median entropy of all the sample firms, and is 0 otherwise. The interaction of the forecast error variable with this entropy dummy, captures the incremental effect of forecast errors on abnormal returns for the subsample of high entropy firms (i.e., firms where negative synergies are high). Once again, since the cost imposed by information asymmetry must be sufficiently high to motivate a spin-off when there are no negative synergies, the expected sign of this interaction term is negative. The coefficient of the interaction term is -17.37 which is significant and concurs with our expectations, and is also smaller in magnitude than 21.49, the coefficient of the forecast error variable. To check the robustness of the previous results, regressions 6 and 7 replicate the analysis in 4 and 5, but with the forecast error variable replaced by the standard deviation in analysts' forecasts. All the results remain virtually unchanged.

Regression 8 is particularly interesting in that the measure of information asymmetry used in this regression is the ratio of intangible assets to total assets of the firm. While it is reasonable to argue that higher fractions of intangibles can be interpreted as higher levels of uncertainty in market valuation, I further refine this measure through an interaction of this term with the market's perception of the intangible assets. I argue that for a given level of intangibles, firms with lower market values (normalized by book values) may be viewed as bearing the largest penalty imposed by the market due to information asymmetry, and so should exhibit a larger positive relation with abnormal returns. Accordingly, I expect a positive coefficient for this interaction term. These conjectures are confirmed from the results in regression 8, where the interaction of intangibles with low market-to-book dummy is significantly positive (coefficient of 23.99, and a t-statistic of 2.28). Again, the results are consistent with the information hypothesis.

The factors that explain the abnormal returns generated around the spin-off event should also be able to explain the incidence of spin-offs, and thus be able to discriminate between firms that spin-off subsidiaries and those that do not. I use the factors discussed above in a conditional logistic regression to predict the incidence of spin-offs. The dependent variable is 1 if the firm divested through a spin-off, and is 0 if it is a control firm. The information hypothesis suggests that the likelihood of a spin-off is increasing in the level of information asymmetry. Further, information asymmetry plays an important role in the theoretical model under the premise that the firm is cash-constrained and is thus forced to depend on external capital. Hence, a direct implication of the model is that, firms with growth opportunities that have low levels of internally generated cash will engage in a spin-off.

The conditional logistic regression 1 in Table 13, indicates that higher levels of forecast errors are significantly (p-value 0.03) associated with higher incidence of spin-offs. The coefficient of the entropy variable is positive and significant (p-value 0.008) indicating that higher the level of unrelated diversification in operations by a firm, the higher is the likelihood that it will divest some of its divisions through a spin-off. Cash flow from operations, which is a measure of liquidity of the firm, is significantly negative (p-value 0.07) suggesting that low levels of internally generated cash lead to higher incidence of spin-offs.[13] These results are consistent with the implications of the model that spin-offs may be a precursor to raising capital. To control for the growth opportunities available to the firm, I use a high-growth indicator variable which is set to 1 if the market-to-book ratio of the firm is higher than the median market-to-book ratio of the set of all sample and control firms, and is set to 0 otherwise. The significantly positive coefficient of this variable suggests that high-growth firms show a higher incidence of spin-offs. To test whether the results are robust to other measures of corporate liquidity, I use operating income in the place of cashflow from operations in regression 2. All the results remain unchanged. Regression 3 uses the standard deviation of earnings forecast to measure information asymmetry, retaining the growth and corporate liquidity variables from regression 2. The coefficient of the standard deviation variable is, however, not significant (p-value 0.18). The entropy, growth, and the liquidity variables are all significant, with the expected signs, indicating that high levels of diversification, and the need to raise external capital continue to be important determinants of a firm's likelihood to divest through a spin-off.

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[13] Cashflow is a better measure of liquidity than some of the income based measures, as it is less susceptible to manipulation of accounting procedures by the managers.

Table 13

Conditional Logistic Regressions to Explain the Incidence of Spin-offs

The dependent variable is 1 for firms that engaged in a spin-off and 0 for the control firms. The forecast errors are measured in the last month of the fiscal year before the announcement of the spin-off. They are defined as the ratio of the absolute value of the difference between the actual earnings and the forecast earnings to the price per share at the beginning of the month. The forecast standard deviation measures the dispersion in the earnings forecasts in the month in which the forecast errors are computed. Entropy is the weighted average of the percentage sales of the various distinct 2-digit SIC industry groups in a firm. Cashflow from Operations is measured as a ratio relative to the total assets of the firm. Cashflow is change in cash from all operating activities and includes changes in operating assets and liabilities. Operating Income is measured as a ratio relative to the total assets of the firm. The Income variable is Sales minus Cost of Goods Sold and other Expenses, before Depreciation and Amortization. D is an indicator variable which is 1 if the firm is high-growth, and 0 otherwise. A firm is classified as a high-growth firm if its Market-to-Book ratio is above the median of the set of all sample and control firms. (p-values of the regression coefficients are in parentheses).

	Predicted Sign	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Forecast Error	+	3.8638** (0.0293)	4.1316*** (0.0074)		2.8766** (0.0438)	2.8683** (0.0394)
Forecast Standard Deviation	+			0.2513 (0.1833)		
Entropy	+	1.4738*** (0.0078)	1.4118** (0.0114)	1.4371*** (0.0086)	1.1726** (0.0179)	1.0652** (0.0341)
Cashflow from Operations	-	- 0.3817* (0.0710)		- 0.3830* (0.0683)		
Operating Income	-		- 0.5227* (0.0833)			
Growth Dummy (D)	+	0.7667** (0.0325)	0.9511** (0.0161)	0.6126** (0.0401)		
Cashflow * D	-				- 0.4429* (0.0662)	
Operating Income * D	-					- 0.3490** (0.0386)
- 2 * Log-Likelihood		72.359***	70.019***	73.505***	72.597***	76.510***

*** Significant at 1% ** Significant at 5% * Significant at 10%

Corporate liquidity constraints are especially important for firms that have profitable investment opportunities available to them. The information hypothesis predicts a higher incidence of spin-offs among such firms. I use an interaction of high-growth opportunities with liquidity, to better measure the cash-constraint conjecture. This term focuses on the liquidity of the subsample of firms with high growth opportunities. The lower the level of liquidity in this subsample, the higher should be the likelihood of a spin-off. Thus the expected sign of the coefficient of this interaction term is negative. Regressions 4 and 5 which use this interaction term, but with the two different measures of corporate liquidity, substantiate this hypothesis. The interaction terms are significantly negative (p-values of 0.07 and 0.04), while the forecast error variable remains significantly positive (p-values 0.04 in both regressions).

VI. CONCLUSION

This study explores the role of information asymmetry in explaining the incidence of, and the gains associated with corporate spin-offs. The information hypothesis argues that spin-offs reduce information asymmetry in the individual divisions of a firm, and result in an overall better market valuation of the separated divisions compared to that of the combined firm. I construct a theoretical model of information asymmetry between the managers and the outside investors, about the operating costs and efficiency of the individual divisions of the firm. The 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, I show that the investors overestimate the cost of the high-growth division. Therefore, 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. Thus, I demonstrate that even in the absence of negative synergies, information asymmetry about a firm's operating costs and efficiency is by itself a sufficient motive for firms to engage in spin-offs.

Using analysts' earnings forecast errors, the standard deviation of the earnings forecasts, and the fraction of intangible assets as measures of information asymmetry, I find that sample firms have higher information dissemination problems than their industry and size matched controls. I also find that information problems decrease after the spin-off. The abnormal returns generated around the announcement of spin-offs is larger for firms with higher earnings forecast errors. This result also obtains when the other measures of information asymmetry are used. I find that for firms which spin-off related subsidiaries, i.e., firms that should have lower negative synergies between divisions, information problems are a more important explanator of the abnormal returns. This supports the theory that while negative synergies may play a role in explaining spin-off gains, mitigation of information problems is also an important factor. Finally, consistent with the predictions of the theoretical model, I find that firms that have larger growth opportunities, but are cash-constrained (firms that have a pressing need for external capital), show a higher propensity to engage in spin-offs.

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APPENDIX

ENTROPY AS A MEASURE OF DIVERSIFICATION

The entropy measure of corporate diversification that is discussed below is adapted from Palepu (1985). The entropy measure is based on three elements of a firm's diversity in operations: the number of product segments in which the firm operates; the distribution of the firm's total sales across these product segments; and the degree of relatedness among the various product segments. As a result, the total entropy measure can be decomposed into two additive components: the unrelated component which measures the extent to which a firm's output is distributed across unrelated industry groups; and a related component that measures the distribution of the output among related segments within each industry group. Thus, the total entropy is higher for firms that are more diversified.

The related entropy arises out of the firm's operations within an industry, and is the weighted average of the percentage sales (measured relative to the total sales of all the segments of the firm in that industry) of each of the firm's product segments in that industry. If the firm operates in several industries, the total related entropy is the weighted average of the related diversification within each of these industries. Thus, DR which represents the total related entropy, is measured as $DR = \sum_{j=1}^{M} DR_j P^j$

where P^j is the fraction of the total sales of the firm that comes from the *j*th industry group, M represents the total number of different industry groups, and DR_j represents the related diversification of each group *j*. The related diversification of each group *j* is computed as $DR_j = \sum_{i=1}^{N_j} P_i^j \ln(1/P_i^j)$ where P_i^j is the fraction of the total sales of the *j*th industry group that comes from segment *i*, and N_j represents the number of the firm's segments in industry group *j*.

In addition to the related entropy, a firm operating in several industries has unrelated entropy. This unrelated entropy component is computed as the weighted average of the percentage sales of each of the industry groups in the firm's total sales. Thus, DU which represents the total unrelated entropy, is computed as

$DU = \sum_{j=1}^{M} P^j \ln(1/P^j)$ where P^j is the fraction of the total sales of the firm that comes from the *j*th group, and M represents the total number of different industry groups. Palepu(1985) shows that under the above definitions of related and unrelated entropies, total entropy, DT, of a firm is simply the sum of related and unrelated components, DT = DR + DU.

In this study, I use 2-digit SIC codes to classify the different divisions of a firm into different industry groups. Divisions belonging to the same 2-digit SIC code are classified into the same industry group. So there will be as many different industry groups for each firm, as there are distinct 2-digit SIC codes for that firm. Within each industry group. divisions are classified into different segments based on 4-digit SIC codes. Since the objective of my study is to be able to resolve differences between spin-offs motivated by information asymmetry and those motivated by improvement in focus, my primary variable of diversification is the unrelated entropy index for each firm. In the regressions analysis, I also use the total entropy index as a robustness check for this variable.

VITA

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