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Abstract

We investigate the tradeoff theory as an explanation for how managers allocate cash to post-spin-off parent and subsidiary firms. Spin-offs provide an opportunity to examine the determinants of cash holdings free from the confounding effects of the pecking order theory. Our results indicate that difference in asset size, sales growth, research and development expenses, net working capital, and leverage significantly affect the difference in cash holdings of post-spin-off entities. These results suggest that cash holdings are decreasing in the ease of raising cash and availability of cash from internal sources, and are increasing in growth opportunities, asymmetric information levels, and financial distress costs.

1. Introduction

Industrial firms in the U.S. hold a substantial portion of their total assets in cash and marketable securities. For example, Kim, Mauer, and Sherman (1998) and Harford (1999) find that approximately 8 percent of a firm's total assets are comprised of cash and short term investments. Given that investments in these assets provide only a nominal return, why do firms hold so much cash? Previous studies have put forward the tradeoff and the pecking order theories as two alternative but not mutually exclusive models for explaining firms' cash holdings.[1] These theories of cash have been derived from the corresponding theories of capital structure. According to the tradeoff theory, managers determine a firm's optimal cash ratio by weighing the costs and benefits of holding cash. The pecking order theory posits that firms faced with significant costs of information asymmetry find issuing new securities to be costly. Maintaining sufficient cash reserves or financial slack allows firms to fund investment opportunities using a relatively cheap internal source of financing.

Studies by John (1993), Kim, Mauer, and Sherman (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), Dittmar, Mahrt-Smith, and Servaes (2003) and Harford, Mansi, and Maxwell (2004) examine these alternative theories by conducting cross-sectional and time series tests of firm cash ratios and present results that are generally consistent with the tradeoff theory.[2] These studies investigate the determinants of firms' liquidity ratios by regressing firms' cash holdings on several variables. However, a firm's current cash holding is the cumulative result of a firm's past operating and financial performance and of events that are at least partially beyond management's control that affect its liquidity. Mackie-Mason (1990) argues that "tests based a

[1] See Opler, Pinkowitz, Stulz, and Williamson (1999) for a detailed description of the pecking order and tradeoff theories. Other papers that examines issues relating to firms' cash holdings are Harford (1999), Almeida, Campello, and Weisback (2003), Mikkelson and Partch (2003), Dittmar and Mahrt-Smith (2004), Kalcheva and Lins (2004), and Pinkowitz and Williamson (2004).

[2] Opler, et al (1999) also find support for the pecking order model.

single aggregate measure of different decisions are likely to have low power for effects at the margin." (see page 1472). Thus, analyzing cash levels instead of the cash allocation decision provides limited information about the decision to hold cash at the margin.

Also, time series and cross-sectional tests have low power in distinguishing between the tradeoff and pecking order theories (see Opler et al, 1999, and Shyam-Sunder and Myers, 1999). For example, Shyam-Sunder and Myers (1999) argue that the cyclical nature of operating earnings makes it appear as if firms are adjusting their cash holdings towards a target ratio as implied by the tradeoff theory even though a firm's liquidity might be explained completely by the pecking order model. Finally, both the tradeoff and the pecking order models often have similar empirical predictions about cumulative cash ratios, making it difficult to distinguish between the alternative motivations.[3] These arguments imply that the tests employed by prior studies cannot cleanly distinguish between these alternative theories as an explanation for a firm's liquidity level.

In this study, we undertake an incremental approach to analyzing the determinants of cash ratios by examining the factors that influence the initial cash allocation decision around a spin-off. In a spin-off, managers break-up an existing firm by divesting a division or a segment into a new company and dividing the firm's assets and liabilities between the post-spin-off entities. Managers must decide the fraction of the pre-spin-off parent's cash (and other assets and liabilities) to be transferred to the post-spin-off subsidiary and the fraction to be retained by the parent. Therefore, focusing on the initial cash allocation decision allows us to investigate the factors that affect the cash holding decision at the margin.

[3] For example, the tradeoff theory predicts that firms with high market-to-book ratios will have more cash to take advantage of investment opportunities. However, if more profitable firms have high market-to-book ratios because market-to-book ratios reflect historical profitability of firms, then the pecking order theory also predicts a positive relation between the two variables.

We examine the factors that affect the cash allocation decision by analyzing the *difference* in cash holdings between the post-spin-off entities. While the amount of cash available to the managers to allocate between the post-spin-off entities is determined by the level of cash held by the parent firm before the spin-off, an examination of the differences in the initial cash holdings eliminates the impact of historical decisions and controls for the confounding effects of the pecking order theory. Thus, the difference in the initial liquidity ratio of the post-spin-off entities only reflects the conscious allocation choice made by the managers based on firm-specific and industry characteristics of the post-spin-off entities. A spin-off therefore provides a cleaner environment to analyze the factors suggested by the tradeoff theory that affect firms' cash holdings than tests of previous studies.[4] Another advantage of using spin-offs in examining the cash allocation decision is that the ex-post cash holdings of these firms are unaffected by the event since no new securities or assets are sold in a spin-off.

In addition to providing insights about the determinants of cash ratios at the margin, our analysis also controls for possible endogeneity of leverage and cash ratios. Because theories of cash ratios are derived from corresponding theories of capital structure, a number of extant studies assume cash ratios as simply residuals of the financing decision. For instance, Opler, Pinkowitz, Stulz, and Williamson (1999) allude to this fact in studying the cash ratios of firms, and Mehrotra, Mikkelson, and Partch (2003) use leverage net of cash in studying the determinants of leverage allocation around spin-offs. The implication here is that it is leverage that is specifically determined and cash ratios are simply obtained as a residual of the leverage. As a consequence factors that affect leverage will also mechanically affect cash ratios. Therefore, not explicitly controlling for this endogeneity of leverage and cash ratios may provide

[4] While our paper attempts to only test the tradeoff theory, it does not challenge the central prediction of the pecking order theory regarding cash, which is that asymmetric information problems are so great for most firms in normal times that it is simply too costly for managers to attempt to move their firm toward it's optimal cash ratio.

spurious correlations between firm-specific factors and cash ratios. Even if cash ratios and leverage are independently allocated, they may be simultaneously determined, and any analysis of cash ratios must control for this simultaneity. We achieve both objectives by also analyzing the determinants of cash ratios in a simultaneous equation set-up with leverage, and using both two-stage least squares and full-information maximum likelihood estimation of the factors affecting cash ratios.

Finally, our study also enhances our understanding of corporate spin-offs. Previous studies by Mehrotra, Mikkelson, and Partch (2003) and Dittmar (2004) only analyze the allocation of the pre-spin-off firm's leverage between the post-spin-off firms. This is the first study to our knowledge that examines the allocation of assets that is not specific to any particular division of the firm.

Our sample consists of 149 firms that conduct a spin-off between 1985 and 2000 that result in 154 subsidiaries. We find no difference in average cash ratios, defined as cash plus marketable securities to total assets, between the post-spin-off parent and subsidiary(s) suggesting that managers do not systematically allocate more cash to one of the post-spin-off entities. However, there are significant differences in raw and industry-adjusted cash ratios between the post-spin-off entity that was allocated a higher cash ratio and the entity that was allocated less cash, implying that the cash allocation decision is not based exclusively on the division of total assets between the post-spin-off entities or that only industry averages affect firms' cash ratios.

We examine the factors that affect the cash allocation decision by relating the difference in cash ratios between the post-spin-off subsidiary and parent to corresponding differences in explanatory variables suggested by the tradeoff theory that have been used in previous studies of

cash holdings. We find a negative relation between firm size and cash holdings implying that small firms that incur higher transaction costs while raising external funds, or firms that have limited access to external capital markets are allocated more cash at the spin-off. Firms that have access to highly liquid internal assets such as non-cash working capital are allocated less cash at the spin-off.

We find that firms' expected future growth opportunities influence their cash holdings; firms with higher sales growth are allocated more cash at the spin-off. This finding is also consistent with the agency cost hypothesis that firms with poor growth potential that are likely to overinvest are allocated less cash. Small firms and firms with future growth opportunities also have high levels of information asymmetry. Allocating more cash to these firms reduces their need to raise external funds thus eliminating the adverse selections costs that these firms are subjected to when they issue new securities. Finally, we find that differences in cash holdings are positively related to research and development expenses suggesting that firms with higher financial distress costs emerge from the spin-off with higher cash ratios. These broad patterns persist even when we control for the possible endogeneity between leverage and cash ratios, indicating that the correlations documented are not spurious. Overall, we conclude that transaction costs, financial distress costs, and agency costs influence a firm's cash allocation and these results complement the conclusions of Kim, Mauer, and Sherman (1998) and Opler et al (1999).

The rest of this paper proceeds as follows: In section 2 we develop the hypotheses tested in this study. We present the model in section 3 and detail the sample selection procedure and present descriptive statistics in section 4. Section 5 presents the results and we conclude in section 6.

2. Hypotheses and Proxies

In this study we investigate the factors that affect a firm's cash holdings by analyzing the cash allocation decision in a corporate spin-off. By examining the difference in cash ratio between post-spin-off entities we eliminate the impact of past operating and financing results as an explanation for firms' liquidity levels. This analysis therefore allows us to focus on variables suggested by only the tradeoff theory. The theory posits that the optimal liquidity ratio is determined by equating the costs and benefits of holding cash. These costs and benefits of cash can broadly be explained by three hypotheses.

2.1. Transaction Cost Hypothesis:

Raising external funds is expensive because of transaction costs and other expenses associated with issuing new securities. Therefore, a benefit of maintaining cash reserves is the mitigation of costs associated with raising funds from outside sources.[5] A significant component of the total cost of selling new securities is fixed costs. This fact suggests that there are economies of scale associated with raising larger proceeds when issuing external securities. Barclay and Smith (1996) and Kim, Mauer, and Sherman (1998) contend that larger firms are better able to exploit the scale economies because they raise large amounts of capital frequently. In contrast, smaller firms have limited collateral, face more adverse selection problems, and are less likely to be able to exploit the scale economies in flotation costs. Thus, smaller firms derive greater benefits from holding cash relative to larger firms.[6] The transaction cost hypothesis therefore predicts that managers allocate a higher fraction of cash to the smaller of the post-spin-off entities.

Firms can finance investments by issuing new securities or by using the cheaper internal

[5] Keynes (1934) refers to this cost as the transaction cost motive for holding cash.
[6] See Whited (1992), Fazzari and Petersen (1993) and Kaplan and Zingales (2000).

sources of cash defined as financial slack. For firms that do not have adequate sources of internal financing, allocating more cash reduces their need for costly external funds. This argument implies a negative relation between the level of internal financing and a firm's cash holding, ceteris paribus. A source of internal financing is the non-cash net working capital that can be converted into cash at a relatively low cost. Future cash flows are an alternative source of internal financing.[7] Therefore, in the context of spin-offs, the transaction cost hypothesis predicts that the post-spin-off firm that is allocated relatively high levels of non-cash net working capital or that is expected to have high cash flows in the future will receive less cash.

Cash flow variability also affects liquidity ratios. Firm with high variability in cash flows face a high probability of experiencing cash shortages in any given period, forcing them to raise costly external funds. Maintaining sufficient cash reserves allows the firms to use these funds during years with low cash flow. A similar argument relates firms' future capital expenditures to their cash ratios. Firms with high future capital expenditures are less likely to be able to finance the investments out of operating income and hence are more likely to have to issue costly new securities. Therefore, the transaction costs hypothesis predicts that the post-spin-off entity that is expected to experience greater variability in cash flow or have higher future capital investments will be allocated a larger fraction of the pre-spin-off cash.

Firms characterized by high degrees of asymmetric information between managers and investors about the values of the assets in place and future growth opportunities, face high adverse selection costs while raising external capital. For these firms, maintaining large cash reserves reduces the need to issue external securities. Therefore, the post-spin-off entity that has a higher level of information asymmetry is expected to be allocated a larger fraction of the pre-

[7] Almeida, Campello, and Weisbach (2003) argue that firms that expect to be financially constrained in the future are more likely to save a large fraction of their cash flows.

spin-off cash.

2.2. Financial Distress Cost Hypothesis:

Opler, et al (1999) and Mehrotra, Mikkelson, and Partch (2003) argue that firms with high cash flow variability have a higher probability of defaulting on their debt and hence, face higher expected financial distress or bankruptcy costs. Because of this possibility, the cost of debt financing for these firms also increases. Firms can reduce the probability of bankruptcy and its associated costs by maintaining sufficient cash reserves and using these funds to meet their fixed obligations during years with low cash flow. This argument implies a positive relation between differences in cash ratios between the post-spin-off entities and differences in cash flow variability.

The firm's leverage ratio might also affect the cash allocation decision. Holding other factors constant, firms with high leverage ratios are less likely to be able to meet their interest obligations and hence more likely to face financial distress and possible bankruptcy in the future. Therefore, for these firms we would expect a greater allocation of cash. However, Mehrotra, Mikkelson, and Partch (2003) find that post-spin-off firms that are allocated more leverage are those with a higher fraction of real assets and hence are firms that are less likely to experience future financial distress. This finding is consistent with John (1993) who argues that high leverage may proxy for access to debt markets. The latter arguments imply a negative relation between leverage and cash ratios. Hence, the prediction of the tradeoff theory regarding the relation between leverage ratio and the cash allocation for post-spin-off firms is unclear.

Finally, firms that make a significant investment in firm-specific assets or growth opportunities will experience a dramatic decline in market value if faced with bankruptcy

because these assets are unique and do not have a high value in secondary markets.[8] By allocating more cash to these firms, managers reduce the probability of future financial distress thus mitigating potential bankruptcy related costs. Therefore, we would expect the post-spin-off entity with greater financial distress costs to be allocated more cash at the spin-off.

2.3. Agency Costs Hypothesis:

Jensen and Meckling (1976), Myers (1977), Barclay and Smith (1995), and Gaver and Gaver (1995) among others argue that firms with higher future growth opportunities face higher agency problems of debt. Further, the agency problems of risk-shifting and underinvestment increase the cost of raising external debt capital for these firms. Maintaining cash reserves help these firms mitigate these agency costs of debt by reducing the frequency with which these firms access external debt markets. Alternatively, for firms with poor investment opportunities, providing excess cash motivates the managers to invest in value dissipating projects. For example, Jensen (1986), Blanchard, Lopez-de-Silanes, and Shleifer (1994), Harford (1999), and Harford, Mansi, and Maxwell (2004) find that firms with excess cash invest in value decreasing projects. Reducing the amount of cash available to managers will alleviate the overinvestment problem.[9] The implication from these arguments is that firms with high future growth opportunities will more likely be allocated higher cash.

Agency costs can also arise when the goals of a manager differ from those of shareholders. Managers' investments in a firm consist of both pecuniary interests and human capital. Should the firm become bankrupt, managers will experience a dramatic decline in their

[8] See Titman and Wessels (1988) and Opler and Titman (1993, 1994).

[9] Dittmar and Mahrt-Smith (2004) conclude that the marginal contribution of cash to shareholder wealth is low for firms that have poor corporate governance. Dittmar, Mahrt-Smith, and Servaes (2003) and Kalcheva and Lin (2004) find consistent evidence internationally. They report that in countries where protection of shareholder rights are weak, firms tend to have high levels of cash.

personal wealth and benefits. Hence, managers have an incentive to see that their firms continue to remain solvent. As stated earlier, maintaining large cash reserves reduces the probability of bankruptcy. An implication of this argument is that managers of the pre-spin-off firm will allocate more cash to the post-spin-off entity that they will control.[10]

2.4. Variable Definitions

Our main variable of analysis is the cash ratio, C/A, defined as the ratio of cash and cash equivalents (data 1) to book value of assets (data 6) of the firm. Cash and cash equivalents on Compustat is defined as "cash and all securities readily transferable to cash," and includes, but is not limited to, letters of credit, certificates of deposit, bonds, and preferred and common stock. This definition of cash is identical to that in Kim, Mauer, and Sherman (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), Faulkender and Wang (2004), and Pinkowitz and Williamson (2004).

We use firm size (SIZE), defined as the natural log of the book value of assets, as a proxy for transaction costs associated with raising new financing. A source of internal funds is the cash flow that the firm is expected to generate in the future. Similar to Opler, et al (1999) we define cash flow (CF) as Income before Depreciation and Amortization (data 13) less interest expense (data 15), income taxes (data 16), and preferred and common dividends (data 19 and 21 respectively), standardized by the year-end book value of assets.[11] Other internal sources of funds include non-cash net working capital, NWC, defined as current assets minus current liabilities minus cash (data 4 – data5 – data1), divided by book assets.

[10] Dittmar, Mahrt-Smith, and Servaes (2003) suggest that increasing non-pecuniary benefits motivates managers to hold more cash.

[11] We also used alternative definitions of cash flows including net profit plus depreciation and amortization less interest, taxes, and dividends and operating income before depreciation and amortization, both standardized by year-end book assets and obtained similar results.

Cash flow variability, defined as SIGMA, is measured as the standard deviation of cash flow (CF) of the median firm in the industry before the spin-off. We use industry volatility because historical data is not available to estimate firm level cash flow volatility for the subsidiary firms. Industry is defined as all firms in the same three-digit Compustat SIC code as the post-spin-off sample firms.[12] Standard deviation of cash flow is calculated over two intervals; from 1980 to the year-end before the spin-off, and the five-year interval that ends the year-end prior to the spin-off (see Dittmar, 2004). As robustness tests, we use the mean standard deviation of all industry firms, and similar to Dittmar (2004) and Mehrotra, Mikkelson, and Partch (2003), we define cash flow as operating income before depreciation and amortization standardized by book assets. Our results are not sensitive to the standard deviation of cash flow measure used.

Similar to Smith and Watts (1992), Jung, Kim, Stulz (1996), and Opler et al (1999) we use market-to-book ratio (MB), defined as book value of assets minus the book value of equity (data 60) plus the market value of equity (data 25 * data 199), divided by the book value of assets, as a proxy for growth opportunities. Opler et al (1999) and Harford, Mansi, and Maxwell (2004) among others use research and development expenditures (R&D – data 46) standardized by year-end sales to proxy for financial distress costs. Consistent with Opler, et al and Pinkowitz and Williamson (2004), we assume that firms that do not report research and development expenditures have zero research and development expenditures. However, Opler and Titman (1994), Aboody and Lev (2000), and Dittmar, Mahrt-Smith, and Servaes (2003) note that investment in research and development is one of the most information sensitive investments and hence is also a proxy for information asymmetry. CAPX is the ratio of capital expenditure (data 128) to the book value of asset. Leverage, LEV, is measured as the ratio of total long-term debt

[12] Similar to Opler et al (1999), we also define an industry as all firms in the same two-digit SIC codes as the spin-off firms and obtain similar results.

to book value of assets. Total long-term debt is measured as debt in current liabilities (data 34) plus long-term debt (data 9). For robustness, we also measure leverage as the ratio of total debt to book value of assets, where total debt is defined as current liabilities (data 5) plus long-term debt (data 9). Our results using this alternative leverage variable are similar to those with our prior measure of leverage. Finally, we measure agency costs arising from managerial opportunism by identifying the post-spin-off entity that retains the CEO.[13] We use the Moody's Industrial and OTC Manuals, Standard and Poor's Corporation Descriptions, and SEC filings to determine whether the CEO of the pre-spin-off parent as of the year-end before the spin-off announcement was retained after the spin-off and which post-spin-off entity he/she controlled. The post-spin-off entity that retains the CEO is assigned value of 1 for the indicator variable CEO and the other post-spin-off entity is assigned a value of 0.

In addition to the factors suggested by the tradeoff theory, we include a variable for industry cash, IND, to control for the influence of industry factors on the cash allocation decision. If managers simply attempt to set the post-spin-off cash ratios for the parent and the subsidiaries as close as possible to their industry medians, then this should be the only variable with explanatory power in the multivariate regressions. The variable is measured as the median cash ratio of all firms with the same three-digit SIC code as the sample firms in the year of the spin-off.

Firm size, market-to-book ratio, net working capital, leverage, and industry cash are measured at the first fiscal year-end following the spin-off completion (year 0). Research and development, cash flow, and capital expenditures, which are flow variables, are measured in the first full fiscal year after the spin-off completion (year +1). Measuring these flow variables in

[13] Because shares in the subsidiary are allocated pro-rata to the shareholders of the pre-spin-off parent examining the fraction of managerial ownership does not provide meaningful information.

year +1 makes it possible to test tradeoff theory predictions in isolation from pecking order effects. For example, when cash flow is measured in the same year as cash ratios, it's unclear whether the relation between cash flow and cash ratios is driven by the preference of managers to hold more cash when expected cash flows are low (and less when expected cash flows are high) as posited by the tradeoff theory or by the simple fact that firms with high cash flow during a given year will have higher cash ratios at the end of that year, controlling for other factors.

The proxy variables used to test the transaction costs, financial distress, and agency costs hypotheses are similar to those used in other papers that examine firms' cash levels. In table 1, we summarize the predicted signs for the variables and the corresponding hypotheses.

3. Methodology

We analyze the cash allocation decision around spin-offs by studying the impact of several factors suggested by the tradeoff theory on the difference in cash ratios between the post-spin-off subsidiary and parent. When a spin-off results in more than one subsidiary, each of the subsidiaries is paired with the parent to create a separate observation.[14] As an alternative specification, we define the dependent variable as the difference in cash ratio of the post-spin-off firm that was allocated the higher cash ratio and that of the firm with lower cash ratio. Mehrotra, Mikkelson, and Partch (2003) argue that the power of test using this specification is low because the dependent variable is always positive. However, the conclusions of the regression analysis based on the alternative specification are not significantly different from the results of our main analysis.

[14] All of the results reported in this study are robust to excluding the multiple-subsidiary spin-offs from the sample.

We estimate the following ordinary least square regression equation, which is similar to the model of cash holdings presented in Opler et al (1999):[15]

$$\Delta CASH_i = \alpha_i + \beta_1 \bullet \Delta IND_i + \beta_2 \bullet \Delta SIGMA_i + \beta_3 \bullet \Delta SIZE_i + \beta_4 \bullet \Delta MB_i + \beta_5 \bullet \Delta R\&D_i + \beta_6 \bullet \Delta CF_i + \beta_7 \bullet \Delta NWC_i + \beta_8 \bullet \Delta CAPX_i + \beta_9 \bullet \Delta LEV_i + \beta_{10} \bullet \Delta CEO_i + \varepsilon_i \quad (1)$$

where α is the intercept term, β_1 through β_{10} are the coefficients of the independent variables, ε is the error term, subscript $_i$ represents the i^{th} parent-subsidiary pair, and Δ represents the difference between each post-spin-off subsidiary and parent pair.

The dependent variable is defined as:

$$\Delta CASH = C_{S,0}/A_{S,0} - C_{Pi,0}/A_{Pi,0} \quad (2)$$

where C/A is the ratio of cash to total assets, the subscripts $_S$ and $_P$ refer to the subsidiary and the parent, respectively, the value of zero for the time subscript indicates the year-end of the spin-off completion. The cash ratio of each entity is measured at the year-end of the spin-off.[16] The independent variables are also measured as a difference of the variables between the subsidiary and the parent. To reduce the effect of outliers on our analysis, we use the Cook's D test that eliminates observations that have an excessive influence on the results.[17]

An issue with the specification in equation (1) is the possible endogeneity of leverage and cash ratios. A number of extant studies assume cash ratios as simply residuals of the financing decision. For instance, Opler, Pinkowitz, Stulz, and Williamson (1999) discuss a narrow view of the financial hierarchy model in their analysis of cash ratios, where they suggest that while leverage may be systematically determined, cash ratios may simply be the residual from the

[15] Opler et al have dividend and regulation dummies in their regression equation (see Table 4). We find that adding a dividend dummy, which proxies for an alternative source of internal financing, does not affect our results.

[16] Ideally, we would like to measure the cash ratio immediately following the spin-off. While it is possible to calculate the cash ratio for the post-spin-off subsidiary using the year-end cash flow statement and cash holding, it is not possible to do so for the parent firm when the spin-off is completed during the course of the fiscal year.

[17] The criterion used to eliminate observations is whether the Cook's D test statistic exceeds four divided by the number of observations.

internally generated cash flows of the firm. Mehrotra, Mikkelson, and Partch (2003) analyze debt ratios net of cash because they argue that "cash reserves offset the effect of financial leverage." The implication that emerges from these arguments is that cash ratios may not be independently determined from debt ratios but may be endogenous to leverage. Any relation documented between cash ratios and firm-specific factors may simply be spurious correlations due to this endogeneity. A related issue is that even if cash ratios are independently determined from debt ratios, they may be simultaneously determined, and any analysis of cash ratios must control for this simultaneity. We achieve both objectives by also analyzing the determinants of cash ratios in the following simultaneous equation system with leverage. We estimate the coefficients in two ways – using Two-stage Least Squares (2SLS), and Full-Information Maximum Likelihood (FIML) estimation of the factors affecting cash ratios.[18]

$$\Delta LEV_i = \gamma_i + \delta_1 \bullet \Delta SIGMA_i + \delta_2 \bullet \Delta MB_i + \delta_3 \bullet \Delta CF_i + \delta_4 \bullet \Delta TAX_i + \varepsilon_i \qquad (3)$$

$$\Delta CASH_i = \alpha_i + \beta_1 \bullet \Delta IND_i + \beta_2 \bullet \Delta SIGMA_i + \beta_3 \bullet \Delta SIZE_i + \beta_4 \bullet \Delta MB_i + \beta_5 \bullet \Delta R\&D_i + \beta_6 \bullet \Delta CF_i + \beta_7 \bullet \Delta NWC_i + \beta_8 \bullet \Delta CAPX_i + \beta_9 \bullet \Delta LEV_i + \beta_{10} \bullet \Delta CEO_i + \varepsilon_i \qquad (4)$$

The leverage equation (3) is replicated from regression 2 of Table 4 in Mehrotra, Mikkelson, and Partch (2003). As before, Δ represents the difference between each post-spin-off subsidiary and the parent pair, and TAX is an indicator variable that is one if the entity has no tax loss carry-forwards and pretax income is positive.

4. Data

Our initial sample consists of all spin-offs between 1985 and 2000 completed by U.S. firms listed on NYSE, Amex, and Nasdaq. We identify this sample from the *Center for Research in Security Prices* (CRSP) database, the National Automated Accounting Research

[18] See Kennedy (2003) for a discussion of the relative merits and disadvantages of the 2SLS and FIML methods.

System, Lexis-Nexis, the *Wall Street Journal*, and Moody's Dividend Record. We exclude equity carve-outs, new issues of a different class of a firm's own stock, tracking stock issues, and other non-spin-off events that some of the above mentioned sources occasionally identify as spin-offs. Also excluded are distributions of shares in royalty trusts, real estate investment trusts, closed-end funds and limited partnerships because these are often undertaken for tax motives and do not represent the separation of different segments of a firm. Finally, the sample does not include non-voluntary spin-offs, defined as spin-offs forced by anti-trust action or undertaken solely to facilitate the merger or sale of either the parent or subsidiary firm. These screening procedures identify 211 pre-spin-off parent firms as our initial sample.

To remain in the sample, the pre- and post-spin-offs firms must be included in the Standard and Poor's Research Insight database, and must have data available for cash holdings at the first fiscal year-end following the spin-off completion. Only 183 of the original 211 spin-offs meet these criteria. We then apply the same criteria used by Opler, et al (1999) in their study of corporate cash holdings to our sample. Spin-offs in which either the parent or the subsidiary is a financial firm, defined as those with SIC codes between 6000 and 6999, are dropped from the sample. These firms frequently hold large inventories of cash and marketable securities and are often required by law to hold minimum levels of financial capital. This data criterion results in the loss of 28 spin-off observations. Spin-offs involving utilities (five observations) are dropped from the sample because these firms are typically subject to government regulation and their financial viability is often guaranteed. Finally, one observation is excluded because the parent firm's equity trades as an American Depository Receipt (ADR).

These sample selection criteria result in a final sample of 149 spin-offs. In Panel A of Table 2, we present the frequency distribution of the sample by year. The sample is weighted

fairly heavily towards the 1996-2000 period, though at least five spin-offs occur in each of the 16 years in the sample period. In five of the spin-offs, the parent firm separates two subsidiaries on the same date, resulting in a final sample of 154 (see Panel B) parent-subsidiary pairs.

Post-spin-off firms operate in a wide range of industries. The 149 post-spin-off parents and 154 post-spin-off subsidiaries span 76 and 85 distinct three-digit SIC codes, respectively. The most common industry for the parent firms is communication equipment (SIC 366) with eight, followed by two industries (SIC 281 and 384) with six. The most common industry for the subsidiaries is computer programming and data processing (SIC 737) with six. 56.49 percent of the parent-subsidiary pairs match at the one-digit level, 35.71 percent match at the two-digit level, 24.03 percent at the three-digit level, and 14.94 percent at the four-digit level. These patterns are consistent with the sample patterns in the extant literature on spin-offs in that most of the spin-offs dissociate parents and subsidiaries operating in different industries.

4.1. Descriptive Statistics

Descriptive statistics for the pre-spin-off firms are presented in Table 3. The pre-spin-off firms have median book and market values of assets of $1,958.19 million and $3,191.14 million, respectively, and median sales of about $1,740 million. Comparing these characteristics of our sample to the sample in other studies indicate that our sample firms are similar to spin-off firms of Dittmar (2004) and Mehrotra, Mikkelson, and Partch (2003).

Mean (median) cash and cash equivalents are approximately $531 ($64) million and account for 8.02 percent (3.55 percent) of book assets of the pre-spin-off firms. These are comparable to the corresponding items in Mehrotra, Mikkelson, and Partch (2003). They are also similar to the features in Kim, Mauer, and Sherman (1998), who find that the mean and median cash-to-book ratios for their sample of 915 large U.S. industrial firms of 8.1 percent and

4.7 percent, respectively. However, Opler et al (1999) and Pinkowitz and Williamson (2004) report that the median firm in the economy holds about 6.5 percent of assets in cash suggesting that the characteristics of pre-spin-off firms reflect those of larger firms in the economy.

The mean (median) market-to-book ratio of the pre-spin-off firms is 1.77 (1.48). The median (mean) pre-spin-off firm earns a 6.44 (6.24) percent cash flow return on book assets in the year before the spin-off. Opler et al find that the median (mean) cash flow ratio across all firms-year to be approximately 7.0 (3.75) percent across their sample. The mean (median) pre-spin-off firm has a leverage ratio of approximately 28 percent (25 percent), which is similar to Dittmar (2004). Total leverage, defined as current and long-term liabilities, account for slightly less than one-half of the firm's assets. In the year prior to the spin-off, the median firm invests about 5.6 percent of its assets in capital expenditures. Of the 150 pre-spin-off firms with dividend data available, 113 (76.6 percent) pay dividends in the year-ending before the spin-off completion year and this fraction is similar to the 77 percent of dividend paying firms in the Mehrotra, Mikkelson, and Partch (2003) sample.

Some of the results reported in Table 3 differ from those of previous studies on spin-offs. A possible explanation for the difference is the sample period covered by the different studies. The sample period of even the most recent study on spin-offs (Mehrotra, Mikkelson, and Partch, 2003) extends only to 1997. Approximately 21 percent of our spin-offs in our sample were conducted between 1998 and 2000. On average, we find that firms than conduct a spin-off before 1998 are smaller in terms of book value ($7,047.7 versus $23,233.3 million) and market value ($10,668.4 versus $31,153.2 million), have lower sales (5,735.8 versus $14,940.5 million), and market-to-book ratios (1.67 versus 2.18). The characteristics of our sample firms that conduct a spin-off before 1998 are similar to those of previous studies that examine spin-offs.

5. Results

The objective of the paper is to analyze the factors that affect the allocation of cash across the different entities around a spin-off. We first examine what happens to cash ratios of the post-spin-off entities in the two years after the completion of the spin-off. We then go on to compare the cash ratios of the post-spin-off parent and subsidiary(s) to determine whether the pre-spin-off cash is divided between these firms in the same proportion as their other assets. Such an analysis also allows us to examine whether managers systematically allocate more cash to either the parent or the subsidiary. We also investigate whether industry cash ratios are an important determinant of the liquidity ratio of post-spin-off firms. Finally, we estimate regression models where the difference in cash ratio between the post-spin-off subsidiary and parent is regressed on several variables suggested by the tradeoff theory to determine the factors that influence the cash allocation decision.

5.1. Univariate Analysis

We study the cash ratios of the post-spin-off parents and subsidiaries in the year of, and two years immediately following the spin-off. These results are presented in panels A and B of Table 4. As the distribution of cash ratios for post-spin-off firms displays substantial right skewness, this discussion will concentrate on median results. Our results indicate that the cash ratios of the post-spin-off entities remain quite stable after the allocation in the two years after the spin-off. Parent firms have a median cash ratio of 4.47 percent in the year of spin-off completion, while the median for the subsidiaries is 5.17 percent. The median cash ratios of both entities decrease somewhat in magnitude in years 1 and 2 following the spin-off, however, the annual change in years 0 to 1 and 1 to 2 are not statistically different from zero. We interpret this finding to suggest that firms continue to maintain the cash ratios allocated to them at the

time of the spin-off and that managers make the initial cash allocation decision after considering the firms' long-term liquidity structure. Thus, isolating the determinants of the cash allocation decision becomes especially pertinent for this sample.

In panel A of Table 5, we present univariate comparisons between parent and subsidiary cash ratios at the first fiscal year-end following the spin-off completion. For each spin-off we calculate the mean and median difference in cash ratios between the subsidiary and the parent and this result is in the third column. The last column of panel A gives the p-value of t-tests (means) and Wilcoxon signed-rank tests (medians) that the cash ratios of the subsidiary and the parent are the same.

An examination of the top row of panel A reveals no significant difference in median cash ratios between post-spin-off parent and subsidiary and is consistent with Mehrotra, Mikkelson, and Partch (2003). Parent firms have a median cash ratio of 4.47 percent, while the median for the subsidiaries is 5.17 percent. The fact that the mean and median cash ratios of the post-spin-off subsidiary is similar to those for the parent implies that managers do not systematically favor either parent or subsidiary firms with higher cash ratios at the spin-off.

In the bottom row of the panel, we adjust the firms' cash ratios for industry effects to test whether managers use the industry as the benchmark in allocating cash between the post-spin-off entities. From the cash ratio of each post-spin-off sample firm, we subtract the cash ratio of the median firm in the industry. We find that the cash ratios of the parent and subsidiary are similar to their industry medians and the mean and median difference in industry-adjusted cash ratios between the post-spin-off firms are not statistically different from zero.

The results presented above raise two questions: First, do managers merely allocate cash to post-spin-off parent and subsidiary(s) firms as a fixed proportion of the total assets allocated?

If managers adopt this policy then little can be learned about corporate cash policies from studying the allocation of cash in spin-offs. Second, do spin-off firms simply match industry cash ratios when setting cash ratios for the post-spin-off parent and subsidiary firms? If this is true then an investigation of how managers allocate cash in spin-offs should only focus on differences in industry factors.

We address the first question by examining the difference in cash ratios between the firm that emerge from the spin-off with the higher cash ratio (high-cash firm) and the post-spin-off firm with the lower cash ratio (low-cash firm). If managers allocate cash to the post-spin-off entities in approximately the same proportion as the other assets, then there should be no difference in cash ratios between high-cash and low-cash firms. The result of this analysis is presented in panel B of Table 5. High-cash firms have a median cash ratio of 8.30 percent, compared to 2.22 percent for low-cash firms. The difference in median cash holdings between the high and low-cash firms is 4.33 percent, significant at one percent level. The magnitude and significance of the difference in median cash ratios indicates that there is substantial variation in cash ratios for pairs of post-spin-off firms, implying that managers do not allocate cash to the post-spin-off entities merely based on the proportion of total assets of the entities.

The question of whether managers are guided only by industry ratios in the cash allocation decision is addressed in the last row of panel B, Table 5. The median cash ratio for low-cash firms is 2.45 percent below the median industry cash ratio while the industry-adjusted cash-to-book ratio for the median high-cash firm is 1.67 percent, both significant at 1 percent level. The difference in median industry-adjusted cash ratios between the high-cash and low-cash firms is about 5.4 percent and highly significant. These results do not support the

hypothesis that managers simply match industry cash ratios when allocating cash to the post-spin-off firms.

We also compare the post-spin-off parent and subsidiary pairs to see whether they differ along other dimensions. We present the descriptive statistics of some financial variables for the post-spin-off entities in Table 6. The mean (median) values for the parents and the subsidiaries appear in the second and third columns of the table, respectively. The differences between the means and medians of these variables, which are the independent variables in the regression tests, appear in the fourth column. A point to be noted is that the number of observations available for the difference of each explanatory variable varies according to the availability of data. We find a significant fraction of the post-spin-off parents and subsidiaries are delisted within two-years of the spin-off completion date resulting in a substantial decrease in the number of observations for year 1 variables.[19] Further, because each pair of subsidiary-parent observations are missing data for different variables, the sample size of multivariate regression analyses is lower than any of the sample sizes reported in Table 6.

We find some significant differences between the post-spin-off parents and subsidiaries. Consistent with the results of previous studies, the post-spin-off parent is significantly larger than the subsidiary. Parent firms have median book value of assets of about $1,800 million in the year of the spin-off while subsidiaries have median assets of $395 million. Similar to Dittmar (2004), we find that, on average, parent firms have higher leverage relative to the subsidiaries at the year-end of the spin-off. Furthermore, while subsidiary firms are allocated a greater amount of working capital net of cash, parents pay more dividends as a fraction of their book assets. Finally, the mean variation in industry cash flow of the parent is less than that for the subsidiary

[19] We find that 14 post-spin-off parents and 11 post-spin-off subsidiaries are delisted, reducing the full sample of 154 sets of spin-offs by 16.23% or 25 observations. CRSP cites mergers as the major reason for delisting of both post-spin-off parents and subsidiaries.

but there is no difference in median values. The cash flow, industry cash ratios, and market-to-book ratio of the parents are similar to those of the subsidiaries. We also find that the difference in research and development expenses to sales and capital expenditure to total assets ratios between the parents and subsidiaries to be insignificant.

Table 7 presents a matrix of correlation coefficients for the variables used in the multivariate regressions. In general the correlations between the independent variables are quite low. The highest correlation is -0.426 (between CF and R&D variables) and the remaining coefficients are below 0.3 in absolute terms. The signs of the correlation coefficients between the cash ratio and the independent variables are generally consistent with the predictions of the tradeoff theory. The exceptions are the market-to-book ratio and capital expenditures, where the coefficient is negative.

5.2. Regression Analysis

Results of multivariate regressions are presented in Table 8.[20] Specification 1 is the full model of equation (1). The coefficient for firm size is negative and significant. This result is consistent with the transaction cost hypothesis that firms that have greater access to the capital markets or have economies of scale in raising outside funds are allocated less cash at the spin-off. We find that the coefficient for net working capital is negative and significant at the 1 percent level. This finding implies that firms that have more non-cash net working capital are allocated less cash, suggesting that net working capital acts as a substitute for cash holdings, and supports the transaction cost hypothesis.

We also find that the coefficient for research and development expenditure is significantly positive suggesting that firms that have higher financial distress costs will be

[20] White heteroscedasticity adjusted errors are used to compute t-statistics in the regression analysis.

allocated higher cash and is consistent with Opler et al (1999). Further, because firm size and research and development expenses could also proxy for the degree of information asymmetry, these results are also consistent with the transaction costs hypothesis that firms with high information asymmetry levels are allocated more cash.

The coefficient for leverage is negative and significant at the five percent level. While the financial distress hypothesis does not have a clear prediction for the sign of the coefficient of leverage, this finding is consistent with John (1993) and Kim, Mauer, and Sherman's (1998) argument that spin-off firms with high leverage are those that are less likely to be in financial distress or that have more access to debt markets and hence do not need to maintain high liquidity level. To confirm that financial distress does not affect the cash allocation decision, we re-estimate the regression replacing leverage ratio with interest coverage ratio. The inability of a firm to meet its interest obligation will force the firm into bankruptcy. Thus, if financial distress plays a significant role in the cash allocation decision, the coefficient of interest coverage ratio should be negative. We define interest coverage ratio as the ratio of interest expense (data item 15) to operating income before depreciation (data item 13) and is measured in year 1. Consistent with our earlier conclusion, we find the coefficient for this variable to be insignificant.

Contrary to the prediction of the agency cost hypothesis, the coefficient of market-to-book ratio is not significant, implying that the availability of future investment opportunities is not a determinant of cash ratios. We offer three explanations for this finding. First, R&D expenditure is also frequently used to proxy for growth opportunities. Therefore, it is possible that R&D could be capturing part of the effect of market-to-book on cash ratios. We test for this possibility by estimating the regression without the R&D variable but the coefficients of the market-to-book ratio and the other explanatory variables do not change substantially. Second,

Mehrotra, Mikkelson, and Partch (2003) argue that high market-to-book ratio for post-spin-off firms more likely reflects the expected profitability of assets in place as opposed to new investments opportunities. Finally, Dittmar (2004) argues that since spin-off firms experience abnormal positive returns subsequent to the event, the market-to-book ratio might not adequately capture firms' growth opportunities.

Because market-to-book ratios for post-spin-off firms might not always capture growth opportunities, we replace this variable by sales growth in the regressions 2 through 5. Dittmar (2004), Dittmar and Mahrt-Smith (2004), and Pinkowitz and Williamson (2004) argue that sales growth also proxies for future investment opportunities. We define sales growth as change in sales from the year end of the spin-off (year 0) to the subsequent year-end, standardized by year 0 sales. The coefficient for sales growth is significantly positive. This result indicates that managers allocate more cash relative to assets to the post-spin-off firm that has higher potential for growth and that firms that are more likely to invest in value decreasing projects are allotted less cash. Also, because sales growth and R&D to sales may both proxy for growth opportunities, we re-estimate the regression omitting the R&D variable. We continue to find the sales growth coefficient to be significantly positive.

The coefficient for cash flow (CF) is insignificant in all specifications of the model. We obtain similar results when we define cash flows as operating income before depreciation as in Dittmar (2004) and Mehrotra, Mikkelson, and Partch (2003). A possible explanation for this result might be the high correlation between this variable and R&D expense. Therefore, we re-estimate the regression eliminating the R&D variable but the coefficient for CF continues to be insignificant.

We find the coefficient for industry sigma, which is a proxy for probability of bankruptcy, to be insignificant. This result is robust to the different measures of industry sigma that we defined earlier and is consistent with the cross-sectional results of Kim, Mauer, and Sherman (1998). This result, coupled with the finding of Mehrotra, Mikkelson, and Partch (2003) that leverage ratios are negatively related to variation in industry cash flow, suggest that managers that are concerned about the probability of future financial distress are more likely to reduce the firm's leverage ratio than to increase the liquidity ratio.

We find no evidence supporting the hypothesis that firms with higher short-term capital expenditures are allocated more cash. The coefficient for industry cash ratio is also insignificant and is consistent with the results of the univariate analysis presented earlier. We also find the coefficient for the CEO dummy variable to be insignificant suggesting that retention of the pre-spin-off CEO does not affect the cash allocation decision.

Specification 3 in Table 8 omits industry cash from the model. The motivation for this regression is to determine if the effect of explanatory variables are subsumed by the effect of industry cash in specification 2. The results yielded by this specification do not differ substantially from the results presented for specification 2.

One possible objection to these results is that a large portion of the difference in post-spin-off cash ratios may be transitory, implying that the observed difference does not reflect the difference in optimum cash ratios between the post-spin-off firms. This could result from management allocating cash based on information it has about large cash inflows or outflows to the parent or subsidiary firm in the year after the spin-off. For example, Krishnaswami and Subramaniam (1999) report a high incidence of new issues among post-spin-off firms relative to various benchmarks. If managers of the pre-spin-off parent firm know that the post-spin-off

subsidiary firm is planning a large debt or equity issue, for example, then they may allocate a lower portion of cash to the subsidiary than they would if they didn't know that the subsidiary would be receiving a large infusion of cash. Because the regressions in Table 8 include variables for cash flow and capital expenditures in the year after the spin-off completion, a large portion of the change in cash in year +1 is already controlled for in those regressions.

To account for other potential changes in cash that results from raising capital or repurchasing shares, we identify firms as having issued either equity or debt when the net equity or net debt issued exceeds five percent of the pre-issue book value of total assets in the first full year after the spin-off.[21] This definition is similar to Hovakimian, Opler, and Titman (2001) and Leary and Roberts (2004). In specification 4, we include a dummy variable that is 1 if the firm has raised capital in the year subsequent to the spin-off year-end and 0 otherwise. The results for the coefficients of the other explanatory variables are not substantially different from the results for specifications 2 and 3. Thus, we conclude that our multivariate results are not attributable to differences in transitory cash holdings.

Opler et al (1999) and Mehrotra, Mikkelson, and Partch (2003) note that it is possible that some of the variables in the model, particularly cash, leverage and capital expenditures may be simultaneously determined. Simultaneity is also a concern in this study, because spin-off managers must allocate both cash and debt for the post-spin-off firms and may also set post-spin-off investment at that time. Specification 1 in Table 8, Panel B, addresses this problem by omitting leverage and capital expenditures from the model. These specifications have the interpretation of reduced form regressions. The procedure adopted to address the issue of simultaneity is similar to that in Table 5, Panel A of Opler, Pinkowitz, Stulz, and Williamson

[21] Net equity issued is defined as the sale proceeds of common and preferred stock (data 108) less the amount of common and preferred stock repurchased (data 115). Net debt issued is the change in the book value of total debt.

(1999). The overall results for the reduced form regressions are not significantly different from the results for specifications 2 and 3. There is a marginal decline in the model's adjusted R-squares. These results imply that simultaneity, if present, does not materially distort the results reported for specifications 2 and 3.

In addition to simultaneity of leverage and cash allocations, cash and leverage may also suffer an endogeneity problem in that cash ratios may be endogenously determined with the allocation of leverage. To control for this potential endogenity, as well as to better correct for the simultaneous determination of cash and debt ratios, we also estimate our cash equation using 2SLS (specification 2) and FIML (specification 3) methods. In general, the results are similar to those in specification 1, providing additional comfort in the robustness of our estimates. These results suggest that neither simultaneity nor endogeneity affect our results materially.

In Table 9, we replicate our analysis of Table 8 on a pooled sample of all post-spin-off parents and subsidiaries. Here, we study the impact of firm and industry characteristics on the cash ratio of the individual parent and subsidiary firms. By pooling the post-spin-off entities and analyzing the determinants of the cash ratios of the individual entities, we can study whether the marginal allocation choice is similar to or different from the determinants of accumulated cash ratios in general. This analysis allows us to compare our findings and conclusions with that of Opler, Pinkowitz, Stulz, and Williamson (1999).

We continue to find significantly positive coefficients for sales growth and research and development expenditures and negative coefficients for firm size, net working capital, and leverage. However, we also find the coefficient for capital expenditure to be negative and significant. This result suggests that firms that are expected to invest more in capital assets in the

next year are allocated less cash, which is contrary to the tradeoff theory. However, this result is similar to the cross-sectional result of Opler et al (1999).[22]

Overall, the results presented in this paper provide strong support for the tradeoff theory and the findings of previous studies. Managers, in determining a firm's cash ratio, weight the benefits and costs of holding cash. We find that variables suggested by the transaction cost, agency cost, and financial distress hypotheses are significantly related to firms' cash holdings in the direction predicted by the tradeoff theory.

6. Conclusion

In this paper we investigate the determinants of corporate cash ratios by examining how firms engaging in spin-offs allocate cash to the post-spin-off parent and subsidiary firms. By concentrating on the initial cash allocation decision, we are able to examine the factors that affect a firms' marginal cash ratio while controlling for pecking order theory. Further, unlike the cross-sectional and time series tests of cash ratios of previous studies that suffer from low power identified by Mackie-Mason (1990), the results of our tests are not affected by past years' flow-of-funds surpluses or deficits because we analyze the differences in the cash allocation between the post-spin-off entities. This paper therefore provides a cleaner test of the factors suggested by the tradeoff theory influencing corporate cash holding policy than those appearing in prior studies.

We find the cash ratios for the post-spin-off firms are relatively stable for at least two years after the spin-off implying that the cash allocation decision made at the spin-off considers the firms' long term liquidity. We find that managers do not allocate cash between the post-spin-off entities based only on the division of total assets nor do they systematically allocate more

[22] See cross-sectional regression results in the fourth column of Table 4 and Table 5, Panel B of their paper.

cash to either the parent or the subsidiary. There is also no evidence that managers use only the industry cash ratio as a benchmark when determining the cash allocation.

We find that the difference in post-spin-off cash between the subsidiary and the parent is negatively related to differences in asset size, net working capital, and leverage and positively related to sales growth and research and development expenditure. These results suggest that firms that have greater access to capital markets or that incur lower transaction costs while raising external funds are allocated less cash. Similarly, managers provide less cash to firms that have greater access to internal assets that are highly liquid. The results for sales growth support the hypotheses that cash ratios are increasing with growth opportunities and also suggest that firms with high potential agency costs (i.e., low growth opportunities) are allocated less cash. Firms that are expected to have high financial distress costs are allocated more cash to reduce the probability of future bankruptcy. Finally, firms with high asymmetric information levels are allocated more cash to reduce their dependence on costly external financing. These relations persist even after controlling for the possible endogeneity between leverage and cash ratios. Overall, we find several factors suggested by the tradeoff theory influence firm's optimal cash ratios and our findings lend support to prior studies that examine broader samples of firms.

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Table 1

Predicted Signs for Proxy Variables

The predicted effects of different variables suggested by the transaction costs, financial distress, and agency costs hypothesis on cash ratios.

Variables	Hypothesis	Predicted Sign
Size	Transaction cost	-
Net Working Capital	Transaction cost	-
Cash Flow	Transaction cost	-
Capital Expenditures	Transaction cost	+
Industry Sigma	Financial distress/ Transaction cost	+
Research and Development	Financial distress	+
Leverage	Financial distress	+/-
Market-to-Book	Agency Costs	+
CEO dummy	Agency Costs	+

Table 2

Sample Distribution

Panel A: Frequency distribution by year of a sample of 149 spin-offs (in which 154 subsidiaries are divested) completed between January of 1985 and December of 2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*.

Year	*Spin-offs Completed*
1985	8
1986	9
1987	12
1988	6
1989	10
1990	5
1991	5
1992	7
1993	8
1994	9
1995	9
1996	15
1997	15
1998	6
1999	14
2000	11
Total spin-offs:	149

Panel B: Distribution of the number of subsidiary firms spun-off by each parent firm.

Number of Subsidiaries Spun-off	*Frequency*
1	144
2	5

Table 3

Descriptive Statistics for Pre-spin-off Firms

Descriptive statistics for a sample of 149 listed U.S. firms completing spin-offs in the period 1985-2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. All data in the table is obtained from Compustat and is measured at the fiscal year-end preceding the spin-off completion. Cash ratio is equal to cash plus marketable securities divided by total assets. Market value of assets is calculated as the book value of assets plus the difference between the market value and book value of equity. Market-to-book ratio is the market value of assets divided by the book value of assets. Cash flow is calculated as earnings before depreciation and amortization less interest expenses, taxes, and common and preferred dividends, divided by book assets. Net working capital is measured net of cash and scaled by book assets. Research and development expenditures (R&D) are scaled by sales. Firms with no data available for R&D are assumed to have zero R&D expenditures. Leverage as total long-term debt divided by book assets and Total leverage is total long-term debt plus current liabilities over total assets. Capital expenditures are also scaled by book assets. Dividends are common plus preferred dividends, scaled by book assets.

Variable	*Mean*	*Min.*	*25%*	*Median*	*75%*	*Max.*	*Num Obs.*
Book value of assets	10,415.20	7.99	460.42	1,958.19	5,384.60	276,229.00	149
Market value of assets	14,930.33	19.04	589.93	3,191.14	8,900.10	313,040.19	149
Sales	7,7663.80	3.19	434.55	1,740.25	5,332.54	162,558.00	149
Cash holdings	530.97	0.20	14.78	64.44	159.00	25,173.00	148
Cash ratio	8.02	0.00	1.54	3.55	8.68	68.89	149
Market-to-book ratio	1.77	0.75	1.21	1.48	1.97	6.58	149
Cash-flow	6.44	-18.24	3.92	6.24	9.66	23.32	146
Net Working Capital	5.93	-44.65	-3.03	4.80	14.73	40.58	138
Property, plant, and equipment	34.00	0.00	17.90	28.63	48.31	86.35	148
Research and development	2.51	0.00	0.00	0.66	2.83	38.94	149
Leverage	27.86	0.00	14.81	25.33	38.68	80.94	149
Total Leverage	47.54	10.21	35.49	46.65	57.45	91.28	139
Capital expenditures	7.29	0.00	3.33	5.62	9.57	36.40	147
Dividends	1.66	0.00	0.06	1.29	2.92	5.88	147

Table 4

Cash Ratios of Parents and Subsidiaries in the Post-Spin-off Period

This table presents the mean (median) cash ratios for the parents and subsidiaries in the year of and in the two years following the spin-off. Cash ratio is equal to cash plus marketable securities divided by total assets. The sample consists of 149 spin-offs of 154 subsidiaries completed between 1985 and 2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. Panels A and B contain cash ratios for parents and subsidiaries respectively, as well as the change in cash ratios from years 0 to 1, 1 to 2, and 0 to 2. Year 0 is the year-end immediately subsequent to the completion of the spin-off. Significance at the 10%, 5%, and 1% levels based on the t-test for means and and Wilcoxon sign-rank test for medians are denoted by *, **, and ***, respectively. The numbers in italics beneath the values for the medians denote the number of observations.

Panel A: Cash Ratio of Post-Spin-off Parent Firms

	Year 0	*Year 1*	*Year 2*
Mean	9.13***	9.16***	8.99***
Median	4.47***	4.34***	4.03***
Number of Obs.	149	136	132

Change in the Cash Ratio of Post-Spin-off Parent Firms

	Year 0 – Year 1	*Year 1 – Year 2*	*Year 0 – Year 2*
Mean	0.31	0.36	0.68
Median	0.17	0.12	0.64*
Number of Obs.	136	132	132

Panel B: Cash Ratio of Post-Spin-off Subsidiary Firms

	Year 0	*Year 1*	*Year 2*
Mean	10.61***	11.71***	11.10***
Median	5.17***	4.25***	3.94***
Number of Obs.	154	145	134

Change in the Cash Ratio of Post-Spin-off Subsidiary Firms

	Year 0 – Year 1	*Year 1 – Year 2*	*Year 0 – Year 2*
Mean	- 0.30	- 0.39	- 0.04
Median	- 0.04	- 0.02	0.12
Number of Obs.	145	134	134

Table 5

Comparison of Cash Ratios between the Post-Spin-off Entities

This table presents the mean (median) raw and industry-adjusted cash ratios for the post-spin-off firms as well as the differences in cash ratios between subsidiary and parent firms at the first fiscal year-end following the spin-off completion. Cash ratio is equal to cash plus marketable securities divided by total assets. Industry-adjusted cash ratio is obtained by subtracting the cash ratio of the median firm in the industry, defined as firms in the same three-digit SIC codes. The sample consists of 149 spin-offs (in which 154 subsidiaries are divested) completed between 1985 and 2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. Panel A contains cash ratios for parents and the subsidiaries and the differences in cash ratios between the two groups. The last column contains the p-values of t-tests (means) and Wilcoxon signed rank tests (medians) of the hypotheses that the parent and subsidiary cash ratios are the same. Panel B presents the cash ratios of firms to emerge from the spin-off with higher cash ratios (the high-cash firms) and the firms to emerge with lower cash ratios (the low-cash firms) and the differences between the two groups. Significance at the 10%, 5%, and 1% levels are denoted by *, **, and ***, respectively. The numbers in italics beneath the values for the medians denote the number of observations.

Panel A: Comparison of parents and subsidiaries in the year of the spin-off.

Liquidity Measure	*Parent Firms*	*Subsidiary Firms*	*Difference (Sub-Parent)*	*P-Value of Difference*
Cash to Book Value of Assets	9.13*** (4.47***) *149*	10.61*** (5.17***) *154*	1.65 (0.07) *154*	0.196 (0.412)
Cash to Book Value of Assets minus Industry Median	0.50 (-0.58) *149*	1.43 (-1.17) *154*	1.07 (0.05) *154*	0.417 (0.770)

Panel B: Comparison of high-cash and low-cash firms in the year of the spin-off.

Liquidity Measure	*Low-Cash Firms*	*High-Cash Firms*	*Difference (High-Low)*	*P-Value of Difference*
Cash to Book Value of Assets	5.35*** (2.22***) *154*	14.21*** (8.30***) *154*	8.86 (4.43) *154*	<0.001 (<0.001)
Cash to Book Value of Assets minus Industry Median	4.18*** (-2.45***) *154*	5.96*** (1.67)*** *154*	10.14 (5.38) *154*	<0.001 (<0.001)

Table 6

Firm and Industry Characteristics of the Post-spin-off Entities

The sample consists of 149 spin-offs (in which 154 subsidiaries are divested) completed in the period 1985-2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. Size is the book value of assets in millions of dollars. Industry sigma is the standard deviation of industry cash flow, where industry is defined by the three-digit SIC code. Market-to-book is measured as book value of assets, minus book value of equity, plus market value of equity, divided by book value of assets. Research and development (R&D) is R&D divided by sales. Firms with no data available for R&D are assumed to have zero R&D expenditures. Net working capital is net of cash, and is scaled by book assets. Cash flow is earnings before depreciation and amortization less interest expenses, taxes, and common and preferred dividends, divided by book assets. Leverage is total long-term debt divided by book assets. Dividends are common plus preferred dividends divided by book assets. Industry cash ratio is the industry median cash-to-book value of assets. Size, market-to-book, net working capital, leverage, and industry variables are measured at the first fiscal year-end following the spin-off completion (year 0). Research and development, cash flow, capital expenditures, and dividends are measured in the first full fiscal year after the spin-off (year +1). Columns (2) and (3) present mean and median values for the subsidiaries and parents respectively. Column (4) presents the difference in the variables between the post-spin-off subsidiary and the parent. *P*-values of differences between subsidiary and the parent firms are obtained using t-tests (Wilcoxon signed-rank tests) and are in column (5). The column for sample sizes (column 6) denotes the number of observations for which valid data for both the subsidiary and the parent firm is available for the variable.

(1) *Variable*	*(2)* *Sub. Mean (Median)*	*(3)* *Parent Mean (Median)*	*(4)* *Difference (Sub.-Parent)*	*(5)* *P-value of Difference*	*(6)* *Sample Size*
Size	1,416.36	9,508.48	-7,958.42	0.005	154
	(394.62)	(1,795.60)	(-1,117.75)	(<0.001)	
Ln(Size)	5.82	7.15	-1.36	<0.001	154
	(5.98)	(7.49)	(-1.28)	(<0.001)	
Industry sigma	25.36	13.27	12.26	0.056	154
	(6.32)	(6.52)	(0.03)	(0.149)	
Market-to-book ratio	1.74	1.75	-0.01	0.927	151
	(1.31)	(1.42)	(-0.16)	(0.141)	
Research and development	5.63	3.27	3.10	0.269	129
	(0.00)	(0.57)	(0.00)	(0.973)	
Net working capital	9.72	4.24	6.00	0.003	140
	(8.79)	(4.79)	(3.28)	(0.009)	
Cash-flow	5.23	4.03	0.90	0.610	122
	(8.44)	(6.45)	(1.72)	(0.158)	
Capital expenditures	7.44	6.85	0.24	0.693	131
	(6.43)	(5.06)	(0.22)	(0.396)	
Dividends	0.66	2.65	-1.98	0.041	132
	(0.00)	(1.01)	(-0.69)	(<0.001)	
Leverage	27.76	32.07	-4.14	0.065	152
	(26.43)	(25.54)	(0.05)	(0.162)	
Industry cash	9.19	8.63	0.58	0.489	154
	(5.59)	(4.13)	(0.00)	(0.348)	

Table 7

Correlation Matrix

This table presents a matrix of correlation coefficients for the variables used in the estimation of equation (1). The variables represent the difference between the post-spin-off subsidiary and the parent for 149 spin-offs between 1985 and 2000 identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal* that resulted in 154 subsidiaries. The abbreviated variable names are used in the table to conserve space. Book value of assets (SIZE) is the natural log of book value of assets. Industry sigma (SIGMA) is the standard deviation of industry cash flow, where industry is defined by the three-digit SIC code and Cash Flow (CF) is earnings before depreciation and amortization less interest expenses, taxes, and common and preferred dividends, divided by book assets. Market-to-book (MB) is measured as book value of assets, minus book value of equity, plus market value of equity, divided by book value of assets. Research and development (R&D) is R&D divided by sales. Firms with no data available for R&D are assumed to have zero R&D expenditures. Net working capital (NWC) is net of cash, and is scaled by book assets. CAPX is capital expenditure standardized by book assets and Leverage (LEV) is total long-term debt divided by book assets. Industry cash-to-book (IND) is the industry median cash-to-book value of assets. Book value of assets, market-to-book, net working capital, leverage, and industry cash-to-book are measured at the first fiscal year-end following the spin-off completion (year 0). Research and development, cash flow, and capital expenditures are measured in the first full fiscal year after the spin-off (year +1).

	CASH	Ln(SIZE)	SIGMA	MB	R&D	NWC	CF	CAPX	LEV	IND
CASH	1.000	-0.280	0.098	-0.021	0.036	-0.193	-0.217	-0.029	-0.259	0.274
Ln(SIZE)		1.000	-0.177	0.036	-0.154	0.158	0.136	-0.028	0.040	-0.241
SIGMA			1.000	0.014	0.026	-0.097	-0.075	0.008	-0.018	0.080
MB				1.000	-0.037	-0.182	0.217	0.069	-0.009	-0.107
R&D					1.000	-0.075	-0.426	0.084	-0.118	0.089
NWC						1.000	0.136	-0.167	-0.214	-0.297
CF							1.000	0.072	0.142	-0.175
CAPX								1.000	0.024	0.012
LEV									1.000	-0.067
IND										1.000

Table 8
Relation between Differences in Cash Ratio and Differences in Firm Characteristics of the Post-spin-off Entities

This table presents regression estimates of the relation between the differences in cash ratios between parent and subsidiary firms emerging from corporate spin-offs and the corresponding differences in various firm and industry characteristics. The sample consists of 149 spin-offs (in which 154 subsidiaries are divested) completed in the period 1985-2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. Industry cash is the industry median cash-to-book value of assets, where industry is defined by the three-digit SIC code. Industry sigma is the standard deviation of industry cash flow. Size is the natural log of the book value of assets. Market-to-book is measured as book value of assets, minus book value of equity, plus market value of equity, divided by book value of assets. Research and development (R&D) is R&D divided by capital expenditures plus R&D expenditures. Firms with no data available for R&D are assumed to have zero R&D expenditures. Net working capital is net of cash, and is scaled by book assets. Cash flow is earnings before depreciation and amortization less interest expenses, taxes, and common and preferred dividends, divided by book assets. Leverage is total long-term debt divided by book assets. CEO is a dummy variable that takes a value of 1 for the post-spin-off firm that retains the CEO of the pre-spin-off firm. Capital raised is a dummy variable that takes on the value 1 if net change in equity or net change in debt is greater than 5 percent of book assets and 0 otherwise. Real size, market-to-book, net working capital, leverage, and industry variables are measured at the first fiscal year-end following the spin-off completion (year 0). Research and development, cash flow, capital expenditures, and capital raised are measured in the first full fiscal year after the spin-off (year +1). *P*-values are in parentheses below the estimates and are calculated using White's (1980) heteroscedasticity-consistent standard errors. Coefficients that are significant at the 1%, 5% and 10% levels are denoted by ***, **, and *, respectively.

Panel A:

Independent Variable	*Specification 1*	*Specification 2*	*Specification 3*	*Specification 4*
Intercept	-0.039	-0.047	-0.047	-0.047
	(0.100)*	(0.034)**	(0.033)**	(0.036)**
Industry cash	-0.009	-0.021		-0.021
	(0.914)	(0.732)		(0.750)
Industry sigma	0.427	0.260	0.207	0.255
	(0.342)	(0.518)	(0.582)	(0.540)
Size	-0.033	-0.037	-0.037	-0.037
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
Market-to-book	0.003			
	(0.540)			
Sales growth		0.063	0.064	0.064
		(0.069)*	(0.069)*	(0.077)*
Research and development	0.052	0.050	0.050	0.050
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
Cash flow	0.042	-0.008	-0.007	-0.008
	(0.557)	(0.889)	(0.889)	(0.890)
Net working capital	-0.178	-0.187	-0.185	-0.187
	(0.009)***	(0.004)***	(0.005)***	(0.007)***
Capital expenditures	-0.237	-0.163	-0.161	-0.163
	(0.129)	(0.324)	(0.329)	(0.324)
Leverage	-0.104	-0.101	-0.101	-0.101
	(0.025)**	(0.024)**	(0.023)**	(0.026)**
CEO	0.009	0.006	0.006	0.006
	(0.689)	(0.758)	(0.766)	(0.759)
Capital raised				-0.002
				(0.930)
Number of Obs.	105	103	103	103
Adjusted R^2	0.266	0.364	0.371	0.357

Table 8 (continued)
Relation between Differences in Cash Ratio and Differences in Firm Characteristics of the Post-spin-off Entities

Panel B:

Independent Variable	*Specification 1*	*Specification 2 (2SLS)*	*Specification 3 (FIML)*
Intercept	-0.049	-0.052	-0.042
	(0.023)**	(0.073)*	(0.053)*
Industry cash	0.011	-0.002	1.000
	(0.879)	(0.989)	(0.998)
Industry sigma	0.242	0.040	0.051
	(0.583)	(0.968)	(0.638)
Size	-0.037	-0.037	-0.027
	(<0.001)***	(0.006)***	(0.003)***
Sales growth	0.079	0.077	0.101
	(0.038)**	(0.028)**	(<0.001)***
Research and development	0.050	0.054	0.055
	(<0.001)***	(<0.001)***	(<0.001)***
Cash flow	-0.024	0.021	0.004
	(0.691)	(0.802)	(0.954)
Net working capital	-0.157	-0.174	-0.730
	(0.034)**	(0.093)*	(0.171)
Capital expenditures		-0.161	-0.287
		(0.428)	(0.073)
Leverage		-0.403	-0.119
		(0.410)	(0.002)***
CEO	0.006	0.009	-0.005
	(0.751)	(0.719)	(0.790)
Capital raised	-0.015	-0.021	-0.059
	(0.537)	(0.686)	(0.081)*
Number of Obs.	104	102	104
Adjusted R^2	0.329	0.364	0.400

Table 9
Relation between Cash Ratio and Firm Characteristics for the Pooled Sample of Post-spin-off Entities

This table presents regression estimates of the relation between cash ratios and firm and industry characteristics for the pooled sample of post-spin-offs parent and subsidiary firms. The sample consists of 149 spin-offs (in which 154 subsidiaries are divested) completed in the period 1985-2000. Spin-offs are identified from CRSP, the National Automated Accounting Research System, Lexis-Nexis and the *Wall Street Journal*. Industry cash is the industry median cash-to-book value of assets, where industry is defined by the three-digit SIC code. Industry sigma is the standard deviation of industry cash flow. Size is the natural log of the book value of assets. Market-to-book is measured as book value of assets, minus book value of equity, plus market value of equity, divided by book value of assets. Research and development (R&D) is R&D divided by capital expenditures plus R&D expenditures. Firms with no data available for R&D are assumed to have zero R&D expenditures. Net working capital is net of cash, and is scaled by book assets. Cash flow is earnings before depreciation and amortization less interest expenses, taxes, and common and preferred dividends, divided by book assets. Leverage is total long-term debt divided by book assets. CEO is a dummy variable that takes a value of 1 for the post-spin-off firm that retains the CEO of the pre-spin-off firm. Capital raised is a dummy variable that takes on the value 1 if net change in equity or net change in debt is greater than 5 percent of book assets and 0 otherwise. Real size, market-to-book, net working capital, leverage, and industry variables are measured at the first fiscal year-end following the spin-off completion (year 0). Research and development, cash flow, capital expenditures, and capital raised are measured in the first full fiscal year after the spin-off (year +1). *P*-values are in parentheses below the estimates and are calculated using White's (1980) heteroscedasticity-consistent standard errors. Coefficients that are significant at the 1%, 5% and 10% levels are denoted by ***, **, and *, respectively.

Independent Variable	*Specification 1*	*Specification 2*	*Specification 3*	*Specification 4*
Intercept	0.276	0.274	0.189	0.272
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
Industry cash	0.077		0.093	0.090
	(0.556)		(0.507)	(0.487)
Industry sigma	-0.301	-0.185	-0.151	-0.287
	(0.136)	(0.427)	(0.492)	(0.160)
Size	-0.018	-0.019	-0.019	-0.017
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
Sales growth	0.056	0.057	0.053	0.060
	(0.007)***	(0.006)***	(0.037)**	(0.006)***
Research and development	0.747	0.768	0.838	0.752
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
Cash flow	0.050	0.052	0.060	0.050
	(0.308)	(0.290)	(0.225)	(0.314)
Net working capital	-0.205	-0.209	-0.160	-0.207
	(<0.001)***	(0.008)***	(<0.001)**	(<0.001)**
Capital expenditures	-0.298	-0.309		-0.297
	(0.015)**	(0.011)**		(0.015)**
Leverage	-0.154	-0.155		-0.152
	(<0.001)***	(<0.001)***		(<0.001)***
CEO		0.019	0.017	0.020
		(0.155)	(0.234)	(0.138)
Capital raised				-0.034
				(0.265)
Number of Obs.	245	245	245	245
Adjusted R^2	0.412	0.414	0.350	0.413