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Learning about Internal Capital Markets from Corporate Spin-offs

ROBERT GERTNER, ERIC POWERS, and DAVID SCHARFSTEIN*

ABSTRACT

We examine the investment behavior of firms before and after being spun off from their parent companies. Their investment after the spin-off is significantly more sensitive to measures of investment opportunities (e.g., industry Tobin's Q or industry investment) than it is before the spin-off. Spin-offs tend to cut investment in low Q industries and increase investment in high Q industries. These changes are observed primarily in spin-offs of firms in industries unrelated to the parents' industries and in spin-offs where the stock market reacts favorably to the spin-off announcement. Our findings suggest that spin-offs may improve the allocation of capital.

THE PREVAILING MODEL OF THE FIRM in corporate finance envisions money flowing in from the capital and product markets and flowing out as investment spending, dividends, and debt payments. A recent line of research has been examining what actually happens when the money is inside the firm (Lamont (1997), Shin and Stulz (1998), Scharfstein (1998), Rajan et al. (2000)). How, for example, does corporate headquarters allocate funds across business and geographic units? If information and agency problems exist between headquarters and the external capital market—a theme that runs through a good deal of the corporate finance literature—does it also exist between headquarters and business units in the internal capital market? If so, do such problems distort investment allocations within the firm?

Understanding how internal capital markets work is important for two reasons. First, the relative efficiency of internal and external capital market transactions is a critical element in defining the boundaries of the firm, much in the same way that the relative efficiency of internal and external product-market transactions is important (Coase (1937)). Second, internal capital markets are an empirically important mechanism by which capital is

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allocated across and within lines of business. Indeed, most corporate investment is financed with internally generated cash flow over which the external capital market has limited control (MacKie-Mason (1990)).

There are mixed views on how well internal capital markets function. Alchian (1969) and Williamson (1970) argue that internal capital markets are more efficient than external markets because corporate headquarters is likely to be better informed than external suppliers of capital about investment opportunities.¹ By contrast, Meyer, Milgrom, and Roberts (1992), Wulf (1997), Rajan et al. (2000), and Scharfstein and Stein (2000) argue that rent seeking by divisional managers can distort the functioning of internal capital markets, inducing corporate headquarters to allocate excessive capital to divisions with poor investment opportunities where rent-seeking incentives are strongest.²

A growing empirical literature analyzes the workings of internal capital markets. Lamont (1997), for example, shows that when oil prices fell dramatically in 1986, diversified oil companies with businesses unrelated to oil made across-the-board cuts in capital expenditures, even though investment prospects in the non-oil businesses seem not to have changed as a result of the oil-price decline. While this study shows that companies use the cash flow generated by one division to cross-subsidize the others—essentially that an internal capital market exists—it does not tell us whether cross-subsidization is efficient or not.

The subsequent literature, by contrast, attempts to address this issue. Shin and Stulz (1998) present evidence that when capital is reallocated across divisions, it does not seem to go in any systematic way to the divisions with the better investment opportunities. Scharfstein (1998) shows that investment by conglomerate divisions tends to be less sensitive to Tobin's Q than investment by more focused firms. In addition, divisions tend to invest more than focused firms in low Q industries and less than focused firms in high Q industries. This problem is more pronounced in firms where management has small ownership stakes, with correspondingly weak incentives to make efficient investment allocations. Similarly, Rajan et al. (2000) show that conglomerates invest more than stand-alone firms in industries with poor investment opportunities, and that this effect is more pronounced in conglomerates that operate in businesses with very different investment opportunities.

¹ Both papers simply assume that headquarters is more informed and will monitor more because the external capital market is comprised of many small investors, none of whom have an incentive to become informed. But, if the external capital is supplied by a large investor such as a bank, will they not have the incentive to become informed and to monitor? Gertner, Scharfstein, and Stein (1994) and Stein (1997) present models in which corporate headquarters has more incentive to become informed than outside investors and, as a result, capital allocation is more efficient.

² Matsusaka and Nanda (1997) present a model analyzing the costs and benefits of internal capital markets that incorporates some of the benefits outlined by Alchian and Williamson and some of the costs associated with excessive investment.

This paper takes a different approach to these issues by examining spin-offs of multidivisional companies. In a spin-off, the parent company establishes one of its divisions as a new publicly traded company and distributes the shares of this company to the parent's existing shareholders. It is almost always structured as a tax-free transaction with no cash flow implications to the parent, spin-off, or shareholders.³ The goal of this paper is to understand how the allocation of capital changes when a division is spun off.

There are several advantages of this approach. The main advantage is that we can compare the investment behavior of the same business in two different regimes for allocating capital—an internal capital market and an external capital market.⁴ This addresses one criticism of previous work—that segments of conglomerates are somehow different than stand-alone firms in some unobservable way and thus should exhibit different investment behavior. We examine spin-offs rather than other kinds of divestitures such as equity carve-outs or asset sales, because spin-offs do not generate cash for either party. In this respect, we believe spin-offs are a well-structured “natural experiment” for our analysis, since there is no real change in financial resources. Thus, one is less likely to argue that a spin-off changes investment behavior because it changes the firm's financial resources, rather than changing underlying investment decisions.⁵

The second reason to look at spin-offs is that we do not have to rely as heavily on COMPUSTAT business segment data, as have previous studies of internal capital markets. Beginning in December 1977, firms were required to report key operating information (e.g., sales, assets, capital expenditures) for particular industries if they accounted for more than 10 percent of a company's consolidated sales, assets, or profits. Unfortunately, the reported segments may not correspond to an actual business unit and may also lump together business units in different industries. In a spin-off, however, the first annual report includes pro forma financial statements for two or more

³ To be considered a tax-free event, the spin-off must meet the following five criteria as outlined in IRS Code Section 355: (1) The parent must possess control (>80 percent ownership of common stock voting power and >80 percent ownership of each class of nonvoting shares) of the subsidiary prior to the spin-off; (2) after the spin-off occurs, both the parent and the subsidiary must still be engaged in lines of business in which each has been active for at least five years; (3) the transaction must not be used as a means of avoiding dividend taxation; (4) shareholders of the parent must maintain a significant ownership interest in both the parent and the spin-off; and (5) the spin-off must have a substantial business purpose, separate from simply saving on income taxes.

⁴ The requirement that there must be continuity between pre- and post-spin-off business lines in order for the spin-off to be considered a tax-free event helps ensure that pre- and post-spin-off data reflect the operating results of a similar collection of assets.

⁵ Note that it is possible for a parent to strip the spin-off of financial resources such as cash prior to the spin-off. Alternatively, the parent could load the spin-off with an excess amount of debt in an effort to rid the parent of financial constraints (see, e.g., Parrino (1997)). Our analysis, however, indicates that these types of actions are not generally occurring. Spin-off firms are spun off with cash levels that are comparable to pre-spin-off years. In addition, spin-off firms begin life with debt-to-equity levels that are similar to the parent.

years, while the spin-off was part of the parent company. These data are more comprehensive than the limited information provided in the segment data and are more likely to correspond to an actual business unit in the firm.

As a caveat, it is important to keep in mind that companies choosing to spin off divisions are not a random subsample of public companies. If undertaking a spin-off is motivated by the desire to eliminate internal capital misallocation, then our sample is biased towards companies where investment misallocation is particularly severe. Thus, one must be careful when drawing conclusions about the overall efficiency of internal capital markets based on what we observe in spin-offs. Nevertheless, if an inefficient internal capital market is indeed one of the rationales behind a spin-off, then a spin-off is probably a good place to look for signs of such inefficiencies.

The evidence that we present is generally consistent with the view that investment is distorted in the internal capital markets of firms that subsequently spin off divisions. Basic investment theory predicts that firms should invest more when they have better investment opportunities; empirically, this usually takes the form of the Q theory, in which investment opportunities are measured by the ratio of the market value of the firm to the replacement cost of its assets. According to the Q theory, firms should invest more as Q rises. We examine the extent to which this is true before and after the spin-off. In particular, we estimate the sensitivity of the spin-off firm's investment to industry Q , while the spin-off is a subsidiary of the parent and afterwards when the spin-off is an independent firm.

Overall, we find an increased sensitivity of investment to Q after the spin-off. This increased sensitivity is more pronounced when the spin-off operates in industries that are unrelated to the parent's industry, and when the stock market responds favorably to the announcement of the spin-off. We also find that firms in low Q industries tend to cut investment relative to their industry peers after the spin-off, while firms in high Q industries tend to increase their investment relative to industry peers. Spin-off firms' investment also moves more closely in tandem with the investment of stand-alone firms after the spin-off. This effect is also more pronounced for unrelated spin-offs and for spin-offs in which the parent's stock price rises considerably in response to the announcement.

There is a large body of prior research on spin-offs. Researchers have documented that parent companies experience positive cumulative abnormal excess returns (CARs) at the announcement of a spin-off (Hite and Owers (1983), Miles and Rosenfeld (1983), Schipper and Smith (1983)). Spin-offs themselves experience positive long-term excess stock returns (Cusatis, Miles, and Woolridge (1993)) and improvements in operating performance (Woo, Willard, and Daellenbach (1992), Daley, Mehrotra, and Sivakumar (1997)). There is also increased analyst coverage and greater accuracy in analyst forecasts following spin-offs (Krishnaswami and Subramanian (1999), Gilson et al. (2001)). Dittmar and Shivdasani (2001) look at the change in investment behavior of *parent* companies after they *divest*

businesses. They find that these firms seem to improve the internal allocation of capital and that they tend to increase their rate of investment, using the proceeds of the divestiture for funding. As far as we know, we are the first authors to explore actual changes in investment behavior of spin-off firms.

The remainder of the paper is organized as follows. Section I describes the data sources and the construction of the sample. Section II summarizes some of the key elements of the data. Section III analyzes the change in investment behavior before and after the spin-off. Section IV considers alternative interpretations of our findings. Section V concludes the paper.

I. Data and Construction of the Sample

We start with a list of 324 spin-offs from Securities Data Corporation's Mergers and Acquisitions Database, occurring between 1981 and 1996. To be included in our sample, a spin-off must satisfy the following criteria: (1) COMPUSTAT and CRSP data are available for at least one year after the spin-off transaction; (2) a copy of the spin-off's first annual report is available; (3) COMPUSTAT and CRSP data are available for the parent before the spin-off; (4) the spin-off is not a bank, financial services company, insurance firm, or financial holding company; (5) we can verify that the transaction is actually a spin-off by checking the annual report or a Lexis-Nexis news report; and (6) the spin-off is a "clean" transaction in which the parent company goes from 100 percent ownership to 0 percent ownership through a pro rata distribution of shares.

We eliminate 31 spin-offs because they are not included in the COMPUSTAT or CRSP databases. We drop 8 spin-offs because COMPUSTAT or CRSP data are not available for the parent, 5 spin-offs because we are unable to find annual reports on the spin-offs, and 51 spin-offs with SIC codes between 6000 and 6500 (financial service and insurance firms). We are unable to verify that a spin-off actually occurred in 12 instances and drop these firms as well.

Finally, we eliminate 65 spin-offs from the sample because they are not "clean" transactions. In several instances, the company was a spin-off of a prior equity carve-out where the parent had previously sold a portion of its ownership in the spin-off division in a public offering. Others are actually rights offerings rather than simple pro rata distributions of shares. Still others are, in fact, joint ventures with one parent deciding to relinquish its ownership interest in the venture by spinning off its share. The remaining 26 spin-offs are part of much more complex restructurings such as Morris Trust transactions, in which the spin-off occurs immediately prior to the merger of the parent with another firm. The complexity of these remaining transactions renders them unsuitable for our purposes. The final sample then consists of 160 corporate spin-offs.

Spin-off financial data are generally available on COMPUSTAT for the first year in which the spin-off operates as an independent entity. In about

half the spin-offs, COMPUSTAT reports one year of pre-spin-off data. For the other half of the sample and for earlier years, we obtain pre-spin-off financial data from the pro forma data in the first annual report. The annual report includes income and cash flow statement data for up to three years before the spin-off and balance sheet data for up to two years before the spin-off. In addition, annual reports typically include a table of summary financial data with five years of the most important balance sheet and income statement data such as net income and total assets. Combining all of the available data generally provides two to three years of usable pre-spin-off operating profit and capital expenditure data for the spin-off. Parent company financial data comes exclusively from COMPUSTAT. Data for both spin-offs and parents run through 1998.

The combined pro forma and COMPUSTAT data are aligned into an event time panel of years -5 to $+5$, where year 0 is the fiscal year during which the spin-off occurs. Thus, year $+1$ constitutes the first full year of independent operations for the spin-off, while year -1 is the last full year of operations inside the parent. We have full data on most spin-offs beginning in year -2 (145 out of 160) running through year $+3$ (135 out of 160). Spin-offs drop out of the sample over time principally because they are acquired or merge. It is important to note that the assets of the spin-off remain on the books at their historical book value. Because no sale occurs, assets are not revalued to market values. This allows us to make meaningful comparisons of accounting data before and after the spin-off.

In the analysis, we use data from firms that operate in the same industries as the spin-offs to provide various benchmarks. Because many firms operate in multiple industries, we confine our comparison firms to "stand-alones," by which we mean firms that operate in only one industry. To identify stand-alones, we use COMPUSTAT segment data, which breaks out key operating data (sales, assets, operating income, capital expenditures, and depreciation) by principal lines of business. Firms are considered to operate in only one industry if, in their COMPUSTAT segment data, they report 100 percent of their sales in a single industry. After stand-alone firms are identified, we calculate industry median values (using COMPUSTAT data for the entire stand-alone firm) for items such as capital expenditures normalized by assets and Q . Spin-off and parent firms are excluded from all industry median calculations.

Our baseline definition of an industry is at the four-digit SIC-code level. A median for an industry is calculated if there are five or more stand-alone firms available for that particular industry. Median values are also calculated for all three-, two-, and one-digit industries in the same manner. Matching is then done at the most disaggregated level having at least five stand-alone firms.

Parents and spin-offs themselves are often comprised of multiple segments in different industries. In comparing these firms to an industry median, we need to take a weighted average of the various industries in which the firm operates. We weight by segment assets and calculate a "chop-shop"

median.⁶ For example, in the Kenner Parker Toys spin-off from General Mills in 1985, Kenner Parker Toys reports a Toys and Games segment (SIC 3944) with \$419.2 in assets (all dollar values reported in millions unless otherwise specified.) General Mills reports three segments: Consumer Foods (SIC 2043), Restaurants (SIC 5812), and Specialty Retailing (SIC 5621) with assets of \$1,091.8, \$467.8, and \$195.5, respectively. Thus, the industry, or “chop-shop” ratio of capital expenditures to assets for Kenner Parker Toys is simply the industry median for SIC 3944. For General Mills, the industry ratio is the asset-weighted average of 62 percent SIC 2043, 27 percent SIC 5812, and 11 percent SIC 5621.

Because spin-off segment data is unavailable prior to year -1 , we use segment weights from the earliest available year when calculating chop-shop industry values for pre-spin-off years. For example, to calculate a chop-shop value for year -2 or -3 , we use the segment data from year -1 (50 percent of sample) or year 0 if year -1 is not available. Note that while the weights might be from a later year, the industry median values are always from the appropriate year. In Section IV, we explore whether this approach introduces any biases that may drive our results.

Two key variables in the analysis are our measures of investment and investment opportunities. Since R&D data are not widely available for the spin-off firms (and certainly not before the spin-off), we focus on capital expenditures as our measure of investment. Capital expenditures are normalized by assets. We use end-of-year assets rather than start-of-year assets in this normalization because using end-of-year assets allows us to analyze more years of pre-spin-off data, and, if there are acquisitions or asset sales during the year, it normalizes by a more appropriate number.

Our primary measure of investment opportunities is the market value of the firm divided by the book value of assets, a proxy for Tobin's Q .⁷ We calculate the market value of the firm as the book value of assets, plus the market value of common equity, less the sum of the book value of common equity and balance sheet deferred taxes.⁸

At times, we break out the analysis into two subsamples of spin-offs, those in industries related to the parents' industries and those in industries unrelated to the parents' industries. Coming up with a measure of relatedness is not straightforward. It is standard in the literature to define two businesses as unrelated if they operate in different two-digit SIC codes. This approach, however, is problematic, as the example of Maxus Energy's spin-off of Diamond Shamrock makes clear. Although the two companies are in

⁶ The qualitative results do not depend on whether we weight by segment assets or segment sales.

⁷ This is not exactly Tobin's Q because we do not attempt to adjust assets to measure the replacement cost of assets. Perfect and Wiles (1994) argue that this adjustment is of little consequence.

⁸ See Smith and Watts (1992), Lang and Stulz (1994), Scharfstein (1998), and Rajan et al. (2000), among others, for examples of research using this particular proxy for Q .

different two-digit industries, they are certainly in related businesses: Maxus Energy is in petroleum exploration (SIC 1311), while Diamond Shamrock is in petroleum refining and marketing (SIC 2911).

Instead of using the two-digit approach, we use our own subjective assessment of whether the parent and spin-off are in related lines of business. This requires us to analyze the reported segments of both the spin-off and the parent as of year 0. In addition, we read annual reports, prospectuses, and news articles to get a full understanding of the businesses of the spin-off and parent and to discern whether these businesses are related or unrelated. Using this procedure, we classify 90 spin-offs as unrelated to the parent and 70 as related. After presenting a series of results using this measure of relatedness, we analyze the robustness of our results to using the standard two-digit method.

II. Characteristics of the Sample

Table I lists the number of spin-offs in each year and the total market value of equity spun off in that year. Table II, Panels A through C, provides summary statistics on some of the key variables for the spin-offs and parents in years -1 , 0 , $+1$. In year 0, a year that straddles both the pre- and post-spin-off periods, spin-offs have mean (median) total sales of \$601.3 (\$253.1) and total assets of \$569.7 (\$211.5), denominated in millions of 1997 dollars. Mean earnings before interest, taxes, depreciation, and amortization normalized by end-of-year assets (operating profit ratio) is 0.051. This is considerably less than the median of 0.117 because of a subset of companies with large operating losses. After subtracting the industry median, the industry adjusted operating income ratio is -0.066 (significant at the 1 percent level), while the median is -0.009 (significant at the 10 percent level).

Despite the fact that spin-offs have lower operating profit ratios than their industry peers, their Q at year 0 is not substantially different. The mean is a bit higher than the industry value, the median is a bit lower, but neither difference is statistically significant. While Q is not significantly different, spin-offs do have higher leverage than the median firm in the industry. Mean (median) leverage (defined as book value of long-term debt divided by book value of long-term debt plus the market value of equity) for spin-offs in year 0 is 0.295 (0.255), which is 0.049 (0.029) greater than the industry median; both differences are statistically significant.⁹

The average ratio of capital expenditures to assets—our measure of spin-off investment—is 0.086, while the median is 0.057. The mean difference between spin-off investment and the median industry investment is 0.014, which is statistically significant, while the median is 0.004, which is not. The latter comparison is probably more meaningful, given that the mean

⁹ Dittmar (2002) also finds that spin-off leverage is higher than the leverage of firms in the same industry. However, after controlling for differences in firm characteristics such as R&D, taxes, and so forth, she finds no statistically significant difference.

Table I
Number of Spin-offs and Total Market Value per Year

This table lists the number of spin-offs in each year in our sample and the market value of the spin-off on the first day of trading denominated in millions of 1997 dollars. See Section II of the paper for details on the criteria for inclusion in the spin-off sample.

Year	Number	Market Value (Million 1997 \$)
1982	1	66
1983	3	1,714
1984	7	2,920
1985	12	3,681
1986	10	9,200
1987	13	6,124
1988	17	9,045
1989	18	7,308
1990	10	4,654
1991	8	4,375
1992	12	7,568
1993	19	21,774
1994	16	14,284
1995	10	7,935
1996	4	1,605
All years	160	102,260

has some outliers. The bottom line from Table II, Panel A, is that in the year of the transaction, spin-offs generate lower operating profit and have higher leverage than their industry peers, but their Q and capital expenditure rates are about the same.

Table II, Panel B, summarizes the data on parent companies. They are considerably larger than the spin-offs with mean (median) sales of \$2,846.1 (\$1,115.2) and mean (median) assets of \$3,817.9 (\$978.9). In contrast to spin-offs, parents generate slightly higher operating profit than their industry peers, but the difference is not statistically significant. Parent companies have higher Q than the industry median; the mean difference is 0.329, while the median difference is 0.119, both of which are statistically significant.¹⁰ Parents also have significantly higher leverage than the industry median. Despite higher Q ratios, parent investment rates are not significantly dif-

¹⁰ A growing body of literature documents that diversified firms generally have lower valuations than a comparable portfolio of pure-play firms, a result known as the diversification discount (Lang and Stulz (1994), Berger and Ofek (1995), Comment and Jarrell (1995), Denis and Thothadri (1999)). On average, parents do not show evidence of the diversification discount; however, regression of Industry Adjusted Q on an asset-based Herfindahl index (not reported in tables) indicates that the more diversified the parent is, the larger is the diversification discount.

Table II
Characteristics of Spin-off Firms, Parent Firms, and a Comparison of Spin-off and Parent Firms in Years -1, 0, and +1

Panel A provides summary statistics on the sample of 160 spin-offs. Year 0 is the fiscal year during which the spin-off occurred. Operating profit ratio is earnings before interest, taxes, and depreciation divided by total assets. The variable Q represents the spin-off's (market value of common equity - book value of equity + total assets - deferred taxes)/total assets. Investment ratio is capital expenditures/total assets. Leverage is (long term debt + current portion of long term debt)/(long term debt + current portion of long term debt + market value of common equity + liquidation value of preferred). Median industry values are subtracted from operating profit ratio, Q , and investment ratio to generate the respective industry-adjusted variables. Panel B provides summary statistics on the sample of spin-off parents, with variables defined as in Panel A. Panel C compares parents and spin-offs, with the definitions of the variables as in Panel A. The upper value in each cell is the mean; the lower value in parentheses is the median. Significance of industry-adjusted differences is measured using both a t -statistic and a sign test. Asterisks next to mean and median values denote the significance level of each test.

	Year - 1	Year 0	Year + 1
Panel A: Spin-off Characteristics			
Sales (1997 millions of dollars)	590.5 (239.7)	601.3 (253.1)	630.4 (263.5)
Assets (1997 millions of dollars)	568.4 (189.6)	569.7 (211.5)	589.0 (197.5)
Operating profit ratio	0.061 (0.115)	0.051 (0.117)	0.073 (0.121)
Industry-adjusted operating profit ratio	-0.059*** (-0.014)	-0.066*** (-0.009)*	-0.041** (-0.008)
Q		1.584 (1.291)	1.643 (1.285)
Industry-adjusted Q		0.150 (-0.041)	0.232** (-0.011)
Leverage		0.295 (0.255)	0.301 (0.267)
Industry-adjusted leverage		0.049** (0.029)*	0.039** (-0.001)
Investment ratio	0.086 (0.052)	0.086 (0.057)	0.076 (0.058)
Industry-adjusted investment ratio	0.013 (-0.004)	0.014** (0.004)	0.011 (0.002)
Number of obs. for investment ratio	158	156	156
Panel B: Parent Characteristics			
Sales (1997 millions of dollars)	3,054.8 (1,259.0)	2,846.1 (1,115.2)	2,855.1 (1,134.8)
Assets (1997 millions of dollars)	4,290.0 (1,330.2)	3,817.9 (978.9)	3,853.5 (1,144.0)
Operating profit ratio	0.135 (0.140)	0.136 (0.145)	0.144 (0.142)
Industry-adjusted operating profit ratio	0.015* (0.004)	0.015 (0.004)	0.029*** (0.021)**
Q	1.573 (1.347)	1.756 (1.471)	1.751 (1.480)
Industry-adjusted Q	0.147*** (0.037)***	0.329*** (0.119)**	0.344*** (0.136)***

Table II—Continued

	Year - 1	Year 0	Year + 1
Panel B: Parent Characteristics (<i>continued</i>)			
Leverage	0.321 (0.282)	0.323 (0.252)	0.323 (0.257)
Industry-adjusted leverage	0.050*** (0.046)***	0.059*** (0.054)***	0.044** (0.025)*
Investment ratio	0.068 (0.052)	0.067 (0.053)	0.064 (0.048)
Industry-adjusted investment ratio	0.005 (0.002)	0.003 (0.000)	0.006 (-0.001)
Number of obs. for investment ratio	157	149	139
Panel C: Spin-off versus Parent in Year 0			
Spin-off sales/(spin-off sales + parent sales)	0.267 (0.211)	0.258 (0.214)	0.216 (0.256)
Spin-off assets/(spin-off assets + parent assets)	0.225 (0.193)	0.238 (0.195)	0.232 (0.192)
Spin-off operating profit ratio - parent operating profit ratio	-0.071*** (-0.021)	-0.078*** (-0.045)**	-0.065*** (-0.023)
Spin-off industry operating profit ratio - parent industry operating profit ratio	0.000 (0.000)	-0.001 (0.000)	0.005 (0.003)
Spin-off Q - parent Q		-0.199 (-0.224)***	-0.070 (-0.200)*
Spin-off industry Q - parent industry Q	-0.028 (0.000)	0.006 (0.000)	0.001 (0.000)
Spin-off leverage - parent leverage		-0.036 (-0.016)	-0.032 (-0.014)
Spin-off industry leverage - parent industry leverage	-0.001 (0.000)	-0.007 (0.000)	-0.011 (0.000)
Spin-off investment ratio - parent investment ratio	0.018** (0.007)*	0.021** (0.009)	0.012 (0.002)
Spin-off industry investment ratio - parent industry investment ratio	-0.002 (0.000)	-0.003 (0.000)	0.000 (0.000)

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

ferent than their industry peers. Thus, in the year of the transaction, parent companies seem to have somewhat higher operating profits, Q , and leverage than the industry, but they do not invest at a higher rate.¹¹

¹¹ Schlingemann, Stulz, and Walkling (2001) find that diversified conglomerates are more likely to divest segments in industries with high capital expenditures and to invest less themselves. In contrast, we find no real differences in the industry investment rates of parents and spin-offs, and we find little difference in their own investment rates. What may explain the differing results is that their sample includes asset sales, which raise cash for the parent. This may, in fact, be their motive and may explain why they invest less and want to get rid of segments that need more capital investment. Powers (2001) shows that there are systematic differences in companies that engage in asset sales, carve-outs, and spin-offs.

Finally, Panel C of Table II compares spin-offs and parents. In year 0, the median spin-off is about 25 percent of the hypothetical combined entity (spin-off and parent together). Spin-offs also have lower operating profit and Q than their parents by a statistically and economically significant amount. Spin-off leverage is moderately less than parent leverage. Spin-off mean investment rates are significantly higher than they are for parents; however, the median difference is not statistically significant. There are no significant differences in operating profit, investment, and Q of the industries in which parents and spin-offs operate.

A number of earlier studies have found positive excess returns in the period during which the spin-off is announced, ranging from 2.8 percent to 5.6 percent (Hite and Owers (1983), Schipper and Smith (1983), Rosenfeld (1984), Slovin, Sushka, and Ferraro (1995), Daley et al. (1997)). In our sample, we find mean positive excess returns of 3.9 percent for the two-day period around the announcement. The median excess return is 2.23 percent, and 68.9 percent of the observations are positive. Both excess returns are statistically significant. Daley et al. and Desai and Jain (1999) show that announcement period returns are larger for unrelated spin-offs. In our sample, the mean announcement period return for unrelated spin-offs is 4.2 percent and the median is 2.3 percent, while, for related spin-offs, the mean is 3.3 percent and the median is 2.6 percent. These findings are similar in magnitude to the above studies, though the differences reported here are not statistically significant.

III. Investment Behavior before and after the Spin-off

A. Baseline Results

One of the most basic predictions of investment theory is that firms with better investment opportunities should invest more. Empirically, this prediction usually takes the form of a Q -based model of investment in which normalized capital expenditures are regressed on Q . Thus, one way to determine whether spin-offs change investment behavior is to examine whether there are changes in the sensitivity of investment to Q for spin-off firms before and after the spin-off. We estimate the following model for years -3 , -2 , -1 , $+1$, $+2$, and $+3$, excluding the year of the spin-off, because it includes both pre- and post-spin-off periods:

$$I_{it} = \beta_{0i} + \beta_1 * Q_{it} + \beta_2 * Q_{it} * Before + \beta_3 * Before + \sum_t \gamma_t * Year_t + \varepsilon_{it}. \quad (1)$$

In equation (1), I_{it} is the ratio of capital expenditures to assets of firm i in period t . Firm fixed effects are captured in the firm-specific intercept term β_{0i} . *Before* is a dummy variable taking the value one in years -1 , -2 , and -3 and zero otherwise. Ideally, a firm-specific measure of Q should be used as a proxy for a firm's investment opportunities. However, because spin-offs are not publicly traded prior to year 0, we cannot observe the pre-spin-off

market value of the firm, so a firm-specific measure of Q is unavailable. Instead, our measure of Q for both the pre- and post-spin-off periods is the median asset-weighted Q of stand-alone firms in the spin-off's industries. Although a firm-specific measure of Q can be calculated in the post-spin-off period, using it as our post-spin-off proxy for investment opportunities could bias our results if firm-specific Q is more (or less) informative about investment opportunities than is industry Q .¹² To minimize the effects of possible mid-year changes in business composition and investment opportunities, we take an average of Q in years t and $t - 1$; none of the results depend critically on averaging in this way. $Year_t$ is a calendar year dummy.

Because other studies have found that cash flow, in addition to Q , explains capital expenditures (see, e.g., Fazzari, Hubbard and Petersen (1988)), we also estimate equation (1) in an augmented form:

$$I_{it} = \beta_{0i} + \beta_1 * Q + \beta_2 * Q * Before + \beta_3 * Before + \beta_4 * SOP_{it} + \beta_5 * SOP_{it} * Before + \beta_6 * POP_{it} * Before + \sum_t \gamma_t * Year_t + \varepsilon_{it}, \quad (2)$$

where SOP_{it} and POP_{it} are the asset-normalized operating profit of the spin-off and parent, respectively.

If investment spending in conglomerates is distorted in some way, then one would expect the spin-off's investment to be less sensitive to Q when it is part of the conglomerate than when it is an independent entity. That is, one would predict: $\beta_1 > 0$ and $\beta_2 < 0$ in equations (1) and (2). It is less clear how distortions in internal capital markets would change the relationship between investment and operating profit. However, if firms are financially constrained, one might expect a spin-off's operating profit to have a bigger effect on investment after it is spun off. When it is part of the conglomerate, the parent's operating profits should have a bigger effect on the spin-off's investment. Empirically, this implies $\beta_4 > 0$, $\beta_5 < 0$, and $\beta_6 > 0$.

The first column of Table III reports the results of estimating equation (1) for the entire sample. The estimate for the Q coefficient, β_1 , is positive and statistically significant; after the spin-off, investment is positively related to industry Q . The coefficient estimate for the interaction term, β_2 , is negative. These coefficient estimates suggest that the firm's pre-spin-off sensitivity of

¹² A potential concern is that industry Q might be a significantly worse proxy for investment opportunities than is firm-specific Q . We think this concern is of limited importance. Using COMPUSTAT data from 1980 to 1998 for all domestic firms having assets of at least \$100 million and primary SIC codes between 1000 and 4000 (2,556 firms, 19,335 observations), we estimate fixed-effects panel regressions with normalized capital expenditures as the dependent variable. We use normalized operating profit, year dummies, and either industry Q or firm-specific Q as regressors. Coefficient estimates for industry Q and firm-specific Q are 0.0236 (t -statistic = 18.40) and 0.0151 (t -statistic = 20.86), respectively. R -squared values for the two regressions are 0.0840 and 0.0891 as compared to an R -squared of 0.0655 without industry Q or firm-specific Q . These results demonstrate that, in this independent sample, the explanatory power of industry Q and firm-specific Q are quite similar.

Table III
The Sensitivity of Capital Expenditures to Industry Q
and Profitability before and after Spin-off

This table reports the results of regression equations (1) and (2) as given in the text. The dependent variable is capital expenditures/assets. Industry Q is the asset-weighted industry median Q of the industries in which the spin-off operates. Operating profit ratio is earnings before interest, taxes, and depreciation divided by assets and is calculated for both the spin-off and the parent firm. Before takes the value 1 for years -3 , -2 , and -1 and takes the value 0 for years $+1$, $+2$, and $+3$. Year 0, the year of the spin-off, is excluded from the regression. The regressions include year dummy variables and firm fixed effects. The numbers in parentheses below the coefficient estimates are p -values.

	Full Sample	
Industry Q	0.024** (0.020)	0.026** (0.015)
Industry Q * before	-0.012 (0.150)	-0.018** (0.038)
Before	0.026* (0.082)	0.026 (0.111)
Spin-off operating profit ratio		0.033** (0.032)
Before * spin-off operating profit ratio		-0.045*** (0.006)
Before * parent operating profit ratio		0.073 (0.110)
No. of firms	160	160
No. of observations	769	746
R^2	0.044	0.060

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

investment to Q is about half that of its post-spin-off level. However, the point estimate of the interaction coefficient is statistically insignificant with a p -value of 0.150.

The second column of Table III reports the results of estimating equation (2), the investment model including spin-off and parent operating profit. We observe the same pattern of Q coefficients, except that now the coefficient of the interaction term is statistically significant. The regression results also indicate that spin-off investment is sensitive to its own operating profit after the spin-off, but not before the spin-off. Instead, before the spin-off, *parent* operating profit is positively related to the division's investment. This finding is consistent with the view that, after the spin-off, firms are financially constrained by their own operating profit, but before the spin-off, they are constrained by the parent's operating profit. Despite the increased sensitivity of spin-off investment to own operating profit, the spin-off appears to be more responsive to investment opportunities after the spin-off has occurred. To the extent that operating profit proxies for investment opportu-

nities, the increased sensitivity to the spin-off's own operating profit is also consistent with the firm's investment moving more in line with investment opportunities.

To get a sense of the magnitude of the difference in the sensitivity of investment to Q before and after the spin-off, consider the following calculations. The average of the industry Q values is 1.41. The within-firm, time-series standard deviation of industry Q is 0.215. Thus, using the estimates from the second column of Table III, before a spin-off, a one standard deviation increase in industry Q from its mean of 1.41 to 1.62 would be predicted to increase normalized investment by 0.0017. Evaluated at the mean investment rate of 0.082, the model predicts an increase to 0.084, a small effect. After the spin-off, the effects of an increase in Q are larger. A one standard deviation increase in industry Q increases normalized investment by .0056, which (at the mean investment level) amounts to an increase in the rate of investment to 0.088. In this case, a 14.9 percent increase in industry Q results in a 7.3 percent increase in the investment rate, an implied elasticity of almost 50 percent.

B. Related versus Unrelated Spin-offs

Table IV reports the result of estimating equations (1) and (2) after breaking out the sample into two subsamples based on whether the spin-off's industry is related to the parent's. There are two reasons to examine spin-offs of unrelated divisions separately. First, it has been argued that conglomerates comprised of unrelated businesses have been the least successful conglomerates (see, e.g., Lang and Stulz (1994) and Berger and Ofek (1995)). If distortions in investment spending contribute to the conglomerate discount, then it seems likely that we should find greater evidence of investment distortions in the unrelated subsample of spin-offs. Second, on a more practical level, industry Q —our proxy for divisional investment opportunities—may be a more appropriate measure of investment opportunities for unrelated divisions where there are no significant operating synergies with the rest of the company. For example, a paper manufacturer that is part of a conglomerate with a lumber division may have different investment opportunities than a stand-alone paper manufacturer. Since the stand-alone paper manufacturers that form the basis of our industry Q measure do not own lumber companies, there may be more measurement error in the Q estimates for the paper manufacturers operating alongside related divisions.

The results reported in the first and second columns indicate that when an unrelated firm is spun off, there is a statistically significant increase in the sensitivity of investment to industry Q . The same is not true for spin-offs of related businesses. As the third and fourth columns of Table IV indicate, investment is insensitive to industry Q after the spin-off. If anything, investment is more sensitive to Q before the spin-off for firms in industries related to the parent. We have no clear explanation of this finding.

Table IV
The Sensitivity of Capital Expenditures to Industry Q
and Profitability Before and After Spin-off:
Related Versus Unrelated Spin-offs

This table reports the results of regression equations (1) and (2) as given in the text. The sample is split according to whether the spin-off operates in industries that are related or unrelated to primary parent industries. This classification is based on the subjective assessment of the authors. The dependent variable is capital expenditures/assets. Industry Q is the asset-weighted industry median Q of the industries in which the spin-off operates. Operating profit ratio is earnings before interest, taxes, and depreciation divided by assets and is calculated for both the spin-off and the parent firm. Before takes the value 1 for years -3, -2, and -1, and takes the value 0 for years +1, +2, and +3. Year 0, the year of the spin-off, is excluded from the regression. The regressions include year dummy variables and firm fixed effects. The numbers in parentheses below the coefficient estimates are p -values.

	Unrelated Spin-offs		Related Spin-offs	
Industry Q	0.039*** (0.004)	0.043*** (0.002)	0.015 (0.367)	0.015 (0.368)
Industry Q * before	-0.041*** (0.000)	-0.046*** (0.000)	0.030** (0.020)	0.019 (0.204)
Before	0.060*** (0.003)	0.051** (0.019)	-0.026 (0.250)	-0.014 (0.605)
Spin-off operating profit ratio		0.023 (0.265)		-0.012 (0.632)
Before * spin-off operating profit ratio		-0.022 (0.381)		-0.042* (0.081)
Before * parent operating profit ratio		0.122* (0.051)		0.026 (0.723)
No. of firms	90	90	70	70
No. of observations	436	424	333	322
R^2	0.129	0.143	0.090	0.102

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

The estimated coefficients from the regressions for unrelated spin-offs suggest a larger effect of the spin-off on the investment- Q sensitivity. Using the regression estimates from the augmented specification (second column of Table IV), a one standard deviation increase in industry Q (using the mean industry Q value of 1.41 and the within-firm standard deviation of 0.228) implies a post-spin-off increase in the investment rate of 0.0098. Evaluated at the means for unrelated firms, investment would be predicted to increase from 0.087 to 0.097, an increase of 11.5 percent. This amounts to an implied elasticity of 71 percent. By contrast, the pre-spin-off sensitivity is essentially zero.

C. High versus Low Announcement Period Returns

Table V breaks out the sample based on the parent company's excess returns at the announcement of the spin-off. As discussed in Section II, mean

Table V
The Sensitivity of Capital Expenditures to Industry Q
and Profitability Before and After Spin-off:
Announcement Effects

This table reports the results of regression equations (1) and (2) as given in the text. High announcement effect spin-offs are those where two-day abnormal returns around the announcement are above the median of 0.0223. The dependent variable is capital expenditures/assets. Industry Q is the asset-weighted industry median Q of the industries in which the spin-off operates. Operating profit ratio is earnings before interest, taxes, and depreciation divided by assets and is calculated for both the spin-off and the parent firm. Before takes the value 1 for years -3, -2, and -1, and takes the value 0 for years +1, +2, and +3. Year 0, the year of the spin-off, is excluded from the regression. The regression includes year dummies and firm fixed effects. The numbers in parentheses below the coefficient estimates are p -values.

	High Announcement Effect		Low Announcement Effect	
Industry Q	0.058*** (0.000)	0.056*** (0.000)	0.010 (0.514)	0.013 (0.422)
Industry Q * before	-0.034*** (0.002)	-0.033*** (0.003)	-0.002 (0.867)	-0.012 (0.434)
Before	0.051*** (0.006)	0.051** (0.011)	0.011 (0.674)	0.008 (0.783)
Spin-off operating profit ratio		0.010 (0.672)		0.029 (0.182)
Before * spin-off operating profit ratio		-0.001 (0.979)		-0.051** (0.017)
Before * parent operating profit ratio		-0.032 (0.635)		0.133** (0.043)
No. of firms	81	81	79	79
No. of observations	396	384	373	362
R^2	0.106	0.113	0.067	0.102

***Significance at the 1 percent level; **significance at the 5 percent level.

and median excess returns are positive, but there is considerable heterogeneity across firms. Announcement period returns reflect the cumulative response to many factors and are thus a noisy signal regarding the perceived benefits of the spin-off. However, if the stock market reacts favorably to the dismantling of an inefficient internal capital market, then we would expect spin-offs associated with large positive announcement effects to exhibit an increase in the post-spin-off sensitivity of investment to industry Q .

The first column of Table V shows that spin-offs with announcement effects above the median of 2.23 percent exhibit an increase in the sensitivity of investment to Q . Similar results hold for the estimation of equation (2). The third and fourth columns of Table V show that for firms with an announcement effect below the median, spin-off investment is insensitive to industry Q both before and after the spin-off.

It should be noted that the announcement effect sample split does not proxy for the relatedness sample split. Of the 90 unrelated spin-offs, 44 have announcement period returns greater than the median value, while of the 70 related spin-offs, 36 have announcement-period returns greater than the median.¹³ Our findings (not reported in tables) indicate that within both the related and unrelated subsamples, the spin-offs with larger announcement effects exhibit greater increases in the sensitivity of investment to Q , both in terms of the magnitude and the significance of the estimated post-spin-off Q coefficients.

D. Changes in the Rate of Investment

If, as some theories predict, conglomerate divisions overinvest in low Q industries and underinvest in high Q industries, we would expect to see a drop in investment for spin-offs in low Q industries and an increase in investment for spin-offs in high Q industries following the separation. To address this implication, we start by calculating the average industry-adjusted investment rate in the three years before the spin-off and the average for the three years after the spin-off.¹⁴ The change is a measure of whether firms increase investment relative to industry peers or cut investment relative to industry peers. The mean change, -0.0004 , is close to zero and statistically insignificant. The average change in industry-adjusted investment, however, masks considerable variation across firms in their response to the spin-off.

The first column of Table VI, Panel A, presents the results of a regression of the change in average industry-adjusted investment on industry Q . Because we do not want to use information in Q that evolves during the period to explain changes in investment during the period, we use industry Q three years before the spin-off as our proxy for whether the firm is in a low Q or high Q industry. The coefficient of Q is positive and the intercept is negative, indicating that spin-off firms tend to increase investment in high Q industries and cut investment in low Q industries. Neither point estimate is statistically significant, however.

The first column of Table VI, Panel B, takes a nonparametric approach to the same question. Of the 100 firms in industries with Q below the mean (1.37) three years before the spin-off, 53 experience a reduction in average industry-adjusted investment rates, statistically indistinguishable from a coin

¹³ The means tell a slightly different story. The mean announcement effect for unrelated spin-offs is 4.79 percent versus 2.96 percent for related spin-offs. Differences are not statistically significant at conventional levels.

¹⁴ Industry-adjusted investment is calculated by subtracting industry investment/assets from spin-off investment/assets. The industry value is calculated using the same "chop-shop" methodology used for calculating industry Q . Where we have fewer than three years of data in either the pre- or post-spin-off periods, averages are calculated using the one year or two years of data that are available.

Table VI
Changes in the Industry-Adjusted Rate of Investment
before and after Spin-off

Panel A: Regression results. The dependent variable in the regressions reported below is the change in the average industry-adjusted investment rate before (years -3 , -2 , -1) and after the spin-off (years $+1$, $+2$, $+3$). The industry-adjusted investment rate is the spin-off firm's capital expenditures/assets less the median capital expenditure/assets ratio for the industry in which the firm operates. Industry Q in year -3 is the independent variable. Unrelated spin-offs are those that operate in industries that are unrelated to primary parent industries. This classification is based on the subjective assessment of the authors. High announcement effect spin-offs are those where the two-day abnormal returns around the announcement are above the median of 0.0223. The numbers in parentheses below the coefficient estimates are p -values.

Panel B: Nonparametric results. The cells in this panel report the number of instances in which the average industry adjusted investment rate rises or falls after the spin-off relative to before the spin-off. The industry-adjusted investment rate is the spin-off firm's capital expenditures/assets less the median capital expenditure/assets ratio for the industry in which the firm operates. Low Q industries are those with industry Q less than 1.37 in year -3 . Unrelated spin-offs are those in industries unrelated to the parent based on the authors' subjective assessments. High announcement effect spin-offs are those where the two-day abnormal returns around the announcement are above the median of 0.0223. The numbers in parentheses indicate the confidence levels of a Wilcoxon signed rank test.

	Full Sample	Unrelated Spin-offs	Related Spin-offs	High Announcement Effect	Low Announcement Effect
Panel A: Regression Results					
Industry Q in year -3	0.018 (0.144)	0.039** (0.014)	-0.015 (0.298)	0.038*** (0.000)	-0.004 (0.196)
Constant	-0.025 (0.177)	-0.063** (0.010)	0.032 (0.115)	-0.041** (0.011)	-0.111 (0.290)
No. of firms/obs.	155	86	69	83	72
R^2	0.011	0.146	0.007	0.106	0.003
Panel B: Nonparametric Results					
Low Q firms reducing industry-adjusted investment/ all Low Q firms	53/100 (0.324)	34/54*** (0.009)	19/46 (0.164)	18/37 (0.512)	36/63 (0.494)
High Q firms reducing industry-adjusted investment/ all High Q firms	37/54** (0.014)	24/31** (0.019)	13/23 (0.260)	19/25*** (0.002)	18/29 (0.552)

***Significance at the 1 percent level; **significance at the 5 percent level.

flip. By contrast, of the 55 firms with industry Q above the mean, 37 experience an increase in their industry-adjusted investment rates, which, using a one-sided sign test, is statistically significant.

The next columns split the sample by whether the spin-off is in an industry related to the parent. Here the results are stronger both in the regression framework and the nonparametric approach. The second column of the

table reports the results for the spin-offs that are unrelated to the parent. The coefficient of industry Q is positive and statistically significant. The estimates imply that for industry Q greater than 1.64, industry-adjusted investment rises and for industry Q below this point, it falls. Likewise, in the nonparametric analysis, 34 of the 54 firms with industry Q below the mean experience a reduction in their industry-adjusted investment, and 24 out of 32 firms in high Q industries experience an increase in their industry-adjusted investment. As the third column of Table VI indicates, there are no statistically significant relationships between Q and investment changes for the subsample of related spin-offs. These findings are consistent with our fixed effects model in which we found that the increase in the sensitivity of investment to industry Q was restricted to the sample of unrelated spin-offs.

Finally, the last two columns of Table VI report the results for the sample based on whether the announcement period returns are above or below the median. The regression results in Panel A show there is a positive and statistically significant relationship between the change in industry-adjusted investment and industry Q for high announcement effect spin-offs. Thirty-one of the 55 firms in low Q industries experience a reduction in their industry-adjusted investment rates; however, this is insignificantly different from a coin toss. By contrast, 21 of the 28 firms in high Q industries increase their industry-adjusted investment rates; this is statistically significant. In the subsample of firms with low announcement-period returns, the change in investment rates is hard to distinguish from zero and bears no relation to Q . These results are all consistent with our earlier finding in Table V that firms with high announcement-period returns exhibit an increased sensitivity of investment to industry Q .

E. Alternative Measures of Investment Opportunities

Thus far, we have relied on industry median Q as a measure of investment opportunities, because we cannot measure actual firm Q prior to the spin-off. While this clearly measures investment opportunities with error, we argued that as long as this measurement error is the same before and after the spin-off, it is unlikely to be what is driving our results. Nevertheless, it is useful to see whether our results are robust to using other proxies for investment opportunities. One alternative is to use the investment rates of other stand-alone firms in the industry as a proxy for investment opportunities on the view that if other firms are making significant investments, it is arguably because investment opportunities are good in the industry. This would suggest estimating the following regression equation:

$$I_{it} = \delta_{0i} + \delta_1 * INDI_{it} + \delta_2 * INDI_{it} * Before + \delta_3 * Before + \sum_t \gamma_t * Year_t + \varepsilon_{it}, \quad (3)$$

Table VII
The Sensitivity of Capital Expenditures to Industry Capital Expenditures before and after Spin-off

This table reports the results of regression equation (3) in which the dependent variable is capital expenditures/assets. Industry capital expenditures is the asset-weighted industry median capital expenditures of the industries in which the spin-off operates. Before takes the value 1 for years -3, -2, and -1, and takes the value 0 for years +1, +2, and +3. Year 0, the year of the spin-off, is excluded from the regression. High announcement effect spin-offs are those where the two-day abnormal returns around the announcement are above the median of 0.0223. Unrelated spin-offs are identified based on the subjective assessment of the authors. The regression includes year dummies and firm fixed effects. The numbers in parentheses below the coefficient estimates are *p*-values.

	Full Sample	Unrelated Spin-offs	Related Spin-offs	High Announcement Effect	Low Announcement Effect
Industry investment rate	0.312*** (0.001)	0.347*** (0.004)	0.392** (0.031)	0.352** (0.013)	0.258* (0.071)
Industry investment rate * before	-0.195* (0.052)	-0.294** (0.029)	-0.173 (0.293)	-0.284** (0.031)	-0.111 (0.507)
Before	0.022* (0.058)	0.023 (0.140)	0.022 (0.208)	0.029* (0.058)	0.013 (0.464)
No. of firms	160	90	70	81	79
No. of observations	769	436	333	396	373

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

where I_{it} is again the spin-off's investment-to-assets ratio and $INDI_{it}$ is the weighted average (again using segment assets as weights) of median investment-to-assets ratios for stand-alone firms in the various industries of spin-off firm i at time t .

One drawback of this approach is that there may be other factors that drive stand-alone investment besides investment opportunities. For example, it is possible that stand-alone firms are more liquidity constrained than conglomerate divisions. Showing that spin-offs act more like liquidity constrained stand-alone firms does not prove that their investment is more sensitive to investment opportunities; it may only prove that they too are liquidity constrained once they are spun off.

The findings reported in Table VII are generally consistent with our previous results indicating that investment is less sensitive to investment opportunities before the spin-off. The first column shows the results of estimating this equation for the full sample. The estimated coefficient of industry investment is positive and statistically significant. More importantly, the coefficient of the interaction term is negative, with a *p*-value of 0.052. Thus, it appears that spin-off firm investment is more sensitive to industry investment after the spin-off than it is before the spin-off.

The second column shows the coefficient estimates for the sample of unrelated spin-offs. The results mirror those for the sample as a whole. Finally, the third column shows the results for related spin-offs, where we find the same pattern of coefficients. Here, however, the coefficient of the interaction term is statistically insignificant. Note that, when we used industry Q as the proxy for investment opportunities, we found that investment by related spin-offs was *more* sensitive to investment prior to the spin-off—a somewhat puzzling finding. These results suggest that this particular finding is not robust to alternative measures of investment opportunities.

The last two columns break out the results based on the magnitude of the announcement-period return. For high announcement-effect firms, the coefficients have the predicted sign and are statistically significant. For spin-offs with low announcement-period returns, the coefficients also indicate an increased sensitivity of investment to investment opportunities after the spin-off, but the coefficients are not statistically significant. Regressions not reported in the table indicate that unrelated spin-offs with high announcement-period returns exhibit the greatest increase in the sensitivity of spin-off investment to median industry investment. Including measures of spin-off and parent operating profit in the regressions has no appreciable impact on the estimated coefficients of δ_1 and δ_2 .

IV. Robustness of the Results

In this section, we investigate whether our results reflect a genuine change in investment behavior or are simply the result of spurious correlation driven by various types of mismeasurement. In particular, we consider three issues: (1) the appropriateness of our industry benchmarks, particularly before the spin-off; (2) our measure of relatedness; and (3) whether spin-offs are becoming more like their industry benchmarks on all dimensions, not just on capital expenditures.

A. Pre-Spin-off Industry Benchmarks

While initial post-spin-off annual reports contain detailed financial information on the company before the spin-off, they often do not contain detailed segment data. Because spin-offs sometimes operate in multiple segments, we have made some assumptions about the pre-spin-off industry segments in order to construct our pre-spin-off industry Q and industry investment measures. Our approach has been to use the closest available segment data to determine pre-spin-off industry weights. To the extent that these weights are less accurate than the post-spin-off weights, our industry measures prior to the spin-off will be subject to more measurement error than the post-spin-off industry measures. This biases the estimated pre-spin-off sensitivity of investment to Q or industry investment towards zero. If this is the case, our results might be driven more by measurement error than by a change in investment behavior.

Table VIII
Single-Segment Firms and SIC-Code-Based
Measure of Relatedness

This table reports the results of regression equation (1) in which the dependent variable is capital expenditures/assets. Industry Q is the asset-weighted industry median Q of the industries in which the spin-off operates. Before takes the value 1 for years -3 , -2 , and -1 and takes the value 0 for years $+1$, $+2$, and $+3$. Year 0, the year of the spin-off, is excluded from the regression. Unrelated spin-offs are identified based on the subjective assessment of the authors. Single segment identifies those spin-offs that report data for only one segment in the years prior to the spin-off. Unrelated spin-offs based on the two-digit SIC code are those spin-offs where the spin-off and the parent segments in the year of the spin-off share no common two-digit SIC codes. The regression includes year dummies and firm-fixed effects. The numbers in parentheses below the coefficient estimates are p -values.

	Unrelated Spin-offs (Single Segment)	Unrelated Spin-offs Using Two-Digit SIC-Code Measure	Unrelated Spin-offs Using Both Measures
Industry Q	0.041** (0.016)	0.023* (0.079)	0.030** (0.037)
Before * industry Q	-0.043*** (0.001)	-0.025** (0.027)	-0.038*** (0.002)
Before	0.069** (0.010)	0.030 (0.132)	0.049** (0.029)
No. of firms	57	101	76
No. of observations	264	494	372
R^2	0.148	0.075	0.120

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

To see whether this could explain our results, we separately analyze the spin-offs that report only one segment at the time of the spin-off. While it is possible that the firm operates in more than one segment prior to the spin-off, it seems unlikely that the pro forma data in the first annual report would reflect anything other than the single post-spin-off segment.

The first column of Table VIII repeats the estimation of equation (1) for unrelated spin-offs that operate in only one segment. There are 57 such firms. The coefficient estimates are essentially the same as the estimates for the full set of unrelated spin-offs. Therefore, it seems unlikely that our basic results are driven by inadequate segment information prior to the spin-off.

B. Measure of Relatedness

As discussed above, it is typical to say that two businesses are unrelated if they operate in different two-digit SIC codes. We have taken a different approach because businesses in different two-digit SIC codes can actually be related. The case of Maxus Energy mentioned previously is one example

where the two-digit approach leads to a misleading conclusion about relatedness. Our approach has been to use a subjective assessment of whether two businesses are related. Because we focus much of our analysis on the unrelated spin-offs, it is natural to ask whether our classification scheme is appropriate. Are our results driven by our use of this scheme rather than the traditional two-digit method?

In an effort to address this question, we classify firms based on the two-digit method. The spin-off is considered to be related to the parent if, in year 0, the spin-off has a segment with the same two-digit SIC code as one of the parent's segments. This approach classifies 70 spin-offs as related and 90 spin-offs as unrelated. Of the 90 unrelated spin-offs according to the two-digit method, 67 (74 percent) are also classified as unrelated using our method. Of the 70 related spin-offs according to the two-digit method, 47 (67 percent) are classified as related according to our method.

As an example of where the two methods disagree, consider the spin-off of the Promus Companies, which created two independent firms, Promus Hotel Corp., which operates hotels, and Harrah's Entertainment, which operates casino hotels. The two-digit method classifies them as unrelated because they are in different two-digit SIC codes, while we classify them as related on the grounds that they both operate hotels (although admittedly, different types of hotels). On the flip side, we classify Earthgrains (which makes bread) as unrelated to its parent, Anheuser-Busch (which makes beer), while the two-digit method considers them related. It is possible to argue that these businesses are related in that they both supply retail grocers and use grain as an input, but we classify them as unrelated in our subjective scheme because the production technology and the final products are quite different. The important point that these examples illustrate is that all businesses are related in some way, but they differ in the extent to which they are related. Both classification schemes rely on implicit judgment about the extent to which businesses are related. Thus, it would be useful to know whether our results are driven by the judgments implicit in both schemes.

The second column of Table VIII reports the results for unrelated spin-offs based on the two-digit method. The results indicate that with this method, unrelated spin-offs also exhibit increased sensitivity of investment to industry Q after the spin-off. The third column shows the results for the 67 firms where the two methods agree in their classification of unrelated firms. The coefficient estimates are larger in absolute value and in significance than in the second column. We cannot say which classification method is better—both clearly have flaws—but we can say that our results are not driven by our particular classification scheme.

C. Are Spin-offs Changing on Other Dimensions as Well?

Another method of addressing the measurement error issue is to ask whether the spin-off firm becomes more like the median industry firm on other dimensions besides capital expenditures. If measurement error in the pre-spin-

Table IX
The Sensitivity of Spin-off Operating Profit Ratio to Industry
Operating Profit Ratio before and after the Spin-off:
Related and Unrelated Spin-offs

This table reports the results of regression equation (3) in which the dependent variable is now spin-off Operating profit ratio: (earnings before interest, taxes, and depreciation)/assets. Observations where spin-off operating profit ratio is less than the sample's 1st percentile or greater than the sample's 99th percentile are excluded. Industry operating profit ratio is the asset-weighted industry median for the industries in which the spin-off operates. Before takes the value 1 for years -3, -2, and -1, and takes the value 0 for years +1, +2, and +3. Year 0, the year of the spin-off, is excluded from the regression. To maintain comparability with the capital expenditure regressions, observations are included only when there is valid capital expenditure data. Unrelated spin-offs are identified based on the subjective assessment of the authors. The regression includes year dummies and firm fixed effects. The numbers in parentheses below the coefficient estimates are *p*-values.

	Full Sample	Unrelated	Related
Industry operating profit ratio	0.828*** (0.004)	0.929** (0.033)	0.641* (0.078)
Before * industry operating profit ratio	-0.067 (0.766)	-0.274 (0.472)	0.206 (0.434)
Before	-.006 (0.885)	0.035 (0.623)	-0.027 (0.632)
No. of firms	160	90	70
No. of observations	737	420	317
R^2	0.065	0.117	0.075

***Significance at the 1 percent level; **significance at the 5 percent level; *significance at the 10 percent level.

off period is the source of our investment results, then we would expect this measurement error effect to carry over to other variables as well. Conversely, if measurement error is not significantly greater in the pre-spin-off period, then other characteristics of the spin-off firm will likely show the same relationship to median industry values in both the pre- and post-spin-off periods. Thus, we analyze changes in the sensitivity of spin-off operating profit to median industry operating profit before and after the spin-off.

Table IX presents regression results using equation (3), with the exception that investment has been replaced with operating profit for both the spin-off and the industry. To maintain comparability with the investment regressions, observations are included only if there is valid data for the investment regressions, that is, the observation was included in the prior investment analyses. In addition, observations where spin-off operating profit is greater than the 99th percentile for the sample or less than the 1st percentile are excluded to limit the impact of some large outliers.

For the full sample, we see that spin-off operating profit is positively related to industry operating profit for both the pre- and post-spin-off period. The coefficient for industry operating profit is 0.828 with a *p*-value of 0.004,

while the coefficient of the interaction term is -0.067 with a statistically insignificant p -value of 0.766 . These findings do not support the notion that there is greater measurement error prior to the spin-off than after the spin-off.

V. Conclusion

This paper documents the change in investment behavior that occurs after a spin-off. We find that spin-off investment moves more closely in line with median industry Tobin's Q and median industry investment after the spin-off. This effect is particularly pronounced in spin-offs of unrelated divisions and in spin-offs in which the stock market reacts favorably to the announcement of the spin-off. We also find that spin-offs of unrelated firms and those with high announcement-period returns tend to cut industry-adjusted investment after the spin-off in low Q industries and increase industry-adjusted investment in high Q industries.

The results indicate that one of the effects of spin-offs—or even one of the reasons they are undertaken in the first place—is to increase the efficiency of capital allocation. One cannot argue, however, that our findings indicate that internal capital markets are inefficient on average; the fact that a firm chooses to spin off a division in the first place is likely to bias our sample to firms with inefficient internal capital markets.

There are a number of questions left unanswered by our paper. First, why are spin-offs associated with an increased sensitivity of investment to investment opportunities? Is it because there is less cross-subsidization across business units? Is it because managers have higher-powered incentives in independent firms? Or is it because managers get more precise signals from the stock market about performance and investment opportunities? Second, why do some internal capital markets function poorly in some settings—as they presumably did in our sample of firms that chose to spin off divisions—but work well in other settings? Answering these questions is important, but will remain a challenge for future research.

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