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DISENTANGLING VALUE: MISVALUATION AND DIVESTITURES

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Disentangling Value: Misvaluation and Divestitures

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ABSTRACT

This paper presents a rationale for divestiture consistent with one of the frequently cited reasons by divesting firms, namely, that the firm is undervalued and splitting the firm into its component businesses will make it easier for the market to value the components accurately. The rationale is based on two basic premises. One, the market can observe the aggregate cash flows of the firm but not divisional cash flows; two, the cost of financing a project by divesting a division is greater than the cost of external equity financing which, in turn, is costlier than internal capital. In this setup, we show that the firm may be misvalued if the informativeness of divisional cash flows regarding the respective divisions' future prospects are different. If an undervalued firm needs external capital, it may resort to costly divestiture while an overvalued firm will use less costly external equity, resulting in correct valuation of the divisions. Among the empirical implications the model yields are: 1) The stock price reaction to a divestiture announcement is positive and is greater for focus-increasing divestitures; 2) Firms that divest invest more than their conglomerate counterparts; 3) Firms that divest are likely to divest the poorly performing divisions.

DISENTANGLING VALUE: MISVALUATION AND DIVESTITURES

In the 1990s, corporate divestiture activity has increased substantially. Spin-off activity, which is one form divestitures can take, has increased each year from $4.25 billion in 1992 to an estimated $70 billion in 1996.[2] As can be seen from Table 1, the reasons advanced by companies for divesting part of their operations tend to fall into two broad categories. One frequently-cited reason is the efficiency gain from selling assets to better users and concentrating on core businesses. The other reason, stated just as frequently, is the market's presumed inability to evaluate conglomerates consisting of unrelated businesses. For example, a reason stated for the recent restructuring of Westinghouse Electric into two units, one in broadcasting (CBS) and the other industrial, is that "...(it) *satisfies Wall Street, which couldn't figure out how to value a $9.5 billion company with one foot in a TV studio and the other in a nuclear-waste dump.*" (Baker (1996)). The same sentiment is echoed in the following analysis of a possible spinoff by Philip Morris of its tobacco and food divisions (Kadlec (1994)): *In any spinoff, the basic idea is to simplify the company for investors. In Philip Morris case, a food analyst can easily value the food business but be confounded by liabilities associated with*

Table 1. Reasons stated by firms for divestiture

	Reason stated for divestiture		
Type of divestiture	Focus operations	Firm undervalued	Poor performance
Equity carveouts	43%	45%	18%
Spinoffs	49%	40%	27%

The sample consists of firms that divested through an equity carve-out or a spin-off during 1985-96. The equity carve-out sample consists of 102 firms and the spin-off sample consists of 162 firms listed in the Securities Data Corporation database. The sample is limited to divestitures of at least $50 million and those in which the parent retains less than 50% ownership. The reasons stated by firms for divestiture were obtained from news reports through the Dow Jones News Retrieval Service. Some firms offered multiple reasons.[1]

[1] Several firms in our original sample did not give a clear reason for divestiture, other than to state that the funds will be used for investment purposes or for paying down debt. Such firms are excluded from the sample in Table 1.

tobacco. So he or she puts a low value on the company. Thus, there seems to prevail the notion that combinations of unrelated businesses are undervalued and the value can be unlocked through a divestiture (see Cusatis, Miles, and Woolridge (1994) for a discussion).

While there is substantial academic literature that examines the implications and the empirical validity of the efficiency gain hypothesis (for example, see Hite, Owers and Rogers (1987) and Lang, Poulsen, and Stulz (1995)), there is very little work that explores the undervaluation hypothesis. In this paper, we provide a model that explains why a multi-divisional firm may be prone to undervaluation and why it might choose to divest a division in the presence of such misvaluation.

Our theory is developed in the context of a model in which a firm consists of two divisions. Each division's cash flows depend on the division's inherent "quality", which may represent, for instance, its competitive advantage. The quality is unknown to everyone and the firm's managers and the market learn about it only through the random cash flows the firm produces. The informativeness of current cash flows regarding future cash flows differs between divisions. One key premise of the model is that while the market can observe the aggregate cash flows produced by the firm each period, only insiders (management acting in the interest of current shareholders) get to observe the divisional cash flows.[3] The firm has a project for which it needs capital which can be raised one of three ways: internal capital (retained earnings), external equity capital, or by divesting a division. The second key premise of the model is that internal capital is less costly than external equity capital which, in turn, is less costly than raising capital through a divestiture.

Suppose the division with the more informative cash flows does well and the other division does poorly. Insiders will correctly place a greater weight on the more informative

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[2] Business Week, May 13, 1996.

[3] Gilson, Healy, Noe, and Palepu (1997) provide evidence that is consistent with the notion that divestitures improve information available to investors. They find a significant improvement in the accuracy and consensus of analysts' earning forecasts after divestitures.

division's cash flow in updating its quality than they would on the cash flows of the other division. In other words, insiders place more weight on the performance of the well-performing division and discount the performance of the poorly performing division. The market, however, can observe only the aggregate cash flows and not the divisional cash flows. Therefore, it rationally updates the overall quality of the firm as if each division's performance is average. Effectively, the market will undervalue the successful division and overvalue the poorly performing division. This results in the undervaluation of the combined firm.

If the firm now needs external capital for the project, it has to issue undervalued securities which increases the cost of capital. Instead, the firm might choose to divest the underperforming division (since it is overvalued) to raise capital. This signals to the market that the division is overvalued and, in a separating equilibrium, the division will be correctly valued. Through divestiture of the division, the firm gets to raise capital at a fair price, but must incur the additional cost of divestiture.

In the scenario where the division with more informative cash flows does poorly, the firm will be overvalued by the market. In this instance, the firm has no incentive to resort to the more costly method of divestiture to raise capital and will attempt to issue overvalued equity to finance the project. The market recognizes this incentive and, in a separating equilibrium, will correctly value the firm.

The model generates several empirical implications. 1) The stock price reaction to a divestiture announcement is positive since firms divest when they are undervalued by the market. 2) Firms that focus are likely to invest more than what their conglomerate counterparts invest in that line of business. Since firms that are more likely to divest are those with large investment needs, they balk at issuing a large quantity of undervalued external equity and resort to divestitures instead. 3) The greater the dissimilarity between the informativeness of the divisions' cash flows the greater the (positive) stock price reaction to a divestiture announcement. This follows from the fact that the greater the dissimilarity, the greater the

undervaluation of the firm. 4) The likelihood of divestiture increases as the cost of external equity financing increases because the difference between the costs of external equity financing and divestiture decreases. 5) Firms divest poorly performing divisions. Firms that divest have the more informative division performing well and the less informative division performing poorly. Therefore the latter division will be overvalued and it is in the firm's interest to try to sell the overvalued division though, in equilibrium, the market realizes this incentive and values the division correctly. While several of these implications are consistent with reported empirical findings, others are yet to be tested.

Several other explanations have been offered for why firms divest. The most common notion is that firms divest assets that are better managed by another firm or manager. Meyer, Milgrom and Roberts (1992) propose that managers of poorly performing divisions, fearing job loss, impose "influence costs" on the firm, expending resources to influence top management to allocate resources to keep their divisions operational. One way to minimize these costs is to divest such divisions. Matsusaka and Nanda (1996) suggest that refocusing through divestiture can serve as a credible way to commit resources to an industry and prevent entry by rivals. Lang, Poulsen, and Stulz (1995) suggest that firms may divest assets to finance projects, pay down debt, or pay dividends if raising capital through security issuance may be too costly due to asymmetric information. While there are some common elements between our model and their hypothesis, the incremental contribution of our paper is that we provide a formal analysis that characterizes an informational asymmetry that makes it optimal for the firm to raise capital through a divestiture instead of a secondary offering.[4] Similar to our model, Habib, Johnsen, and Naik (1997) provide an explanation based on asymmetric information. However, in contrast to our model, their explanation is based on the assumption that there are investors better informed than the management. By divesting divisions that then trade separately, the

[4] The notion that firms might convert undervalued or "latent" assets into cash to resolve informational asymmetry even if such a process is costly is advanced in Brennan (1990).

price system conveys more information about future cash flows than the single conglomerate stock price, thereby enabling managers to make better investment decisions. In the paper, we discuss the similarities and the differences between the empirical implications of the existing theories and our misvaluation hypothesis and suggest ways to test whether misvaluation is one of the significant reasons for divestiture.

We also explore the impact of expected future financing costs on the firm's decision to diversify in the first place. Such an analysis provides an additional explanation for diversification that is a variant of Williamson's (1975) internal capital markets argument. Our model introduces a cost to diversification based on asymmetric information between the market and insiders. Since external equity financing is more costly than internal capital, there is a benefit from diversification as well – diversification tends to increase available internal capital. Thus, the decision by a firm to diversify or focus in the first place (even in the absence of any synergy from diversification) trades off the expected benefit of lower cost internal capital against the expected cost of divestiture if the firm is undervalued. This trade off provides the following implications. 1) Firms benefit more when they can diversify into businesses that are similar in the information content of their cash flows. As the divisions become dissimilar in the information content of their cash flows, the extent of potential undervaluation when the more informative division performs well increases, raising the probability of a costly divestiture. 2) In economies where the cost of raising external equity capital is low, fewer firms will be diversified. As the cost of raising external equity decreases, the benefit from diversification decreases since internal capital is less valuable.

The paper is organized as follows. Section I presents the model. Section II analyzes the potential misvaluation of a multi-division firm. Section III deals with the future financing strategy of a firm that has chosen to diversify. Section IV deals with the ex-ante decision to diversify in light of the potential future costs and benefits. Section V concludes.

I. The Model

The model consists of three dates, 0, 1, and 2. Consider a conglomerate formed at date 0 that consists of two divisions, labeled X and Y.[5] The divisions have certain assets-in-place that are expected to produce cash flows at dates 1 and 2. In addition, division X expects to develop a project at date 1. This project will require an investment of I dollars at date 1 and will produce a cash flow of $f(I)$ at date 2. It is assumed that $f(\cdot)$ is strictly increasing and strictly concave, i.e., $f' > 0$ and $f'' < 0$, and that $f(0) = 0$. The exact value of I will be known only at date 1. The uncertainty regarding I at date 0 is characterized by the probability distribution function U (and corresponding density function u) with the support $[\underline{I}, \bar{I}]$. Division Y has no future project.[6]

The assets-in-place of each division have some inherent "quality" that represents the ability of the division to generate cash flows in the future. For example, quality can be viewed as the ability of the firm to develop innovative products, manufacture the products efficiently, and market them more effectively than the competition. In particular, the quality can be good (G) or bad (B). At date 0, the quality of a division is unknown to everyone, including current shareholders and the management of the company.[7] All participants have the same prior probability θ_j that division j is of quality G.

Figure 1 shows the cash flows generated by the assets-in-place of division j at dates 1 and 2. If the quality of division j's assets-in-place is G, they will produce a cash flow of H with probability p_j or a cash flow of L with probability $(1 - p_j)$ at date 1, where $H > L$. If instead the quality is B, the assets-in-place will produce a cash flow of L with certainty at date 1. Similarly, if division j's quality is G, the assets-in-place will produce an expected cash flow of

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[5] Similar results can be obtained in a model with more than two divisions, though the analysis becomes cumbersome.

[6] It is immaterial whether both divisions have projects or only one does. All the analysis holds if, for example, both divisions have projects. This assumption merely keeps the analysis simple.

[7] The idea is that quality is multidimensional and difficult for even insiders to know with perfect precision.

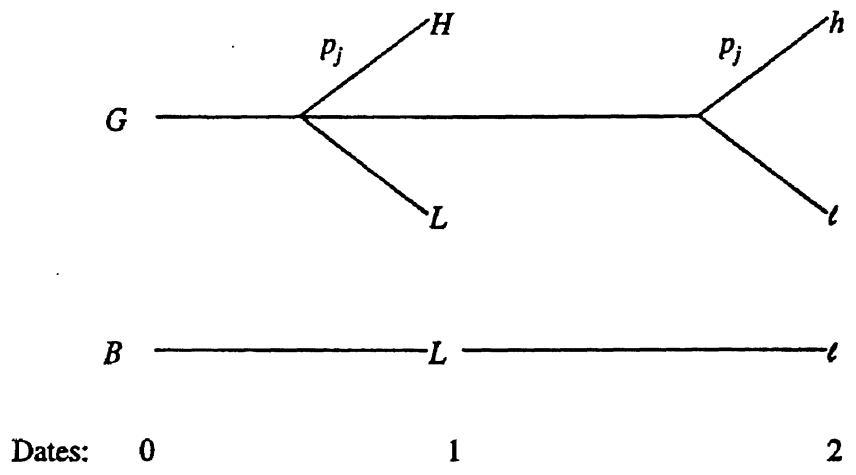

Figure 1. Cash flows from assets-in-place of Division j, $j \in \{X, Y\}$.

h with probability p_j or an expected cash flow of ℓ with probability $(1 - p_j)$ at date 2, with $h > \ell$; if the quality is B, the assets-in-place will produce a cash flow of ℓ at date 2. It is assumed that h and ℓ are very large compared to I, the investment required for division X's project.[8] It is assumed that the probability distributions of cash flows generated by the assets-in-place of divisions are independent of each other and over time.

At date 1, the uncertainty regarding division X's project is resolved; specifically, I, the investment required, becomes known. If the date 1 cash flow is greater than I, the firm finances the project with internal capital and pays out the surplus, if any, to shareholders. If the investment I exceeds the date 1 cash flow, the firm must seek external capital. It can raise external capital either through an equity offering or by divesting a division.[9] It is assumed that the value of either division exceeds the maximum amount of external capital required. A divestiture might be achieved either through an initial public offering to investors (equity carve-

[8] Cash flows h and ℓ at date 2 should be viewed as expected values of all future cash flows. They are significantly larger than H or L, the date 1 cash flows. The distribution of these future cash flows is assumed to such that the firm cannot raise capital using risk-free debt.

[9] For simplicity, only equity financing is considered in this paper. The analysis holds if the firm is allowed to issue risky debt. We also assume that the investment does not lend itself to project financing.

out) or by selling the division to another company or investors through a privately negotiated deal (asset sales or selloff).[10] In either case, we only consider complete divestiture, where firm *X* completely divests itself of a division, without retaining any stake in it.[11]

Both external equity financing and divestitures are costly. In the case of external financing, the firm must incur transaction costs such as underwriter, management, and selling fees, registration expenses etc.[12] In addition, as Bhide (1990) notes, there are several reasons why internal capital is less expensive. Central management can obtain better information than outside investors about a firm's projects and therefore allocate capital more effectively. Since outside investors have less information about the projects, they may charge a higher cost of capital (Stein (1996)).[13] It is assumed that the incremental cost of external financing is proportional to the amount raised and the proportionality constant is denoted by *c*.

On the other hand, if a diversified firm chooses to divest a division to raise capital, it must incur costs such as investment banking fees if the division is being sold to another company, or underwriting fees and expenses if the divestiture is done through an IPO.[14] In both cases, the firm must expend resources on reputed financial intermediaries, auditors, and independent experts to certify the value of the division since there is no market valuation of individual units. Also, if the market for the division being sold is not competitive, the firm

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[10] We do not explicitly consider spinoffs, where the firm distributes the ownership of the division to its current shareholders on a pro rata basis. The reason is that spinoffs do not generate any capital. However, our model can be extended to deal with the firm using the spinoff to get fair valuation of its stock and then raising capital later through an equity offering (see discussion in Section V).

[11] While considering partial divestiture complicates the analysis, the intuition of our model holds. As will be shown later, when the firm divests, the divested division and the firm are valued correctly by the market. If we allow that the cost of a partial divestiture still exceeds the cost of raising external equity, all results hold.

[12] These expenses can be viewed to some extent as compensation to underwriters for resolving information problems between firms and investors by assessing fair value and certifying the offering price of securities.

[13] One reason all information about a project is not revealed to outside investors may be that revealing sensitive information might put the firm at a competitive disadvantage (Gertner, Gibbons, and Scharfstein (1990)).

[14] We find that the underwriting costs and expenses as a percentage of gross amount issued for a sample of 138 equity carveouts during 1985-96 are 2.5 to 3 percentage points higher than that for similar sized seasoned equity issues. Our sample contained carveouts with issue size of at least $50 million and those in which the parent retained less than 50% ownership. Details can be provided on request.

might have to bargain with the buyer and settle for less than what it considers fair value. In addition, there may be internal costs of reorganization. For example, the firm must formalize contracts that assign patent rights resulting from centralized research and development to the divisions; similarly, it must distribute personnel in centralized activities such as accounting, information systems, maintenance, purchasing, etc., to the divisions. Finally, if there was any operating synergy, it will be lost. It is assumed that the net cost of selling a division to finance a project is higher than the cost of raising external capital, especially since the divisions are assumed to be much larger in size than the project. Specifically, it is assumed that the cost of divesting a division $D > c(\bar{I} - 2L)$; that is, the cost of divesting a division is greater than the cost of raising the maximum required external capital for the project. It is also assumed that the net present value of the project is positive even net of divestiture costs, that is, $f(I) > I + D$ for $I \in [\underline{I}, \bar{I}]$.

There is likelihood of informational asymmetry developing between the insiders (management) and the market. This arises from the fact that insiders can observe the cash flow generated by each division at date 1 but the market can only observe the cash flow generated by the firm as a whole (the sum of the cash flows of the divisions).[15] The asymmetry between what the two parties observe is of consequence only if the total cash flow at date 1 is $(H + L)$. In this case, as will be discussed below, the market's posterior of the division quality will be different from that of management. If, however, the total cash flow is $2H$ or $2L$, the posteriors will be symmetric.

At date 2, final cash flows h or ℓ are realized and the firm liquidates. All agents are assumed to be risk-neutral. The discount rate is zero. There is no agency problem between

[15] It is not uncommon for companies not to release divisional financial statements. For example, AT&T released financial statements for its equipment division (named Lucent Technologies) for the first time at the time of the spinoff. Even if financial statements are available, they do not necessarily reveal the divisional cash flows, since it is relatively simple to shift cash flows across divisions through transfer pricing. Shah and Thakor (1987) use a similar assumption in the context of project financing. Gilson, Healy, Noe, and Palepu (1997) document that more precise information becomes available after a divestiture (see footnote 3)

management and shareholders and the goal of the management is to maximize current shareholder wealth – therefore, the term "management" will be used to denote insiders. There are no taxes.

II. Misvaluation at date 1

In this section, we analyze the effect of the informational asymmetry regarding the firm's cash flows (if firm X diversifies) on the valuation of the firm. Any misvaluation by the market affects the cost of external equity capital.

a. Valuation of firm by management

Since management observes the cash flows from individual divisions, it calculates the posterior probability of division j being of quality G as follows:

$$\Pr(G|H) = 1,$$
$$\Pr(G|L) = \frac{\theta_j(1-p_j)}{1-\theta_j p_j} \equiv \phi_j. \tag{1}$$

Let $v_j(s_j)$ denote the expected value of the date 2 cash flows generated by the assets-in-place of division j, $j = X, Y$, if management observes s_j, $s_j \in \{H, L\}$ at date 1, where s_j is the date 1 cash flow of division j. Then,

$$v_j(H) = p_j h + (1-p_j)\ell, \tag{2}$$

$$v_j(L) = \phi_j p_j h + (1-\phi_j p_j)\ell. \tag{3}$$

Equation (2) follows from the fact that a cash flow of H reveals the quality to be G. In equation (3), the management uses the posterior distribution of quality given by equation (1) to compute $v_j(L)$. There are four possible states of the world at date 1 based on whether each division's cash flow is H or L. Let $v(s_x,s_y)$ denote the date 1 expected value of date 2 cash flows generated

by the combined firm's assets-in-place if management observes state $s_x s_y$, $s_x s_y \in \{HH, HL, LH, LL\}$. Then,

$$v(s_x s_y) = v_x(s_x) + v_y(s_y). \tag{4}$$

The management's expected value of all the date 2 cash flows, including that generated by division X's project, is $v(s_x s_y) + f(I)$.[16]

b. Valuation of the firm by the market

The market only observes the sum of the cash flows of the two divisions. If the aggregate cash flows are $2H$ or $2L$ (states HH or LL), there is symmetric information between the market and the management. Since states HL and LH both produce a total cash flow of $(H + L)$, the market cannot distinguish between the two states and, hence, its valuation of the firm is identical in these two states. Let $V(s_x+s_y)$ denote the market's expected value of the date 2 cash flows generated by the assets-in-place of the firm if the market observes state (s_x+s_y), $(s_x+s_y) \in \{2H, H+L, 2L\}$. Then,

$$V(2H) = v_x(H) + v_y(H) \tag{5a}$$

$$V(2L) = v_x(L) + v_y(L) \tag{5b}$$

$$V(H+L) = \Pr(s_x s_y = HL \mid s_x+s_y = H+L)v(HL) + \Pr(s_x s_y = LH \mid s_x+s_y = H+L)v(LH) \tag{5c}$$

The market's expected value of all the date 2 cash flows, including that generated by division X's project, is $V(s_x+s_y) + f(I)$.

[16] As mentioned earlier, if the cash flow at date 1 exceeds I, the excess is paid out as dividends at date 1.

c. Effect of informativeness on misvaluation

It can be seen from equations (4) and (5c) that the firm will be misvalued by the market if states *HL* or *LH* occur. Whether the firm will be undervalued or overvalued depends on how informative the cash flows are regarding divisional quality. For example, if cash flow *H* is more informative about the division's quality than cash flow *L*, then the firm will be undervalued. To formalize this notion, we define a measure of informativeness of the signal, in the context of our model.

Definition: The term $\lambda_j \equiv (1-p_j)/(1-\theta_j p_j)$ is defined as the ***noisiness*** of division *j*'s date 1 cash flows in revealing the division's quality.

To see the intuition behind λ_j, observe that

$$\lambda_j = \frac{1-p_j}{1-\theta_j p_j} = \frac{\Pr\left(CF_j = L \middle| Quality\ of\ \ j = G\right)}{\Pr\left(CF_j = L\right)} \tag{6}$$

As λ_j increases, the probability of obtaining a date 1 cash flow of *L*, if the division's quality is *G*, increases. This means that it is difficult to distinguish whether the quality is *G* or *B* on observing a cash flow of *L*; in other words, the precision of the *L* signal decreases. This can be seen more formally by noting that the posterior $\phi_j = \theta_j \lambda_j$, and therefore, as λ_j increases, the posterior ϕ_j approaches the prior θ_j. Hence, the lower the value of λ_j the greater the informativeness of division *j*. We discuss later ways in which the relative informativeness of divisions may be measured. Without loss of generality, we assume that division *X* cash flows are more informative, that is $\lambda_x < \lambda_y$.

The following proposition states the condition under which the firm will be undervalued if the aggregate cash flow is $(H + L)$. All proofs are in the Appendix.

Proposition 1: Suppose the market observes only the firm's aggregate cash flows while management observes the divisional cash flows. Then, if division *X*'s cash flows are more informative about divisional quality ($\lambda_x < \lambda_y$), the firm will be undervalued when division *X* produces *H* and division *Y* produces *L* (i.e., management observes state *HL*).

Proposition 1 states that, under asymmetric information, the firm will be undervalued if the division with the more informative cash flows regarding quality performs well.

It must be noted that changes in λ_j, which are caused by changes in θ_j and p_j, also affect the value of the division, since $\theta_j p_j$ is the probability of the high cash flow in each period. Therefore, when we analyze the effect of changes in λ_j, we keep the divisional value constant by holding the product $\theta_j p_j$ fixed.

III. Financing strategy at date 1

This section analyzes the date 1 financing decision of firm. At date 1, the investment *I* required for the project is realized. If the firm has enough cash from assets-in-place, it is optimal to fund the project from retained earnings since external financing is costly. If retained earnings are insufficient, and states *HH* or *LL* are realized, the firm will use external equity financing for the excess cash needed, since in these states there is no asymmetric information between the management and the market about the firm's quality. If states *HL* or *LH* are realized, however, the firm will be misvalued at date 1. The following analysis focuses on the external financing decision when these states occur and asymmetric information exists.

a. Separating equilibrium

In this sub-section, we investigate the conditions under which a separating equilibrium exists, that is, the firm's financing choice reveals the realized state to the market.

Suppose state *HL* is realized. The firm is now undervalued (Proposition 1). Therefore, if it seeks external equity financing, it has to bear not only the cost of external financing *c*, but

also the cost of undervaluation. If the latter cost is high enough, the firm may prefer to raise the excess capital required through a divestiture. It has the incentive to divest division *Y*, which is overvalued. This follows from the fact that division *Y* produced a low cash flow but the market values it at the "pooled value." Of course, in equilibrium the market would recognize this incentive and value division *Y* (and hence the firm) correctly.

This discussion suggests the possibility of a separating equilibrium in which the firm finances the project by divesting division *Y* in state *HL* but resorts to external equity financing in state *LH* and the market infers the realized state correctly. A necessary condition for such an equilibrium to exist is that the firm must not have the incentive to deviate and raise external equity financing if state *HL* occurs. To derive this condition, observe that if the firm divests division *Y* in state *HL* and the market correctly infers the state, the expected value to current shareholders is given by

$$v(HL) + f(I) - E(I) - D, \tag{7}$$

where $E(I) \equiv I - (H + L)$ is the excess external capital required in state *HL* or *LH*. If, on the other hand, the firm resorts to external equity financing, in the proposed separating equilibrium, the market presumes state *LH* has occurred and hence the firm will need to sell a fraction α of the firm to raise *E(I)*:[17]

$$\alpha = \frac{(1+c)E(I)}{v(LH) + f(I)}. \tag{8}$$

Therefore, the expected value of cash flows to current shareholders is given by

$$(1-\alpha)[v(HL) + f(I)].$$

[17] It is assumed that the cost of external equity financing c is a linear function of the capital required, rather than the amount raised.

For the firm not to resort to external equity financing in state *HL* it is necessary that the above expression be less than expression (7):

$$v(HL) + f(I) - E(I) - D \geq (1-\alpha)[v(HL) + f(I)].$$

Equivalently,

$$\alpha[v(HL) + f(I)] - E(I) - D \geq 0. \tag{9}$$

Another necessary condition for the existence of the separating equilibrium is that the firm not have the incentive to divest division *Y* in state *LH*. Given the structure of the model, this condition is easily satisfied. If the firm sells division *Y* in state *LH*, the division is sold at a loss. This follows from the fact that the management's estimate of division *Y*'s quality is higher than that of the market since the market believes that the date 1 cash flow of division *Y* is *L* while the management knows that it is *H*. In addition to the cost of undervaluation, the firm also has to bear the higher divestiture cost *D* compared to the cost of external equity financing. Therefore, the firm will never resort to a divestiture of division *Y* if it has observed state *LH*.

The following proposition formalizes the above discussion. The equilibrium concept used is the sequential equilibrium of Kreps and Wilson (1982). Note that the proposition states the market belief for the out-of-equilibrium move of divesting division *X*.

Proposition 2: Suppose condition (9) is satisfied and the total cash flow of the firm is $(H + L) < I$. Then there exists an unique (in outcome) separating equilibrium that satisfies the Cho-Kreps (1987) criterion in which

i. If management observes state *LH* it will finance the project through external equity.

ii. If management observes state *HL*, it will divest division *Y* and finance the project.

iii. The market beliefs are as follows:

a) If external equity financing is observed, the realized state is *LH*.

b) If divestiture of division *Y* is observed, the realized state is *HL*.

c) If divestiture of division *X* is observed, the realized state is *LH*.

b. Pooling equilibrium

In situations where condition (9) is not satisfied pooling equilibria might exist in which the firm raises capital through the same technique (external equity or divestiture) irrespective of whether state *HL* or state *LH* occurs. The most intuitive of these pooling equilibria is the one in which the firm always raises capital through external equity financing irrespective of whether state *HL* or *LH* occurs. It will be shown (see proof of proposition 3) that pooling equilibria in which the firm always resorts to divestiture to raise capital do not exist. We analyze below the pooling equilibrium in which the firm always uses external equity financing to raise capital.

Consider a pooling equilibrium in which the firm always issues equity to finance the project and where the market believes that the firm will divest division *Y* only if state *HL* obtains and divest division *X* only if state *LH* obtains. In this case, the fraction of the firm to be sold to investors is given by

$$\alpha' = \frac{(1+c)E(I)}{V(H+L)+f(I)}. \qquad (10)$$

In this equilibrium, if state *LH* obtains, the firm has no incentive to deviate from the equilibrium strategy for three reasons. First, the equilibrium strategy allows the firm to sell overvalued securities (Proposition 1). Second, if it deviates and sells off division *Y*, the market assumes that state *HL* obtained, and hence will undervalue division *Y*; if it deviates and sells off division *X*, the market still only values the division fairly. Finally, the cost of divestiture exceeds the cost of equity financing.

If state *HL* obtains, the firm will not deviate from the equilibrium strategy if

$$(1-\alpha')[v(HL)+f(I)] > v(HL)+f(I)-E(I)-D. \tag{11}$$

The left-hand side of condition (11) is the expected value of date 2 cash flows to current stockholders if the firm issues external equity; the right-hand side is the expected value of date 2 cash flows to current stockholders if the firm deviates from the equilibrium strategy and sells off division *Y*, resulting in the market belief that state *HL* has obtained (same as expression (7)). Condition (11) can be written as

$$\alpha'[v(HL)+f(I)]-E(I)-D<0. \tag{12}$$

Note that the firm has no incentive to divest division *X* in state *HL* since the division will be undervalued given the market's belief that state *LH* has occurred if it observes the divestiture of division *X*. The following proposition describes the pooling equilibrium.

Proposition 3: Suppose condition (12) is satisfied and the total cash flow of the firm is $(H+L) < I$. Then, there exists a unique (in outcomes) pooling equilibrium that satisfies the Cho-Kreps (1987) criterion in which the firm uses external equity financing to fund the project. The market's beliefs are:

i. If external equity financing is observed, the realized state is *HL* with a probability equal to $\Pr\{HL \mid H+L\}$.

ii. If divestiture of division *Y* is observed, the realized state is *HL*.

iii. If divestiture of division *X* is observed, the realized state is *LH*.

Comparing equations (8) and (10), it can be seen that $\alpha > \alpha'$. This follows from the fact that $v(LH) < V(H+L)$; $v(LH)$ is the lowest value of the date 2 expected cash flows generated by the firm's assets-in-place while $V(H+L)$ is the market's estimate of the average value of the date 2 expected cash flows generated by the firm's assets-in-place given that market has observed $(H+L)$. The fact that $\alpha > \alpha'$ implies that it is possible for both conditions (9) and (12) to be

simultaneously satisfied. In this case, both the separating equilibrium described in proposition 2 and the pooling equilibrium described in proposition 3 can exist simultaneously. For simplifying the analysis, it is assumed that if conditions (9) and (12) are both satisfied, the separating equilibrium results.[18]

c. Effect of investment level on the mode of financing

The cost of undervaluation in state *HL* is increasing in the investment level *I*. Therefore, the value of *I* will have an impact on the mode of financing the project. Recall that a divestiture results in a separating equilibrium in which the division and the firm are correctly valued. The next proposition shows that in state *HL*, if the internal cash flow is insufficient to fund the project, the firm resorts to external equity at relatively low levels of *I* and to divestiture of division *Y* when *I* is high. In state *LH* the firm uses external equity financing irrespective of the investment level.

Proposition 4: Suppose the total cash flow of the firm is $(H + L) < I$. Then, there exists an investment level I^* such that for $I < I^*$, the pooling equilibrium of proposition 3 results and for $I \geq I^*$, the separating equilibrium of proposition 2 results. In other words, for $I < I^*$, the firm uses external equity financing to finance the project irrespective of whether state *HL* or *LH* results; for $I \geq I^*$, it raises capital through divestiture of division *Y* if state *HL* results and through external equity if state *LH* results.

In the above proposition, at the threshold level of investment I^*, the wealth of current shareholders from selling-off division *Y* just equals their wealth from using external equity

[18] Note that if condition (9) is not satisfied, condition (12) is always satisfied and hence a pooling equilibrium results.

financing. In other words, I^* is the investment level at which condition (9) is satisfied as an equality, i.e.,[19]

$$\alpha(I^*)[v(HL)+f(I^*)]-E(I^*)-D=0. \tag{13}$$

At an investment of I^*, the cost of undervaluation in state *HL* just equals the cost differential between a divestiture and external equity financing. As I increases beyond I^*, the cost of undervaluation keeps increasing, making it even more attractive to divest division *Y*. Similarly, if I is less than I^*, the cost differential between a divestiture and equity financing is lower than the cost of undervaluation in state *HL* resulting in external equity financing of the project.[20]

d. Effect of ex post observability on the decision to divest

The above discussion has analyzed conditions in which a conglomerate, undervalued by outside investors, will raise financing through the divestiture of a division. In that process, divestitures also resolve the existing informational asymmetry. In addition, by eliminating the source of informational asymmetry (the inability of outside investors to identify the source of the cash flows), a divestiture will also preclude the development of information asymmetry in the future. Hence, if the firm needs to access the market for external financing in the future, divestitures will be desirable not only to overcome current informational problems, but to avoid potential problems from information asymmetry in the future as well. To illustrate the impact of potential future misvaluation on the current divestiture decision, we briefly discuss a possible

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[19] Given our assumption that date 2 cash flows are very large compared to the investment required ensures that $I^* < \bar{I}$.

[20] Condition (13) defines I^* given our assumption that a separating equilibrium results if it exists even if a pooling equilibrium also exists. If we make the alternative assumption that the pooling equilibrium exists results when both exist, I^* will be defined by the equality of condition (12). The nature of our results is unaffected by how I^* is defined. Also, note that there exists an investment level, as defined by the equality of condition (12), above which only a separating equilibrium exists. Thus, our assumption that a separating equilibrium results if it exists even if a pooling equilibrium also exists is not critical to any of our results.

extension to the model to allow for more than one date at which the firm may need to raise external financing.

Consider the current model with the modification that there are investment opportunities at both date 1 and a subsequent date 1½ (between dates 1 and 2). Assume that the probability distribution of date 1½ cash flows is identical to that of date 1. In other respects the assumptions of the model are unchanged and the terminal (date 2) cash flow distribution is as before (Figure 1). Now consider a conglomerate in state *HL* at date 1. We will now argue that the possibility of external financing needs at date 1½ can increase the firm's incentive to divest at date 1.

If the type *HL* firm divests, it will be correctly valued at date 1 in the separating equilibrium and, since both management and outsiders will have symmetric information about divisional cash flows at date 1½, it will be correctly valued at date 1½ as well. If the type *HL* firm chooses to issue equity (either in a pooling equilibrium or as a deviant strategy in a separating equilibrium), then, in addition to being undervalued at date 1, it can also expect to be undervalued at date 1½, prior to choosing its date 1½ financing strategy.[21] Therefore, if the firm divests at date 1, it incurs divestiture costs at date 1, but can sell fairly-priced equity at date 1½, incurring external financing costs, *c*. On the other hand, by not divesting at date 1, it faces undervaluation costs at date 1 and may face either divestiture costs or further undervaluation costs plus external financing costs at date 1½. At the margin, the possibility of facing another round of undervaluation costs at date 1½ will tend to increase the firm's incentive to divest in date 1.[22]

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[21] It can be verified that if the date 1½ cash flow realization is either $H + L$ or $2L$, the firm will be undervalued by outside investors. The firm will be fairly valued only when the cash flow realization is $2H$ (thereby revealing both divisions to be of type *G*). We can supply a formal proof if desired.

[22] In this discussion we have ignored the differences in the firm's internal cash flow position at date 1½ arising from divesting or remaining a conglomerate at date 1. In the next section, issues having to do with the firm's internal cash flow position are analyzed fully in the context of the firm's initial (date 0) decision to conglomerate.

e. Implications

The above analysis generates several empirical implications.

Implication 1: The stock price reaction to a divestiture is positive.

Since the firm resorts to a divestiture only in state *HL* in which it is undervalued, upon announcement of a divestiture, the stock price of the firm should rise. A similar result is derived in Nanda (1991). This implication is consistent with the empirical evidence on several type of divestitures. Among studies that find positive stock price reactions for selling firms at divestiture announcements are Rosenfeld (1984), Jain (1985), Klein (1986), Hite, Owers, and Rogers (1987), and Slovin, Sushka, and Ferraro (1995). Schipper and Smith (1986) and Slovin, Sushka, and Ferraro (1995) find a similar result for parent companies that execute equity carve-outs. Studies that find positive stock price reaction for parent companies at the announcement of spinoffs are Schipper and Smith (1983), Hite and Owers (1983), Rosenfeld (1984), and Slovin, Sushka, and Ferraro (1995). A related implication is that firms that focus will outperform those that do not. Comment and Jarrell (1995) find evidence that is consistent with this implication. They find that firms that increased their focus by 0.1 (using Herfindahl Index) have an *additional* stock return of 2.9% in the year they changed the focus.

Implication 2: Firms that divest and thereby become focused will invest more than firms that stay diversified.

This follows from proposition 4 which shows that firms that divest have greater investment needs. It is to avoid the huge loss due to undervaluation from issuing large amounts of external equity that the firm chooses to divest. When investment needs are smaller, they can be met through internal cash reserves; even if the reserves are insufficient, the cost of undervaluation may not be large enough to offset the cost differential between a divestiture and external equity.

Implication 3: Firms divest poorly performing divisions.

The division that is divested (division Y) is the division that is overvalued (before the divestiture announcement).[23] But the reason for divesting is that the firm is undervalued which happens only if division Y (the less informative division) has performed poorly. Hence the division that is divested is the one that has performed poorly. This result is similar to that obtained by Meyer, Milgrom, and Roberts (1992) except that they rely on influence costs to obtain it. There is some indirect evidence that is consistent with this conclusion. John and Ofek (1995) find that the operating margins of firms that divest improve even in the year of the sale. If one assumes that there was insufficient time to implement changes to the remaining lines of businesses and reap the benefits, this suggests that the asset that was sold was performing poorly. Given the difficulty of measuring divisional performance, the lack of direct empirical data is not surprising. However, companies often cite poor performance as a reason for divesting a division. In our sample of equity carveouts in Table 1, 18 of the 102 firms stated poor performance as the sole reason for divestiture while 8 more cited it as one of the reasons.[24]

Proposition 4 also has implications for the announcement effect of equity issues. There are two situations in which an equity issue is observed in our model. If I is less than I^*, there will be a pooling equilibrium in which the firm issues equity irrespective of the state and hence there will be no stock price reaction. If I is greater than I^*, the firm issues equity only if it has observed state LH and hence there will be a negative stock price reaction. On average, therefore, there will be a negative stock price reaction to an equity issue. This is consistent with the empirical evidence on equity issues (see Smith (1986) for a survey of this literature).

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[23] Slovin, Sushka, and Ferraro (1995) find a value decrease for the competitors of the carved-out entity. They interpret this as support for the view that the divested division in an equity carveout is overvalued. It must be mentioned, however, that they find the opposite result for spinoffs.

[24] Hite, Owers, and Rogers (1986) also report that firms often state that the reason they are selling a division is because of poor performance.

It is interesting to investigate whether the stock price reaction to a divestiture announcement is related to how dissimilar the two divisions are, particularly in light of the recent literature on focus. In our model, dissimilarity is characterized by the relative informativeness of the cash flows of the two divisions. Recall that informativeness is characterized by the parameter $\lambda_j, j \in \{X, Y\}$. Therefore, one way to investigate the effect of changes in relative informativeness is to keep, say, λ_x fixed and vary λ_y. As discussed in Section II, however, changes in λ_j due to unconditional changes in θ_j and p_j will also change the value of division j at date 1, given by

$$\theta_j p_j h + (1-\theta_j p_j)\ell. \tag{14}$$

If λ_x is held constant and λ_y is increased by increasing both θ_y and p_y, division Y becomes larger with respect to division X. Therefore, the undervaluation of the firm increases, partly due to the fact that relative informativeness has increased and partly because the relative size of division Y has increased. To control for this, we examine the effect of changes in informativeness while keeping the divisional value constant by holding the product $\theta_j p_j$ fixed.

Proposition 5: Suppose $\theta_j p_j, j \in \{X, Y\}$ are constants. Then the stock price reaction to a divestiture announcement is increasing in $(\lambda_y - \lambda_x)$. In other words, as relative informativeness of the divisions diverge, the stock price reaction to a divestiture announcement becomes more positive.

One way to interpret the above proposition is as follows. In our model, the degree of unrelatedness is measured by the relative informativeness measure $(\lambda_y - \lambda_x)$. A firm with a high $(\lambda_y - \lambda_x)$ becomes more focused following a divestiture than a firm with low $(\lambda_y - \lambda_x)$. With this interpretation, the following implication is obtained.

Implication 4: The more focus-increasing the divestiture is, the greater the stock price reaction to the divestiture announcement.

John and Ofek (1995) provide evidence consistent with this implication. They find that the divesting firm's abnormal equity return around the divestiture announcement is significantly positively related to the change in focus (measured by the sales-weighted Herfindahl index) in the year of the divestiture. Daley, Mehrotra, and Sivakumar (1997) report significant value creation around the announcement of cross-industry spinoffs only, a finding that is consistent with the implication. The implication follows directly from the fact that the misvaluation is positively related to the divergence of the divisions' informativeness.[25] Consistent with this, Berger and Ofek (1995) find evidence suggesting that conglomerates with higher relatedness (as measured by the divergence in the two-digit SIC codes of the divisions) between their divisions tend to be less undervalued. It must be noted, however, that there is no study that we are aware of that directly uses relative informativeness as a measure of relatedness. One way to measure the relative informativeness of a firm's current cash flow in predicting its future cash flows is to measure the sensitivity of stock price to earnings surprises. Since the stock price is the present value of future cash flows, its sensitivity to earnings or cash flow surprises measures the informativeness of the firm's cash flows. Divisional informativeness can be proxied by the sensitivity of stock prices of firms in the same industry to earning surprises. Our model would predict that the greater the disparity between this measure of informativeness between the divisions of the divesting firm, the more positive the stock price reaction to the announcement of the divestiture.

Many of the implications of our misvaluation hypothesis are consistent with the efficiency hypothesis, namely, that there is value created by transferring assets to those that can

[25] Since divisional cash flows are uncorrelated in our model, this result suggests that a more appropriate measure of divisional relatedness is their relative informativeness and not the correlation between divisional cash flows.

manage it better. In particular, the implications that stock price reaction to divestitures is positive and greater for focus-increasing divestitures and that firms divest poorly performing divisions is consistent with both hypotheses. Implication 2, that firms divest will invest more than firms that stay diversified does not necessarily follow from the efficiency hypothesis. Therefore, if we find that total investment in the divested firms increases compared to the investment before divestiture, it would be consistent with the misvaluation hypothesis. To the extent that firms make truthful announcements about the reasons for divestiture, we expect this effect to be stronger in the sample of divestitures where at least one of the stated reasons is misvaluation. An additional way to distinguish between the two hypotheses would be to regress the stock price reaction to divestiture announcements against the measure of informativeness suggested above while controlling for conventional measures of focus based on the Herfindahl index (John and Ofek (1995)) or SIC codes (Berger and Ofek (1995)). The misvaluation hypothesis would predict a significant relation between the informativeness measure and the stock price reaction to divestiture announcements, especially in the sample of divestitures where at least one of the stated reasons is misvaluation.

IV. The decision to diversify at date 0

In the previous sections, we assumed that the firm became a conglomerate at date 0 and examined the effect of misvaluation on its decision to divest at date 1.[26] The expected costs of future (date 1) financing costs may play an *incremental* role in the firm's decision to diversify and become a conglomerate at date 0. In this section, we analyze the effects of expected future financing costs on the firm's decision to diversify at date 0. Such an analysis sheds some light on the role of internal capital markets on the decision to diversify in the first place. This is in

[26] We analyze a model with investment need in one period only (date 1). The results of this section will be qualitatively unchanged if we introduced investment needs at more than one date (as in Section III (*d*)).

the spirit of Willamson (1975) and Stein (1997) who stress the importance of internal capital markets in multi-divisional firms.

To highlight the effect of financing costs on the decision to diversify, we assume that there is no net synergy (synergy minus cost of merger) between firms X and Y at date 0 and ignore other benefits from merger.[27] At date 0, firm X can either choose to stay focused or become a conglomerate by merging with firm Y. If it stays undiversified, it will have less internal cash available at date 1 and therefore is more likely to need costly external equity financing. If the firm diversifies, the need for costly external financing is reduced. However, in some states of the world it will be undervalued and, if the need for investment capital is high, it will resort to a costly divestiture of division Y to raise capital. In our model, the firm's decision to diversify or focus at date 0 will be based on minimizing the expected costs of raising capital at date 1. Note that the possibility of misvaluation does not play any direct role in this decision at date 0 since the expected cost of issuing undervalued equity is fully offset by the expected benefit from issuing overvalued equity. Misvaluation, however, can affect the method of financing at date 1 and, hence, its effect on the date 0 decision to diversify will be only through its effect on the choice of financing method since the two alternatives have different costs.[28]

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[27] Aside from the benefits from internal capital markets, several other explanations have been offered both for why firms diversify. Explanations include building "deep pockets" to prey on rivals (Montgomery (1994) and Bolton and Scharfstein (1990)), less vigorous competition among diversified firms meeting each other in multiple markets (Bernheim and Whinston (1990)), moral hazard (Jensen (1986) and Shleifer and Vishny (1989)), managerial risk aversion (Amihud and Lev (1981)), reduction in cost of capital due to reduction in total risk if investors are unable to diversify on their own (Bhide (1990)), and the resource hypothesis that argues that excess capacity in production factors leads to diversification if they cannot be sold off at value (Penrose (1959) and (Teece (1980)).

[28] One might argue that the firm can avoid the cost of divestiture at date 1 by simply raising capital at date 0, when there is no informational asymmetry. While we have not explicitly considered this possibility, it will not affect the qualitative nature of our results. The firm that chooses to raise capital at date 0 clearly intends to diversify – since external capital is costly, it is optimal for a focused firm to wait till date 1, when financing needs are known, to raise capital. For our results to hold, it is only necessary that it not be optimal for the diversifying firm to raise so much capital at date 0 as to preclude the possibility of divestiture in state HL at date 1. To see this, define E^* as the threshold level of external financing above which there is a separating equilibrium and below which there is a pooling equilibrium. It can be verified that E^* is independent of the amount of capital raised at date 0. In order to

Using ΔK to denote the difference in the expected date 1 cost of financing if the firm stays focused as compared to if it diversifies, we have

$$\begin{aligned}\Delta K = \Pr(HH)&\left[\int_{H}^{\bar{I}} c(I-H)dU - \int_{2H}^{\bar{I}} c(I-2H)dU\right] \\ &+ \Pr(HL)\left[\int_{H}^{\bar{I}} c(I-H)dU - \int_{H+L}^{I^*} c[I-(H+L)]dU - \int_{I^*}^{\bar{I}} DdU\right] \\ &+ \Pr(LH)\left[\int_{H}^{\bar{I}} c(I-L)dU - \int_{H+L}^{\bar{I}} c[I-(H+L)]dU\right] \\ &+ \Pr(LL)\left[\int_{H}^{\bar{I}} c(I-L)dU - \int_{2L}^{\bar{I}} c(I-2L)dU\right].\end{aligned} \tag{15}$$

where U is the probability distribution function of I. ΔK is computed by multiplying the difference in financing cost (cost of external equity or divestiture) in each state between when the firm is focused and when it is diversified, by the probability of that state. The first term in each bracket of equation (15) is the financing cost if the firm stays focused while the second term is the financing cost if it diversifies. Note that the cost of divestiture D enters the expression only in state HL when $I \geq I^*$. The management chooses focus if $\Delta K < 0$ and diversifies if $\Delta K > 0$.

We investigate below how the informativeness measure (λ) and the cost of external equity financing (c), affect ΔK and the hence the incentives to focus or diversify at date 0.

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always avoid divestiture at date 1, a firm needs to raise enough capital at date 0 such that the amount of external capital needed at date 1 is at most E^*. Suppose a firm does this. Now let us consider whether this is optimal. A dollar reduction in amount of capital raised at date 0 reduces expected external financing costs since in all symmetric information states and in the pooling equilibrium there is a positive probability with which this dollar will (ex-post) turn out to be surplus. However, such a reduction will slightly increase the probability of divestiture and therefore increase the expected divestiture cost. Since the change in divestiture probability is small, unless D is very large, the benefit of a dollar reduction from E^* in the capital raised at date 0 outweighs the expected cost (which is a significant fraction of c, the cost of raising external financing). Hence the firm will not raise enough date 0 capital to preclude the possibility of divestiture at date 1 and our results hold. There could also be other reasons, such as agency problems, that prevent a firm from raising capital earlier than needed.

We first analyze the effect of informativeness on ΔK. As in the case of proposition 5, we hold constant $\theta_j p_j$, because unconditional changes in θ_j and p_j can also affect the value of the division j at date 0, given by:

$$\theta_j p_j (H+h) + (1-\theta_j p_j)(L+\ell). \tag{16}$$

If divisional value changes as informativeness changes, the size of the project relative to that of the firm also changes. As before, to control for this, we analyze the effect of changing informativeness while keeping the divisional values constant by keeping the product $\theta_j p_j$ fixed and varying p_j. In the following proposition, we investigate the effect of the relative informativeness of the divisions by keeping the informativeness of division X (λ_x) constant while increasing that of division Y (λ_y). Note that as λ_y increases, the informativeness of that division decreases. This enables us to maintain the assumption, made without loss of generality, that division X is more informative than division Y.

Proposition 6: Suppose $\theta_j p_j$, $j \in \{X, Y\}$ are constants. Then, for a given λ_x, ΔK is decreasing in λ_y. In other words, for a given size of assets-in-place, the firm is more likely to stay undiversified as relative informativeness of the divisions diverge.

If $\lambda_y = \lambda_x$, it is clearly optimal to diversify at date 0 since there is no cost to diversification. Whether focusing is an optimal decision for a set of $\{\lambda_y, \lambda_x\}$ depends on the parameters, especially the probability of state HL and the values of c and D. If the parameters values are such that it is optimal for the firm to not diversify for some values of $\lambda_y > \lambda_x$, then proposition 6 shows that it is optimal to remain undiversified if λ_y is greater than some threshold value and it is optimal to diversify if λ_y is less than the same threshold value. The intuition is that as the informativeness of the divisions diverge, the firm will be forced into a costly divestiture at date 1 if state HL occurs even when external financing needs are not that high in order to avoid

selling undervalued equity. As the likelihood of a costly divestiture increases, the firm's incentive to remain focused increases. [29]

We next investigate the effect of changes in the cost of external financing on the diversification decision. The following proposition shows that as c increases, the firm resorts to a divestiture for lower external financing needs.

Proposition 7: $\frac{\partial I^*}{\partial c} < 0$. In other words, as the cost of external equity financing increases, the level of investment at which the firm resorts to a divestiture in state *HL* decreases, making it more likely that the firm will divest.

As c increases, the firm finds it less attractive to stay in a pooling equilibrium and issue undervalued equity if state *HL* occurs. An implication of this result is that the stock price reaction on announcement of equity issues for firms with high costs of external financing will be more negative. This is because, as c increases I^* decreases, increasing the probability of a separating equilibrium which increases the information content of the announcement.

Proposition 8: In markets where the cost of external equity financing is low, firms are more likely to stay focused.

The intuition behind this result is straightforward. It can be seen from equation (15) that if $c = 0$, ΔK is negative. If $c = 0$, there is no cost to external equity financing and hence there is no benefit to diversification. By continuity, this will be true for some range of c close to zero. This result is consistent with Bhide's (1990) argument that one of the reasons for the reversal of the diversification wave of the 1960s and 1970s is the increased efficiency of the capital markets.

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[29] Our model also implies that the propensity to diversify increases with the correlation of divisional cash flows. If the correlation increases, the probability of states *HL* or *LH* occurring decreases thus reducing the expected cost of divestiture at date 1. This increases the incentive to diversify at date 0.

V. Conclusions

This paper presents a reason for divestiture that is based on asymmetric information. Specifically, it argues that if the market cannot observe divisional cash flows but only aggregate cash flows, firms will be misvalued. When firms need external capital and they are undervalued, they may find external equity capital too expensive and may resort to divesting to raise capital. In addition to providing a formal argument for one of the commonly stated reasons for divestiture our model also provides several empirical implications pertaining to the decision to divest:

- The stock price reaction to a divestiture announcement is positive since firms divest when they are undervalued.
- The greater the dissimilarity between the informativeness of the divisions' cash flows the greater the (positive) stock price reaction to a divestiture announcement.
- Firms that focus are likely to invest more than what their conglomerate counterparts invest in that line of business.
- Firms divest the poorly performing divisions.

While the formal model deals with divestitures that raise capital, the model and its results can also be easily extended to spinoffs in which no capital is raised. Suppose spinoffs are less costly than other forms of divestiture (since other forms involve finding a buyer while spinoff is to the firm's stockholders). Now an undervalued firm might wish to do a spinoff even if does not need capital immediately. It does so to get correctly valued (as divisional cash flows are realized) for future external capital needs. The reason a separating equilibrium could be sustained is that overvalued firms do not benefit by mimicking this behavior since divestiture leads to symmetric information in the future which is not to their advantage.

In the paper, we suggest that informativness can be empirically measured by the sensitivity of the stock price to earnings surprises and that this would allow for a direct test of the misvaluation hypothesis. In addition, we argue that the result that firms that focus are likely

to invest more than what their conglomerate counterparts invest in that line of business can be used to distinguish the misvaluation hypothesis from other theories of divestitures.

Since divestiture is a costly method of financing, our theory provides a cost to diversification which firms must trade off against any advantage of diversification. In our model, we consider the cost saving from the availability of additional internal capital as the benefit of diversification. Such a trade off provides the following testable implications:

- Firms benefit more when they diversify into businesses that are similar in the information content of their cash flows.
- In economies where the cost of external equity capital is low, more firms will be focused. As the cost of raising external equity decreases, the benefit to diversification decreases since the resulting additional internal capital is less valuable.

Appendix

Proof of Proposition 1

It can be seen from equation (5c) that $V(H+L)$ is a weighted average of $v(HL)$ and $v(LH)$. Therefore, to show that the firm is undervalued when the realized state is HL, it only needs to be shown that $v(HL) > v(LH)$ if $\lambda_x < \lambda_y$. Using equation (4),

$$v(HL) = p_x h + (1 - p_x)\ell + \phi_y p_y h + (1 - \phi_y p_y)\ell, \text{ and,}$$

$$v(LH) = \phi_x p_x h + (1 - \phi_x p_x)\ell + p_y h + (1 - p_y)\ell.$$

Hence,

$$v(HL) - v(LH) = [(1-\phi_x)p_x - (1-\phi_y)p_y](h-\ell)$$

$$= \left[\frac{1-\theta_x}{1-\theta_x p_x} p_x - \frac{1-\theta_y}{1-\theta_y p_y} p_y\right](h-\ell), \text{ substituting for } \phi_j \text{ from equation (1).}$$

Therefore, $v(HL) > v(LH)$ *iff* $\frac{1-\theta_x}{1-\theta_x p_x} p_x > \frac{1-\theta_y}{1-\theta_y p_y} p_y$.

Subtracting both sides from 1, we get, $v(HL) > v(LH)$ *iff* $\frac{1-p_x}{1-\theta_x p_x} < \frac{1-p_y}{1-\theta_y p_y}$. □

Proof of Proposition 2:

Existence

Given the proposed equilibrium beliefs, the firm has no incentive to deviate from the equilibrium strategy and raise capital through external equity if state HL has occurred, given condition (9). If it deviates and divests division X, it still incurs the cost of divesting, but division X is undervalued since market belief is that state LH has occurred.

If state LH has occurred, the expected cash flow to current shareholders if the firm uses external equity financing is

$$v(LH) + f(I) - (1+c)E(I).$$

If the firm deviates from the equilibrium strategy and divests division *X*, the market infers that state *LH* has occurred and the expected cash flow to current shareholders is

$$v(LH) + f(I) - E(I) - D.$$

Since $D > c(\bar{I} - 2L) > cE(I)$, there is no incentive to divest division *X*. If it divests division *Y*, this division will be undervalued since the market's beliefs are that state *HL* has occurred. Therefore, the expected cash flow to current shareholders is even less than what can be obtained by selling division *X*. Hence the firm uses external equity financing if state *LH* has occurred. This proves the existence of the proposed separating equilibrium.

Uniqueness

To prove that the proposed equilibrium is the unique separating equilibrium, consider other possible separating equilibria. Clearly no separating equilibrium in which the firm uses external equity financing in state *HL* is sustainable. In this equilibrium, the firm will use external financing even in state *LH*, since it can issue overvalued equity which is also a cheaper way to raise capital than a divestiture. Similarly, no separating equilibrium is sustainable in which the firm divests either division to finance the project in state *LH*. Consider the separating equilibrium in which the firm divests division *j* in state *LH* and division *k* in state *HL* (the only possibility since we just showed that no equilibrium is sustainable in which external equity is used in state *HL*). This equilibrium can be ruled out using the Cho-Kreps criterion. Consider the off-equilibrium path belief if the firm issues external equity. The worst market belief from the firm's perspective in state *LH* is that the market associates external equity with state *LH* as this results in the lowest equity value. Even in this case, the firm that has observed state *LH* is better off deviating from the equilibrium strategy and issuing external equity since it

is a cheaper option than a divestiture. Therefore, no separating equilibrium exists in which the firm divests either division in state *LH*.

This leaves only the separating equilibrium in which the firm sells off division *X* in state *HL* and resorts to external equity financing in state *LH* with corresponding consistent market beliefs. We show that this equilibrium cannot exist since both the necessary nonmimicry conditions cannot be satisfied simultaneously. For the firm to not divest division *X* in state *LH* the following condition needs to be satisfied:

$$v_x(H) + v_y(H) + f(I) - E(I) - D < v_x(L) + v_y(H) + f(I) - (1 + c)E(I).$$

The left-hand side is the expected cash flows to current shareholders if the firm deviates from equilibrium strategy in state *LH* and divests division *X*. Division *X* is valued by the market under the assumption that the division produced a cash flow of *H* at date 1 since it is being sold at the market price, while division *Y* is valued at its true value $v_y(H)$. The right-hand side is expected cash flow to current shareholders if the firm stays with the equilibrium strategy and sells equity. This condition reduces to

$$v_x(H) - v_x(L) + cE(I) < D. \tag{A1}$$

On the other hand, if the firm observes state *HL* and deviates from the equilibrium strategy to sell equity, it must sell the fraction

$$\hat{\alpha} = \frac{(1+c)E(I)}{v_x(L)+v_y(H)+f(I)}.$$

For the firm not to deviate by selling equity if it observes state *HL* the following condition must hold:

$$(1-\hat{\alpha})[v_x(H)+v_y(L)+f(I)] < v_x(H)+v_y(L)+f(I)-E(I)-D.$$

The left-hand side is the expected cash flow to current shareholders if the firm deviates and sells equity. The right-hand side is the expected cash flow if follows the equilibrium strategy and divests division *X*. This condition reduces to

$$\hat{\alpha}[v_x(H)+v_y(L)+f(I)]-E(I)>D. \tag{A2}$$

Together conditions (A1) and (A2) imply that

$$\hat{\alpha}[v_x(H)+v_y(L)+f(I)]>v_x(H)-v_x(L)+(1+c)E(I).$$

Substituting for $\hat{\alpha}$ and rearranging terms, this condition reduces to

$$(1+c)E(I)[v_y(L)-v_y(H)]>[v_x(H)-v_x(L)][v_x(L)+v_y(H)+f(I)-(1+c)E(I)].$$

The first term on the right-hand side is clearly positive; the second term is positive because the project is assumed to have positive net present value. The term in the square brackets on the left-hand side is negative. Therefore, both conditions (A1) and (A2) cannot be simultaneously satisfied. Hence the separating equilibrium where the firm divests division *X* in state *HL* and sells equity in state *LH* does not exist. This proves the proposed separating equilibrium is the unique separating equilibrium.□

Proof of Proposition 3:

Existence

Given the proposed equilibrium beliefs and condition (12), the firm has no incentive to deviate from the equilibrium strategy and raise capital by divesting division *Y* in state *HL*. It has even less incentive to deviate by divesting division *X*, since division *X* will be undervalued given the proposed beliefs. The firm also has no incentive to deviate from the equilibrium strategy and raise capital by divesting division *X* in state *LH*. By doing so, it loses the benefit of overvaluation in equilibrium in addition to incurring the additional cost of divestiture. It has

even less incentive to deviate by divesting division *Y* since the division will be undervalued. This proves the existence of the proposed pooling equilibrium.

Uniqueness

The other two types of pooling equilibria involve the firm divesting a division irrespective of which state obtains. Consider first the pooling equilibrium in which the firm always divests division *Y*. If state *LH* obtains, division *Y* is being sold at a discount if the firm follows the proposed equilibrium strategy. If it deviates to selling equity, the worst that can happen is that it will be correctly valued (if the market belief is that selling equity implies state *LH*) and incurs the lower cost of equity financing. If the market belief is that selling equity implies state *HL*, the firm gets to issue overvalued equity and is even better off. Thus the firm will deviate from the equilibrium strategy in state *LH*, breaking the equilibrium.

Consider now the pooling equilibrium in which the firm always divests division *X*. If state *HL* occurs, division *X* is being divested at a discount if the firm follows the proposed equilibrium strategy. By the same logic as above, it pays the firm to deviate and sell equity irrespective what beliefs the market holds for this action. Thus this equilibrium is also not sustainable. Therefore, the equilibrium in proposition 2 is the unique pooling equilibrium.□

Proof of Proposition 4:

The outline of the proof is as follows. Suppose the left-hand side of condition (9), which is the sufficient condition for the existence of the separating equilibrium, is strictly increasing in *I*. Then, given that I^* is the *I* that equates the left-hand side of (9) to zero, it follows that condition (9) is satisfied for $I \geq I^*$ and, hence, a separating equilibrium exists in this range of *I*. The monotonicity also implies that condition (9) is not satisfied for $I < I^*$. But if condition (9) is not satisfied, condition (12), the condition for the existence of the pooling equilibrium, must be satisfied. To see this note that $\alpha' < \alpha$ from equations (8) and (10). Hence the pooling equilibrium exists for $I < I^*$.

It only remains to be shown that the left-hand side of condition (9) is strictly increasing in I. Denote the left-hand side of condition (9) by w. Then, substituting for α from equation (8),

$$w \equiv (1 + c)E(I)Z - E(I) - D, \text{ where}$$

$$Z \equiv \frac{v(HL) + f(I)}{v(LH) + f(I)}.$$

Differentiating Z with respect to I, we have,

$$\frac{\partial Z}{\partial I} = -\frac{v(HL) - v(LH)}{[v(LH) + f(I)]^2} f'(I) < 0, \quad \text{since } v(HL) > v(LH) \text{ and } f' > 0.$$

Differentiating w with respect to I,

$$\frac{\partial w}{\partial I} = (1+c)Z + (1+c)E(I)\frac{\partial Z}{\partial I} - 1 > (1+c)\left[Z - 1 + E(I)\frac{\partial Z}{\partial I}\right].$$

Hence, $\frac{\partial w}{\partial I} > 0$ if the term in the square brackets is positive. Since

$$\left[Z - 1 + E(I)\frac{\partial Z}{\partial I}\right] = \frac{v(HL) - v(LH)}{v(LH) + f(I)} \times \left[1 - \frac{E(I)f'(I)}{v(LH) + f(I)}\right],$$

and the first ratio on the right-hand side is positive, it remains to be shown that the term in the square brackets is positive.

Since f is concave and $f(0) = 0$, $f(I)/I > f'(I)$. Also, since $E(I) < I$, $f(I) > E(I)f'(I)$, and it follows the term in the square brackets is positive.□

Proof of Proposition 5:

The value of the firm before the announcement of divestiture is $V(H+L)$ and its value after is $v(HL)$ since divestiture signals state HL (proposition 3). Therefore, the stock market

reaction to a divestiture announcement is $[v(HL) - V(H+L)]/V(H+L)$. From equations (4) and (5c) it follows that

$$v(HL) - V(H+L) = \Pr\left\{s_x s_y = LH \middle| s_x + s_y + H + L\right\}[v(HL) - v(LH)].$$

However, since

$$\Pr\left\{s_x s_y = LH \middle| s_x + s_y = H + L\right\} = \frac{\Pr(LH)}{\Pr(HL) + \Pr(LH)}$$
$$= \frac{\theta_y p_y (1 - \theta_x p_x)}{\theta_x p_x (1 - \theta_y p_y) + \theta_y p_y (1 - \theta_x p_x)},$$

it is a constant given that $\theta_j p_j, j \in \{X, Y\}$ are constants. It can be seen from the proof of proposition 1 and the definition of λ_j in equation (6) that

$$v(HL) - v(LH) = (\lambda_y - \lambda_x)(h - \ell).$$

Therefore, for a given V(*H*+*L*), the stock price reaction is positively related to $\lambda_x - \lambda_y$.□

Proof of Proposition 6:

It can be seen from the definition of λ_j (equation (6)) that it is inversely related to p_j if $\theta_j p_j$ are constant. Therefore, it is sufficient to show that ΔK is increasing in p_y. Since $\theta_j p_j, j \in \{X, Y\}$, are constant, all the $\Pr(s_x s_y)$ terms in expression (15) for ΔK are independent of p_y. Differentiating ΔK with respect to p_y

$$\frac{\partial \Delta K}{\partial p_y} = \Pr(HL)\left[-c[I^* - (H+L)] + D\right] u(I^*) \frac{\partial I^*}{\partial p_y},$$

where u is the probability density function of I. Since $D > c(\bar{I} - 2L)$, we need to show that I^* is increasing in p_y to prove the proposition. From the definition of I^* in equation (13)

$$\alpha(I^*)[v(HL) + f(I^*)] - E(I^*) - D = 0.$$

Substituting for α from equation (8) and differentiating with respect to p_y, we get

$$0=(1+c)\frac{\partial I^*}{\partial p_y}\left\{\frac{v(HL)+f(I^*)}{v(LH)+f(I^*)}-\frac{1}{1+c}\right\}$$
$$+\frac{(1+c)[I^*-(H+L)]}{[v(LH)+f(I^*)]^2}\left[\begin{array}{l}\left\{\frac{\partial v(HL)}{\partial p_y}+f(I^*)\frac{\partial I^*}{\partial p_y}\right\}[v(LH)+f(I^*)]\\ -\left\{\frac{\partial v(LH)}{\partial p_y}+f(I^*)\frac{\partial I^*}{\partial p_y}\right\}[v(HL)+f(I^*)]\end{array}\right].$$

Rearranging terms and dropping the common $(1 + c)$ term,

$$\frac{\partial I^*}{\partial p_y}\left[\frac{v(HL)+f(I^*)}{v(LH)+f(I^*)}-\frac{1}{1+c}+f'(I^*)E(I^*)\frac{v(LH)-V(HL)}{[v(LH)+f(I^*)]^2}\right]$$
$$>[v(LH)+f(I^*)]\frac{\partial v(HL)}{\partial p_y}+[v(HL)+f(I^*)]\frac{\partial v(LH)}{\partial p_y}. \qquad \text{(A3)}$$

Since only cash flows of division Y are affected by changes in p_y, $\frac{\partial v(s_x s_y)}{\partial p_y}=\frac{\partial v_y(s_y)}{\partial p_y}$.

From equation (3), $v_y(L) = \phi_y p_y h + (1 - \phi_y p_y)\ell$. Substituting for ϕ_y from equation (1),

$$v_y(L)=\frac{1}{1-\theta_y p_y}\left[\theta_y p_y(1-p_y)h+[1-\theta_y p_y-\theta_y p_y(1-p_y)]\ell\right].$$

Therefore, $\frac{\partial v(HL)}{\partial p_y}=\frac{\partial v_y(L)}{\partial p_y}=-\frac{\theta_y p_y}{1-\theta_y p_y}(h-\ell)<0.$

From equation (2), $v_y(H) = p_y h + (1 - p_y)\ell$. Therefore, $\frac{\partial v(LH)}{\partial p_y}=\frac{\partial v_y(H)}{\partial p_y}=(h-\ell)>0.$

It follows that the right-hand side of equation (A3) is positive. To prove the proposition, it needs to be shown that the bracket term on the left-hand side of equation (A3) is positive. It is therefore sufficient to show that

$$\frac{v(HL)+f(I^*)}{v(LH)+f(I^*)}-1+f'(I^*)E(I^*)\frac{v(LH)-V(HL)}{[v(LH)+f(I^*)]^2}>0.$$

Rearranging terms, the left-hand side reduces to

$$\frac{v(HL)-v(LH)}{v(LH)+f(I^*)}\left[1-\frac{f'(I^*)E(I^*)}{v(LH)+f(I^*)}\right].$$

It was shown at the end of proposition 4 that this expression is positive.□

Proof of Proposition 7:

From the definition of I^* in equation (13)

$$\alpha(I^*)[v(HL)+f(I^*)]-E(I^*)-D=0.$$

Substituting for $\alpha(I^*)$ from equation (8), denoting $E(I^*) \equiv I^* - (H+L)$ by E^*, and defining

$$Z(E^*) \equiv \frac{v(HL)+f(I^*)}{v(LH)+f(I^*)} > 1,$$

the equation for I^* reduces to

$$(1+c)Z(E^*)E^* - E^* - D = 0.$$

Differentiating with respect to c (omitting the argument of Z)

$$\frac{\partial E^*}{\partial c}\left[(1+c)\left\{Z+E^*\frac{\partial Z}{\partial E^*}\right\}-1\right]+ZE^*=0.$$

To prove the proposition it is sufficient to show that $\left\{Z+E^*\frac{\partial Z}{\partial E^*}\right\}-1>0$. Since

$$\left\{Z+E^*\frac{\partial Z}{\partial E^*}\right\}-1=\frac{\partial}{\partial E^*}(E^*Z-E^*),$$

it is sufficient to show that the term on the right-hand side is positive. Since

$$(E^*Z-E^*)=\frac{E^*[v(HL)-v(LH)]}{v(LH)+f(I^*)},$$ we have

$$\frac{\partial}{\partial E^*}(E^*Z - E^*) = \frac{[v(HL) - v(LH)]}{[v(LH) + f(I^*)]^2}[v(LH) + f(I^*) - E^* f'(I^*)] > 0.$$

The inequality follows because $v(HL) > v(LH)$ and, $f(I^*) > E^* f'(I^*)$ by the concavity of f (see proofs of proposition 4 or 5).□

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