What is a Dollar Worth? The Market Value of Cash Holdings

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Abstract

This study investigates the market value of cash held by firms. In general, we estimate the value of a marginal dollar of cash to be about $1.20. However, we find large cross-sectional differences consistent with existing theory. We document that the quality and volatility of the firm's investment opportunity set as well as the magnitude of stockholder-bondholder conflicts impact the value shareholders place on cash holdings. Firms with good growth options have their cash valued at a premium to those with poor growth prospects. Additionally, cash is valued less in firms with stable investment programs and those nearer to financial distress. We do not find that access to the capital markets affects shareholder's valuation of cash holdings. Overall, it appears that the investment opportunity set, rather than the financing opportunity set of the firm affects the value that shareholders place on a firm's cash holdings.

1. Introduction

A curious fact of financial markets is that some firms have cash holdings in excess of their market value. To highlight this point, the Wall Street Journal reported that several firms had negative enterprise values.[1] This phenomena raises the obvious question: What value do investors place on the cash holdings of a firm? In this study, we investigate the value that investors assign to the liquid assets held by a firm and examine what factors determine the market value of cash and marketable securities.[2]

While the liquid assets of firms have been explored in the financial economics literature, most of those studies have dealt with the level of cash holdings of corporations (see for instance, Opler, Pinkowitz, Stulz and Williamson (1999), Harford (1999), Mikkelson and Partch (2002), and Kim, Mauer, and Sherman (1998)). These studies examine why firms hold cash and what impact it has on their investment policies. For the most part, previous studies have tried to determine whether managers waste cash or use it for purposes that increase firm value. The other side of the debate is how investors perceive firms' cash holdings. To date, there has been no study empirically examining the value of cash as measured by shareholders.

Traditionally, cash holdings are thought of as zero net present value (NPV) investments. As such, one dollar of cash should increase the market value of the firm by one dollar. In perfect capital markets, this result would obtain; however, given that capital markets are imperfect, this may not hold. At a minimum, due to taxes and flotation costs, it may be costly to transfer cash into or out of the firm. These transaction costs are ultimately borne by the shareholders and should affect their valuation of cash holdings. More importantly, it has been argued that there are valuation effects of cash holdings because of their impact on investment policy (see for instance Harford (1999)).

Myers and Majluf (1984) argue that financial slack has value because it allows firms to take positive NPV opportunities they might otherwise forego due to the costs of external finance. Thus, a dollar of cash

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[1] "Some Tech Firms Achieve a New Nadir", Wednesday, April 25, 2001, pg. C1. They define enterprise value as the market value of a company plus its debt and preferred stock minus its cash.

[2] We refer to liquid asset holdings, both cash and marketable securities, as cash holdings.

held by a firm may be valued at more than a dollar by its shareholders. On the other hand, Jensen (1986) argues that shareholders may want the firm to distribute its cash because free cash flow will be squandered. Harford (1999) provides support for this by showing that cash rich firms tend to make value decreasing acquisitions. Hence, cash held by a firm may be valued less than dollar for dollar. The implications of Myers and Majluf (1984) and Jensen (1986) are that cash can have both benefits and costs to shareholders. Financial slack creates value up to the point where a firm exhausts its positive NPV projects. After that, costs of cash holdings may exceed the benefits and cash may be valued less than dollar for dollar. The bottom line is that growth options, agency costs, and market frictions might impact the value shareholders place on a firm's liquidity. Accounting for these, it becomes an empirical question as to what value shareholders place on a firm's cash holdings and what factors determine that value.

Using the regression approach of Fama and French (1998) (hereafter, FF), we show that, on average, shareholders value a marginal dollar of cash at a significant premium to face value. Our estimates range from $1.19 to $1.25 with standard errors of roughly $0.10 and seem to support the assertion in Myers and Majluf (1984) that liquidity can be valuable. Additionally, splitting the sample by firm characteristics, we find large cross-sectional differences in the value of cash. Our cross-sectional tests result in estimates of the marginal value of cash which range from $0.26 to $2.38. The main determinants of the value of liquidity are the growth options of the firm, the volatility of its investment opportunities, and the magnitude of stockholder-bondholder conflicts. Specifically, we find that firms with poor growth options, those with more predictable investment opportunities, and those nearer to financial distress have their cash valued at a significant discount to book value. We find that, controlling for growth options, access to the capital markets does not seem to impact the value placed on a firm's cash holdings. Overall, it appears that the investment opportunity set, rather than the financing opportunity set of the firm affects the value that shareholders place on a firm's cash holdings.

The evidence in this paper seems to support the contentions of both Myers and Majluf (1984) and

Jensen (1986). Consistent with Myers and Majluf, we find that shareholders place a premium on liquidity for firms with high growth options. This suggests that for some firms, increasing cash holdings can be a positive NPV project. On the other hand, consistent with Jensen's (1986) assertion that firms may waste free cash flow, we find that for certain firms, shareholders value cash significantly less than dollar for dollar. Finally, we find support for the argument that stockholder-bondholder conflicts can also affect the value of cash holdings, because firms with higher probabilities of financial distress have their cash valued at significantly less than financially healthy firms.[3]

The results in this study contribute to the literature on firms' cash holdings by shedding light on investors' perceptions of the importance of firms' cash balances. It discusses the determinants of investors' valuations of a dollar held by the firm, and documents that the market values liquidity differently depending on firm characteristics. Thus, this paper empirically examines aspects of cash holdings previously unaddressed in the literature. Overall, our results indicate that growth options and agency costs do, in fact, impact the value that shareholders place on liquidity and the impact can be quite large.

The rest of the paper is organized as follows. Section 2 motivates our analysis along with reviewing the previous literature on liquid asset holdings. Section 3 presents a theoretical discussion of the market value of cash holdings and offers empirical predictions. Section 4 describes the data and the methodology used in the study. Section 5 presents the general results and Section 6 concludes.

2. Cash Holdings and Firm Valuation

If capital markets are perfect, then cash held by the firm would be valued dollar for dollar by investors. Therefore, whether the firm pays out cash as dividends or holds on to it is irrelevant. If the firm pays out the dollar to investors, it could always raise cash when needed for positive NPV projects. However,

[3] These results support Jensen and Meckling (1976), which shows that agency costs of debt can lead to lower firm values.

if capital markets are imperfect or there are agency costs between managers and stockholders, or conflicts between stock and bondholders, then a dollar held by the firm may not be valued at a dollar by investors.

2.1. Costs and benefits to cash holdings

If capital markets are imperfect, then holding cash may not simply be a zero NPV investment. Opler et al. (1999) discuss various motives for firms' cash holdings and describe the transaction and precautionary motives. The transaction motive for holding cash is based on Miller and Orr (1966) who argue that firms hold cash simply for daily transactions. Mulligan (1997) argues in favor of a transaction motive in which firms' cash holdings are based on its activity, technological sophistication, and opportunity costs. Both papers argue that there are economies of scale in cash holdings.

Another reason firms may hold cash is the precautionary motive. In this case, firms hold cash in order to continue to invest in positive NPV projects during periods when external finance is costly. This situation is of particular importance to firms that have positive NPV investment opportunities but are unable to generate enough internal cash to take advantage of them. This would imply a positive NPV to cash holdings by firms that have a reasonable probability of being rationed out of the credit markets during times of tight credit. Opler et al. (1999) find support for the precautionary motive for cash holdings. In this paper, we do not address the transactions motive for cash holdings because in those models, the focus is the level of cash on hand, rather than marketable securities. Because we examine cash and marketable securities together, we cannot and do not make inferences regarding the transactions motive. Rather, the focus of this paper is the precautionary motive to hold cash so that investment can continue during times when external finance is difficult to obtain

The main argument for firms maintaining financial flexibility is discussed in Myers and Majluf (1984) who contend that asymmetric information between investors and management makes external financing costly. Their study implies a positive value to financial slack for firms with good growth options.

Without slack, firms may pass up positive NPV projects, leading to underinvestment. This could be particularly prominent in firms that have uncertainty in the arrival of investment opportunities, where the capital markets may be too slow in providing capital, causing firms to forego the investment. Therefore, there are some cases in which a firm may desire to hold large cash balances that would be consistent with maximizing shareholder value. If cash enables firms to undertake projects which increase value, then one dollar of cash held by the firm could have a value greater than one dollar to investors. Mikkelson and Partch (2002) provide some evidence that cash holdings may be valuable to shareholders by looking at operating performance. They show that the five-year performance of cash rich firms are not significantly different from firms which are not cash rich.

Jensen (1986) argues that excess cash held by firms may lead managers to waste it on negative NPV projects. Thus, he asserts that it is better for management to pay out the cash in the form of dividends and use debt to finance future investments. Easterbrook (1984) claims that frequently going to the capital markets disciplines management and controls their wasteful behavior. Both studies argue that the capital markets can be used to control managerial opportunism. Harford (1999) provides support for Jensen's argument by showing that cash rich firms tend to make value decreasing acquisitions. Harford also documents a negative investor reaction to cash stockpiling. Furthermore, Blanchard, Lopez-de-Salinas, and Shleifer (1994) find that firms receiving cash windfalls spend that cash inefficiently.

Finally, Jensen and Meckling (1976) discuss the conflicts which may arise between stockholders and bondholders when risky debt is introduced into the firm. Since equity is a call option on the value of the firm, shareholders prefer a riskier investment program. Cash holdings are risk-free and as such, shareholders may value liquidity at a discount. This is likely to be particularly prominent in firms where the risk of financial distress is high since the benefits of the cash may accrue mainly to bondholders.

In recent years, we have seen instances, such as Kirk Kerkorian's battle with Chrysler, where shareholders have gone to great lengths to force management to pay out what is perceived to be excess cash.

If shareholders are concerned that management may spend cash inefficiently or that bondholders may obtain the benefits of the liquidity, the market might value the firm's cash at less than dollar for dollar.

The previous literature argues both sides of the debate on the need for cash. The evidence and theory indicates that firms should hold cash, but too much could be costly to shareholders. The question is what value do investors place on cash holdings and how do they determine that value? We explore these issues in the following sections.

2.2 Predictions of the market value of cash holdings

Given the prior literature and discussion, it seems reasonable to expect cross-sectional differences in the market value of cash holdings. We hypothesize that the value shareholders place on the liquid assets of a firm will be a function of certain firm characteristics. Specifically, the value of cash should be related to: the growth opportunities of the firm, the extent to which investment opportunities are predictable, the magnitude of stockholder-bondholder conflicts, and the extent to which the firm can access the capital markets.[4] The remainder of this section explains each of the hypotheses and what we predict the results should be. The hypotheses and predictions are summarized in Table 1.

H1: Firms with greater growth opportunities should have higher values placed on their cash.

The reason that liquidity has value in Myers and Majluf (1984) is because the firm would be forced to forego a positive NPV project. Similarly, Jensen's (1986) free cash flow argument relies on the fact that firms may have few good investment opportunities. Thus, the primary theoretical determinant of the value of cash holdings should be the investment opportunity set of the firm. We expect that shareholders of firms with a better investment set should place a greater value on the firm's liquid assets. Empirically, we assume

[4] Taxes may also play a role in determining the value of cash holdings depending on the relation between the marginal tax rates of the marginal shareholder and the corporation. Examination of estimated marginal tax rates finds little impact on the value of cash. The results are available from the authors by request.

that firms with higher levels of sales growth would be firms with positive NPV projects.[5] An argument can also be made that dividends can signal fewer growth options of the firm because if the firm had a large amount of unfunded opportunities, shareholders would prefer the firm to reinvest the earnings rather than pay them out. Lastly, firms which spend more on research and development (R&D) or capital expenditures may indicate that they have better growth opportunities than other firms.

H2: Firms with greater predictability in their investment program should have lower values placed on their cash.

The idea that firms can use cash to take advantage of positive NPV investments is consistent with a real option value to cash holdings. Standard option pricing theory shows that option values increase with the volatility of the underlying asset. We test whether shareholders place an option value on liquidity by examining the volatility of the firms' capital expenditures. For firms which have relatively predictable investment outlays, it is easier to be ready with the capital to undertake the investment. With stable capital expenditures, firms can either budget internal cash for the project, or they could enter the capital markets and know how much money they will need to raise. On the other hand, firms with high volatility in their investment opportunities may need to hold cash to take advantage of investments when they arise. Since firms with volatile investment opportunities may be forced to forego positive NPV projects if they delay, they cannot wait until investment opportunities arise to go to the capital markets. If the firm attempts to access the markets in anticipation of an investment opportunity, then this financing could be very costly due to information asymmetries. Thus, shareholders may value the cash of these firms at a premium since they expect that it would be used to increase firm value. Empirically, we measure volatility of investment

[5] Market to book ratio is commonly used as a measure of growth options; however, we cannot use this measure because our regression approach uses market to book as the dependent variable. Thus, we need to find other empirical proxies for growth options.

opportunities using the standard deviation of a firm's capital expenditures over our entire sample period.[6]

H3: Firms with greater stockholder-bondholder conflicts should have lower values placed on their cash.

When the risk of financial distress is present, conflicts can arise between stockholders and bondholders. Jensen and Meckling (1976) were among the first to elaborate on the potential agency costs of risky debt, namely the chance for asset substitution. Because equity is a call option on the firm, shareholders should prefer a riskier investment program than bondholders. Clearly there is no investment less risky than holding cash. It is likely the case for firms close to financial distress that the benefit of cash holdings will accrue to the bondholders and not the stockholders. As such, we would expect to see shareholders place a lower value on the cash holdings in these firms. As proxies for likelihood of financial distress, we use Altman's (1968) Z-score, interest coverage ratio, and firm leverage. Additionally, firms close to financial distress are unlikely to make long-term investments in research and development. Thus, we also use the level of R&D expenditures as a proxy for financial distress.

H4: Holding growth options constant, firms with greater access to the capital markets should have lower values placed on their cash.

If firms were able to easily obtain external funds, then holding cash would not be terribly important. However, for firms with good investment projects and limited or costly access to the capital markets, they might have to pass up positive NPV investments.[7] Therefore, shareholders would prefer these firms to hold cash and we would expect to see greater value placed on their cash holdings. Empirically, firms that may

[6] Here we are using look ahead information, but we do so in order to more correctly classify firms by the volatility of their investment programs. We are not attempting to create or examine any implementable strategy of identifying these types of firms ahead of time so this should not materially affect our results.

[7] Costs of accessing the financial markets can be either explicit or implicit. Explicit costs include flotation costs and tax consequences. Implicit costs include asymmetric information, underpricing, and time .

have a high cost of external finance are likely to be small firms or those which do not pay dividends. These firms are thought to have limited access to the capital markets, thus it would be relatively costly for them to depend on external financing. Additionally, we might expect that firms with low interest coverage ratios or high amounts of leverage are likely to have less access to the capital markets.

One important caveat remains about our tests. The four hypotheses are not mutually exclusive and neither are the empirical proxies we use to test them. Notice that some of the empirical measures can be used to test more than one hypothesis. In some cases, the predicted direction is different. For instance, leverage is indicated as negatively related to value of cash in H3, but positively related to the value of cash in H4. In such a case, it will be easier to distinguish among the different hypotheses than the predictions on dividends, for instance. Notice that lower value of cash holdings for firms which pay dividends could be supportive of either H1 or H4 depending on one's belief of whether dividends represent poor growth options, or greater capital market access.

3. Data and Methodology

Data for this study come from the 2000 COMPUSTAT tapes (numbers in parentheses are COMPUSTAT data item numbers). Our analyses begin with all firm years from 1955 to 1999. Financial firms are deleted from the sample because of the unique role that cash plays for these types of firms. Utilities are also deleted because they are regulated and should have a small differential between the cost of internal and external funds.

Market value of the firm is calculated at fiscal year end as market value of equity + book value of debt (54 * 199 + 34 + 9). Following FF (1998), earnings are defined as earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits (18 + 15 + 50 + 51). We define cash as cash plus marketable securities (1), while dividends are measured as common dividends paid (21). We also obtain data

on total assets (6), net assets, which is defined as total assets less cash (6 - 1), EBIT (13), capital expenditures (128), taxes (16), and research and development expenses (46). When R&D is missing, we set it equal to zero.

In evaluating the value of a dollar of cash held by a firm, it is important to control for other variables that may account for a firm's market value. To address the variables that may impact market value and thus isolate the impact of cash holdings on value, we employ the methodology of FF (1998). Since we are concerned with the market value of cash holdings, we examine regressions with market value of the firm as the dependent variable. However, as discussed in FF (1998), using market value can lead to problems with heteroscedasticity, so we deflate all variables by book value of assets. In this paper, we refer to X_t as the level of variable X in year t divided by the level of assets in year t. We use dX_t to indicate the change in the level of X from year t-2 to year t, divided by the book value of assets in year t $((X_{t-2} - X_t)/Assets_t)$. Similarly, dX_{t+2} indicates the change in the level of X from year t to year t+2, divided by the book value of assets in year t $((X_{t+2} - X_t)/Assets_t)$.

The main variables, described above, are abbreviated in the rest of the paper as: market value of the firm (M); earnings (E); assets (A); net assets (NA); research and development expense (RD); interest expense (I); dividends (D); and cash and marketable securities (C). Following Shin and Stulz (2000) and FF (1998), we trim our observations at the 1% tails measured using the full sample. Because we require 2-year changes in some of the variables, our usable sample ends in 1997. Additionally, after data requirements, we have fewer than 500 firms in each year prior to 1962 and thus the sample we use in our regression analyses starts in 1962. Lastly, we eliminate any firm year where the firm changed its fiscal year end sometime during the two years before or after the observation year. Our final sample is 9,701 firms representing 84,534 firm years from 1962 to 1997.

4. Summary Statistics

The summary statistics for our sample of firms are shown in Table 2. We see that the ratio of market value to book value for the average firm is close to one. The mean for M_t is 1.2 while the median is 0.93. We also notice that the average firm earns about six cents for each dollar in assets. This is similar to the seven cents that FF (1998) find. In fact, the majority of our means are very similar to those in their paper (see Panel B of their Table II, page 833). This is to be expected since we use their definitions with a larger sample of firm years. The similarities suggest that we have successfully implemented their methodology.

We also find that firms hold roughly ten percent of their assets in the form of cash and marketable securities. The median firm has 5.8% of its assets in cash.[8] Additionally, we show that the median change in cash holdings (dC_t and dC_{t+2}) is nearly zero, indicating that firms' cash holdings tend to be persistent, a result consistent with the findings of Opler et al. (1999).

Table 2 shows that firms' profitability has been increasing over time as the changes in earnings are slightly positive both at the mean and median. Additionally, the net assets of the mean firm grow quite a bit over time. The standard deviation of net assets is also quite large, which may be surprising since one may expect that firms' asset bases would have been more stable. As with earnings, firms' research and development expenditures and interest expenses increase through time. Perhaps not surprisingly, dividends change relatively little through time. Finally, the future change in mean market value (dM_{t+2}) is roughly 50% greater than the change in net assets, but the standard deviation is three times as large. This is to be expected since market values tend to be more volatile than book values.

Before we do a regression analysis of firms, as with any study of firm data, we are concerned about multicollinearity. Table 3 shows the correlation matrix for the variables of interest in determining the market value of a dollar held by the firm. Because FF (1998) use all their variables simultaneously in their regressions, we do not focus on the correlations among them. Instead, our concern is whether the cash

[8] While the median is similar to the 6.1% found for U.S. firms by Pinkowitz and Williamson (2001), the mean is lower than their 18%, but that is to be expected since they measure cash to net assets. Since net assets is assets minus cash, their denominator is smaller.

variables we have added are highly correlated with the other independent variables. We see from the last three rows that only five of the 51 correlations are greater than 0.30 (in absolute value), and none are greater than 0.47. Due to the few large correlations, we believe that our cash variables will allow us to accurately measure the market value of cash holdings.

4.1. The Market Value of a Dollar

The main emphasis of this paper is the market value of a dollar held by a firm. To directly test for this we use the regression model shown below:

$$\begin{aligned} M_{i,t} = {} & \alpha + \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+2} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+2} + \\ & \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} + \beta_8 dRD_{i,t+2} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+2} + \\ & \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+2} + \beta_{15} dM_{i,t+2} + \beta_{16} C_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

In equation (1), we include only the current level of cash holdings. We also examine specifications which include the past and future two year changes in cash holdings ($dC_{i,t}$ and $dC_{i,t+2}$) as well. The regression specifications are nearly identical to those in FF (see their equations (1) and (3) on pages 822 and 824), except that we use net assets and augment their model with cash holdings. In all our regressions, the dependent variable is M_t, the market to book ratio. In the regression framework, β_{16}, the coefficient on cash holdings should serve as a measure of the market to book value of the marginal dollar. Because cash and marketable securities are carried on the books dollar for dollar, the coefficient should represent the market value of an additional dollar of cash.

While this regression methodology allows us to estimate the market value of cash holdings, there are several potential problems that should be discussed. FF (1998) provide a thorough explanation of the econometric issues associated with their basic regressions and indicate that some of the problems can be mitigated by estimating the models using the method of Fama and MacBeth (1973). Thus, all of our regressions use this methodology (hereafter FM), which involves running yearly cross-sectional regressions

and using the series of coefficients to make our inferences. The coefficients reported in our tables are the mean of the cross-sectional regression coefficients, while the standard errors are also derived from the time series of regression coefficients. This method should lessen the impact of any survivor bias and/or serial correlation. Additionally, all variables are deflated by total assets to address the likely heteroscedasticity. However, there are additional issues unique to our specifications which must be also addressed.

Foremost is that we do not take a position on whether firms have an optimal level of cash holdings. It may be the case that there is no optimal amount and firms simply accumulate cash when their internal cash flows exceed investments and draw down their cash holdings when the reverse is true. Thus, cash holdings are mechanically determined by the flow of funds deficit and shareholders should not prefer one level of cash to another. On the other hand, firms may specifically target the level of their cash holdings and attempt to increase or decrease their cash balances when they stray from the target. Opler, et al (1999) find support for the idea that firms have target levels of cash, but at the same time, their results indicate that the flow of funds deficit also explains some of the changes in cash holdings.

If there is no optimal level of cash holdings, then our results should accurately reflect the market value of cash. Each dollar a firm obtains should have the same value to shareholders and the marginal value of a dollar would be independent of the level of the cash holdings. However, if there is an optimal amount of cash holdings, then our estimates of the market value of cash are conditional on where the firm is relative to its optimum. For firms below their target holdings, we would expect shareholders to value the marginal dollar higher than they would for firms above their target.

Because of the optimality issue, we examine two different specifications in an attempt to address this concern. Our first specification, shown in equation (1), uses only the contemporaneous level of cash holdings. The second includes not only the current level, but also the prior and future two year changes in cash holdings. If a firm is either at its target or there is no target, then the past and future changes are less important to the current value placed on cash holdings and the first specification should provide us with a

reasonable estimate of the market value of cash. However, if a target exists and the firm is not currently there, then the changes in cash holdings are likely important because it controls for movements toward/away from that optimum. In this case, the second specification which controls for changes in cash should be more valuable.

Ultimately though, we must concede that our regressions make no attempt to explicitly specify where a firm is relative to an optimal level of cash holdings. Thus, the coefficients on cash have to be interpreted narrowly. For our point estimates to be valid, one of three assumptions must be made. Either there is no optimal level of cash holdings for a firm, or there is an optimal level, but, on average, all firms are at their target for each year in our sample, or firms are away from their targets, but the coefficients on changes in cash will control for this. In Tables 4-6, we assume one of the above is true, but are agnostic as to which one.

In addition to the optimality concern, there is one further specification issue that should be addressed. In order to separate the cash component from the rest of the firm, we examine the change in net assets rather than total assets so as not to capture cash in both variables. The other place where separating out the cash may cause difficulties are the earnings variables. Certainly in the case where we include the past and future changes in cash holdings, there is a potential problem because earnings are essentially just a combination of cash earnings and accruals. To confirm that this issue does not materially affect the estimates, we run all regressions substituting the earnings variables with measures of level and changes in accruals. This allows us to focus solely on the cash component. These unreported results are similar and suggest that isolating the cash component does not cause specification problems.[9]

The first column in Table 4 uses the FM method of running cross-sectional regressions each year and using the time series of coefficients to generate inferences. The numbers in parentheses are the time-series standard errors and the adjusted R^2 is simply the average of the adjusted R^2s from the 36 cross-sectional

[9] The results tend to show that the coefficient on cash holdings is higher than that reported when the earnings variables are included. This is to be expected because in such a specification the cash variable also contains earnings information that is not captured by the accruals. The results are available upon request.

regressions. While our dependent variable is specified slightly differently, many of our coefficients are of similar magnitude as those in FF (1998). The major exception is the coefficient on interest expense which is negative in their paper while significantly positive in ours. The interpretation of the coefficient on I_t is that for every dollar a firm has in interest expense, its market value increases by roughly three and a half dollars. Interestingly enough, the positive coefficient is precisely what FF expected to find in their study. It is possible that their omission of cash holdings obscured this result in their analysis.[10] One reason is that if cash impacts a firm's market value then including cash could lead to a cleaner interpretation of the impact of debt. It may also indicate that, as Opler, et al (1999) discuss, cash holdings can be thought of as negative debt. This idea is given additional support from Table 3, which shows that cash and interest expense are negatively correlated, hence, they could act as substitutes.

Nonetheless, the important coefficient for this study is the 1.25 on cash holdings (C_t). It appears that the market values one dollar of cash at $1.25 with a standard error of about $0.093. When we include the changes in cash holdings in the second specification, we find a coefficient of $1.19 with a similar standard error. The two regressions indicate that, on average, the market values cash at a significant premium to its book value.[11] The results for the full sample seem to suggest that, on average, the benefits of financial slack outweigh the potential agency problems associated with it.

5. Market value of a dollar across firms

Table 4 includes all firms simultaneously, while the predictions discussed earlier and in the prior literature suggest that there may be cross-sectional differences in the market value of a dollar. Thus, it is

[10] This does not imply that the regressions in FF (1998) are misspecified. While the specifications are similar, the goals of their regressions are different than ours.

[11] The reported results use contemporaneous measures of market values and accounting values. For robustness, we also examine regressions where market values are obtained either 3 or 6 months after the end of the fiscal year. This allows for the possibility that investors may be unaware of the accounting figures until after the annual report is released. The results, available upon request, indicate coefficients of roughly $1.30 with similar standard errors as those reported.

possible our inferences are muddled by including the full sample of firms. We attempt to examine our prior hypotheses about cross-sectional variation in the value placed on cash by segmenting our sample by firm characteristics. In order to do this, we use a series of interactive dummy variables in our regressions. We again use the FM regression method. Each year, the cross-sectional regression takes the form of:

$$y_i = \alpha + \sum_{j=1}^{J} \gamma_j (\delta_j * c_i) + \sum_{k=1}^{K} \beta_k x_{k,i} + \varepsilon_{i,} \quad (2)$$

where the $X_{k,i}$ variables are the variables from the regressions in Table 4, with the exception of cash. The cash variable is interacted with dummy variables indicated by the $*_j$s. The dummy variables serve to segment firms by a particular characteristic. In most cases, we segment firms into quintiles and J=5, while for dividends, and R&D expenses, we segment the firms into only two classes and thus J=2.[12]

To determine the dummy variables, we rank the firms each year by the characteristic of interest and sort them into quintiles (or halves). We then create a dummy variable to represent membership in one of the quintiles (halves). Thus, $*_1$ would equal one for firms in the lowest quintile, and zero for all other firms. As a specific example, when we examine H1, that growth options should affect the value of cash holdings, one of the firm characteristics which we examine is sales growth. In this case, $*_1$ would equal one for the lowest sales growth firms and $*_5$ would equal one for the highest sales growth firms. The estimated coefficients $(_1$ and $(_5$ would represent the market value of cash for firms with low and high sales growth, respectively. An advantage of this specification is that we allow firms to switch quintiles from year to year.

However, in examining whether there are cross-sectional differences in the value of cash, there are new econometric issues to deal with. Foremost among them is whether to include individual intercepts for each characteristic group or to use a common intercept. The regression in equation (2) uses a single intercept for each of the different groups. The constraint is imposed for two reasons. First, our study is interested in

[12] We also examine regressions which include continuous interaction variables rather than splitting the sample into quintiles or halves and find similar inferences.

whether there are different values assigned to cash holdings based on cross-sectional variation. Thus, the coefficient of interest to us is the slope and not the intercept. Second, we have no theory to suggest that there should be different intercepts in the specification.

Equation (2) is basically a constrained regression where we not only restrict the estimation to a single intercept, but where we require that the coefficients on all the control variables are the same across all types of firms. A benefit to this methodology is that we obtain greater efficiency in our estimates; however, it is possible that the constraints are unnecessarily restrictive and should not be imposed. With no theory to guide us, we attempt to determine the robustness of our results by using two other specifications.

First, we also report results where individual intercepts are specified (the $*_j$s are included on their own as well as in interaction form). This still restricts the coefficients on the control variables to be equal across groups, but allows for the possibility of separate main effects associated with the firm characteristics. This type of specification will be of greater importance when we test our hypothesis regarding growth options. Our dependent variable is essentially market to book, which is itself a proxy of growth options. The allowance for separate intercepts for each group will control for the fact that higher sales growth firms are likely to have higher market to book ratios.

Second, we examine separate regressions for each of the groups. Thus, we re-estimate the regressions of Table 4 using only the firms which fit a particular characteristic (i.e. high sales growth firms, or firms which pay dividends). This gives us not only individual intercepts, but allows the coefficients on the control variables to vary across firm characteristics. While this estimation is the least restrictive of all our techniques, the downside is that we run the estimation on only a subset of the data, and thus are discarding information and sacrificing efficiency.

We report the results of these estimation methods in Table 5. The row marked interaction intercepts indicates whether separate intercepts are included for each group or whether the regression is run using only the subset of firms fitting the characteristic (the column with the heading “subsample”). In all cases, the

control variables are the same as those in Table 4. The regression is run both including and excluding the lead and lag changes in cash. Because we are only interested in the market value of a dollar held by the firm and for ease of presentation, we only report the interaction coefficients for the smallest and largest quintile.[13] These correspond to γ_1 and γ_5 in equation (2). The characteristics we use to segment our firms are those mentioned in Table 1: sales growth, dividends, R&D expenditures, capital expenditures, investment volatility, Altman's Z-score, interest coverage ratio, and leverage.

5.1 Growth opportunities and market value of cash holdings

Our primary hypothesis is that firms with greater growth opportunities should have higher valuations on their cash holdings. The most widely used empirical measure of growth options is Tobin's Q or the market to book ratio. However, since this is essentially our dependent variable, segmenting firms by this measure could lead to spurious results. Thus, in Table 5, we examine growth opportunities by examining the sales growth of firms, dividends, R&D expenditures, and capital expenditures. Sales growth is defined as the one year growth rate in sales. Rather than segment firms on the level of R&D expenditures, we simply divide the sample into those firms which report nonzero R&D expenses and those which report zero expenses for the year. Capital expenditures are divided by firm assets in order to normalize the levels for ranking purposes.

We find that in all six of our specifications, firms with higher sales growth have significantly larger coefficients on cash holdings. Additionally, in all the regressions, high sales growth firms have their cash valued at a premium to face value while the low sales growth firms have cash valued at a discount. These regressions seem to provide support to both Myers and Majluf (1984) and Jensen (1986) which argue that the valuation of liquidity would be most affected by the growth opportunities of the firm. Our results suggest that for firms with good growth options, holding cash can be a positive NPV investment, while for firms with few growth options, the market values cash at less than dollar for dollar. It is reasonable to assume that the

[13] The full regression results of each of the sub-samples are available from the authors.

discount accounts for the probability that management may waste the cash on poor investments as suggested by Jensen.[14]

The second set of regressions segments firms by whether or not they pay dividends. In these regressions, it is always the case that firms which do not pay dividends have significantly higher coefficients on cash than firms which do pay dividends. Even more than that, in all but one of the regressions, the coefficient for dividend paying firms is significantly less than $1.00 while for firms which do not pay dividends, the coefficients are reliably greater than $1.00 in two of the specifications. The results clearly show that the value of cash holdings is negatively related to paying dividends. If dividend paying firms have fewer growth options than non-payers, these results strongly support the prior sales growth evidence.

We also find that firms which report R&D expenses have higher valued cash holdings than those which do not in all six specifications. Additionally, the marginal value of liquidity is always greater than $1.00 for firms which report research and development expenses. Lastly, we find that firms with high capital expenditures have their cash holdings valued significantly more than firms with low capital expenditures in each specification. Furthermore, like the prior evidence, the value of the marginal dollar of cash is significantly greater (less) than one dollar for the high (low) capital expenditure firms. While level of capital expenditures does not directly control for the quality of the investment opportunities, it seems to be the case that empirically, the more capital expenditures a firm makes, the greater its investment opportunity set is perceived.

The hypothesis that firms with greater growth options will have larger values placed on their liquidity seems to be firmly supported. The results of the sales growth, dividend, R&D, and capital expenditure regressions all suggest that cash can be a positive NPV investment for firms with many growth opportunities.

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[14] A potential concern is that our sales growth results are hard-wired because our dependent variable is market to book which is essentially growth options. By ranking firms individually, we may simply be sorting firms into "winners" and "losers". To address this concern, we also examine regressions where we sort firms by industry characteristics. Firms are sorted each year based on the median sales growth for their 2 digit SIC code. While this procedure introduces more noise into the estimates, the results are qualitatively similar and suggest that the sales growth results are not spurious.

Overall, the empirical evidence seems to strongly support the theoretical prediction of Myers and Majluf (1984) that financial slack has value when firms have good growth options.

5.2 Investment uncertainty and market value of cash holdings

The next set of regressions examines the volatility of the investment opportunities of each firm by segmenting companies based on the standard deviation of their capital expenditures. H2 postulates that firms with higher predictability in their investment program should have lower valuations associated with their cash holdings. All six regressions indicate that low volatility firms have their cash valued at a discount to high volatility firms.

While the differences are always significant, in four of the regressions, the coefficient for the high volatility firms is not reliably greater than face value. There are at least two reasons to believe that the coefficients we report for the high volatility firms are actually conservative with respect to the option value of cash. First, we only report the lowest and highest quintile of volatility and it is possible that the relationship is not monotonic. Shareholders might be wary of firms which have very high volatilities in their capital expenditure programs either because it casts doubt on management or because it suggests that the firm is betting on a risky project. As such, it might be the case that volatility is valued up to a certain point. This seems to be the case since the coefficients with interaction intercepts are 0.86, 1.17, 1.32, 1.29, and 1.21 for the respective quintiles (with standard errors of 0.08 to 0.16). We see a similar pattern when the lead and lag changes in cash are included. Thus, this seems to suggest that the magnitude of the high volatility coefficient is less than one might expect because shareholders seem to be wary of firms with very volatile investment programs. It appears that the greatest value is for firms around the median with neither extremely high nor low investment volatility.[15]

[15] While the relation between option value and volatility is theoretically unambiguous and monotonic, our empirical measure of volatility is only a proxy for the underlying variability of the investment program. Additionally, it is likely that our empirical metric is not only a proxy for volatility, but could also be measuring other things such as asymmetric information.

Second, how frequently the investment opportunities arise is theoretically less important than how long the window for accepting the project remains open. It is likely that our measure of volatility is not a great proxy for measuring whether investment opportunities are able to be delayed. While our results are supportive of the idea that higher volatility in the investment program makes liquidity more valuable, we believe that we may be understating the magnitude of the effect. Overall, the results support the notion of a real options value inherent in cash holdings.

5.3 Financial distress and market value of cash holdings

Our third hypothesis is that firms with greater likelihood of financial distress should have lower valuations of their liquid assets because of agency costs between stockholders and bondholders. We have already seen the results using R&D expenses. In the remainder of Table 5, we augment these with regressions segmenting firms by Altman's Z-score, TIE ratio, and leverage. Firms with Z-scores of 3 or greater would be predicted to not enter bankruptcy while firms with a score of 1.80 or lower are likely to enter bankruptcy (Altman (1968)). We are concerned only with firms who have the possibility of financial distress and not necessarily those which are likely to enter bankruptcy. Thus, we use a breakpoint of 3.0 to separate the firms.[16] We have only a handful of firms in 1962 with Z-scores below three, so we drop that year from the sample and examine the cross-sectional regressions from 1963 forward. In all six regressions, firms with Z-scores above three have cash values greater than those closer to financial distress. Further, for firms with scores below three, the coefficients are quite small, on the order of 0.30. Since cash holdings are unlikely to benefit shareholders of firms which are likely to experience financial distress, this result is not surprising. More importantly, these results explain how some high tech firms can trade at a market value below their cash holdings. If the firms are likely to enter financial distress, then the shareholders place a large discount on the cash holdings of the firm and as such, the market capitalization of the firm can be below the book value of

[16] We find similar results if we break the firms at 1.8 or if we segment the firms into quintiles each year.

the cash holdings.

There is an additional factor to consider with the Z-score regressions. It may be the case that we have underestimated the full impact of financial distress because of a potential survivor bias. While the FM methodology allows firms to enter and leave the panel, because of the lag and lead differences in the regressions, we require a firm to have 5 years of consecutive data in order to enter the regression. For firms which are most likely to become financially distressed, this requirement may cause them to drop out of the sample. Hence, the lowest Z-score firms potentially under represent the riskiest firms.

The results of the Z-score regressions support the hypothesis that cash is less valuable when firms have a greater likelihood of financial distress. Additionally, the results from the R&D expenditures and TIE ratio regressions further support this idea since cash is more valuable for firms which made R&D investments and had high coverage ratios. However, the leverage regressions suggest no difference in the value of liquidity between firms with little debt and those that are highly levered. Despite this, overall, the results appear consistent with the arguments of Jensen and Meckling (1976). For three of the four empirical proxies, it appears that stockholder-bondholder conflicts can greatly affect the value that shareholders place on the liquidity of the firm.

5.4 Capital market access and market value of cash holdings

We have seen that the value shareholders place on cash holdings varies based on the quality and volatility of the investment opportunity set as well as agency costs between stockholders and bondholders. All of these factors measure different aspects of how firms may spend cash once they have it inside the firm. The remaining aspect of cash holdings which is important is the cost with which firms can bring liquidity into the firm. If firms could obtain external funds cheaply and easily, then the existing cash holdings of the firm should be less important. On the other hand, if market frictions impair certain firms from raising capital, then we should see different valuations on the cash holdings of firms. Our fourth hypothesis is that firms with

greater access to the capital markets should have lower values placed on their cash holdings. However, since growth options are a major determinant of the value of liquidity, we need to simultaneously control for the investment opportunity set of the firms.

In order to examine whether capital market access affects the value of cash, we control for growth options in two different ways. First we use regressions which include multiple interactions as shown in equation (3).

$$M_i = \sum_{h=1}^{H} \sum_{j=1}^{J} \alpha_{h,j} \delta_{h,j} + \gamma_{h,j} (\delta_{h,j} * c_i) + \sum_{k=1}^{K} \beta_k x_{k,i} + \varepsilon_i \qquad (3)$$

The interaction dummy variables are constructed on two dimensions rather than a single one. For instance, in examining whether firm size impacts the value of liquidity, we construct 25 different dummy variables ($*_{h,j}$) which represent the intersection of independent quintile breakpoints on sales growth and firm size. In the table, the reported coefficient for large firms is the interaction coefficient on cash holdings for firms in both the largest quintile of size and the largest quintile of sales growth (i.e. $(_{5,5}$). This is compared to the coefficient for firms in the largest quintile of sales growth and the smallest quintile of size ($(_{5,1}$). Using this method allows us to estimate the model with all of our data. Because the results in Table 5 suggest that the inclusion of separate intercepts has a substantial impact on the sales growth coefficients, we include them in equation (3) as denoted by the $"_{h,j}$s. In the table, we refer to this procedure as "Dual Interactions".

As an additional check, we examine regressions where we estimate the model from equation (2), including individual intercepts, using only those firms in the highest quintile of sales growth. For this analysis, we first rank all firms into quintiles of sales growth based on the prior year. We keep only the high growth firms and subsequently rank only those firms on the basis of the characteristics measuring capital market access. In the table, this procedure is reported under the heading "Only High Growth". Similarly to our prior analysis, for each procedure, we examine FM regressions both with and without the lag and lead

change in cash holdings. The results of our estimations are shown in Table 6.

Our first set of regressions shows that cash is not more valuable in small, high growth firms than it is in large, high growth firms. In fact, we find that cash holdings in large firms are significantly more valuable than those in small firms. If smaller firms are less able to access the capital markets, then these results do not imply that cash is more valuable for firms where external finance is more difficult to acquire. It is possible that the results imply that for firms with good growth options, larger firms tend to have relatively more valuable investment projects.

Fazzari, Hubbard, and Petersen (1988) argue that dividend payout acts as a proxy for capital market access. When we segment our high growth firms on the basis of whether or not they pay a dividend, there does not appear to be any difference among the coefficients, either significantly or in economic terms. We see similar results when we segment firms by TIE ratio, and to a lesser extent, when we break firms by leverage.

Overall, the results seem to suggest the value shareholders place on liquidity is unaffected by the firm's access to the capital markets. Thus, our fourth hypothesis is not supported. The lack of differences in Table 6 has several possible explanations. First, it may be the case that our empirical proxies for capital market access are poor. While other variables such as bank relationships or debt ratings would likely be better metrics, we do not have enough data on these measures to use them. Second, the lack of differences may simply suggest that the US capital markets work well and that the frictions associated with raising capital are fairly small. Further research should examine this issue on a cross-country basis where the variation in the development of the capital markets can be exploited.

5.5 Summary of the market value cash holdings

Overall, our results suggest that there are cross-sectional differences in the valuation associated with cash holdings. It appears that firms with greater growth opportunities or more volatile investment programs

have their liquid assets valued at a premium to face value. Additionally, it seems that firms which are likely to face financial distress have a significant discount placed on the value of their cash holdings. At the same time, we do not find support for the idea that firms with poorer capital market access have more valuable cash holdings. It appears that the value of liquidity comes from how shareholders perceive the firm will spend its cash and not from how, or whether, the firm can obtain the cash.

6. Conclusions

In this study we show that, on average, the market value of a dollar held by a firm is approximately $1.20 and significantly greater than one dollar. However, we also find substantial cross-sectional differences in the market value of a dollar. We show that firms with good growth opportunities have a higher premium on each dollar relative to firms that have poor growth options, which is consistent with investors valuing liquidity. We also find that firms which are likely to face financial distress have their cash valued at a substantial discount to one dollar. Additionally, we find support for the idea that firms with greater uncertainty in their investment program have greater valuations placed on their liquid assets. Finally, our results do not support the idea that access to the capital markets affects the value of cash holdings.

Our results suggest that, on average, shareholders believe the benefits of liquidity outweigh the potential agency problems associated with it. At the same time, our cross-sectional tests provide support for the financial slack arguments of both Myers and Majluf (1984) and Jensen (1986). Overall, it appears that the investment opportunity set, rather than the financing opportunity set of the firm affects the value that shareholders place on a firm's cash holdings.

This study expands the literature on corporate cash holdings by examining investors' valuation of corporate cash holdings. Our study takes a unique approach by estimating the market value of the firm's cash. Future research should attempt to incorporate the idea of optimal cash holdings and examine whether this changes our inferences.

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Table 1
Summary of Hypotheses and Predictions

The sign in parentheses in the final column indicates the predicted relationship on the value of cash holdings that the empirical proxy should have.

Hypothesis	Prediction of value of cash	Empirical proxies (Sign)
H1: Growth Options	Greater growth options makes cash more valuable	Sales growth (+) Dividends (-) R&D expenditures (+) Capital Expenditures (+)
H2: Predictability of Investment Opportunities	Greater predictability makes cash less valuable	Standard deviation of capital expenditures (+)
H3: Probability of Financial Distress	Greater probability of distress makes cash less valuable	Altman's Z-score (+) R&D expenditures (+) Interest Coverage Ratio (+) Leverage (-)
H4: Capital Market Access	Holding growth options constant, greater access makes cash less valuable	Firm size (-) Dividends (-) Interest Coverage Ratio (-) Leverage (+)

Table 2
Summary Statistics

Compustat variable numbers are in parentheses. X_t is the level of variable X in year t divided by the level of assets in year t. dX_t is the change in the level of X from year t-2 to year t divided by assets in year t $((X_{t-2} - X_t)/A_t)$. dX_{t+2} is the change in the level of X from year t+2 to year t divided by assets in year t $((X_{t+2} - X_t)/A_t)$. M is (Market value of equity + short term debt + long term debt) (54*99 + 34 + 9). E is earnings defined as earnings before extraordinary items + interest + income statement deferred tax credits + investment tax credits (18 + 15 + 50 + 51). NA is net assets, which is defined as assets - cash (6 - 1). RD is research and development expense (46). When R&D is missing, it is set to zero. I is interest expense (15). D is common dividends (21). C is cash and marketable securities (1). The sample includes 9,701 firms representing 84,534 firm years from 1962-1997.

Variable	Mean	1st Quartile	Median	3rd Quartile	Standard Deviation
M_t	1.215	0.676	0.925	1.391	0.957
E_t	0.057	0.044	0.077	0.107	0.113
dE_t	0.010	-0.015	0.018	0.046	0.113
dE_{t+2}	0.016	-0.022	0.019	0.060	0.142
dNA_t	0.153	0.033	0.163	0.303	0.276
dNA_{t+2}	0.252	-0.001	0.161	0.372	0.535
RD_t	0.020	0.000	0.000	0.021	0.045
dRD_t	0.004	0.000	0.000	0.002	0.022
dRD_{t+2}	0.006	0.000	0.000	0.003	0.034
I_t	0.024	0.010	0.020	0.033	0.020
dI_t	0.003	-0.002	0.002	0.010	0.017
dI_{t+2}	0.007	-0.003	0.002	0.013	0.025
D_t	0.012	0.000	0.004	0.019	0.016
dD_t	0.002	0.000	0.000	0.003	0.007
dD_{t+2}	0.002	0.000	0.000	0.004	0.008
dM_{t+2}	0.376	-0.133	0.117	0.511	1.493
C_t	0.102	0.025	0.058	0.132	0.121
dC_t	0.015	-0.016	0.005	0.041	0.105
dC_{t+2}	0.027	-0.021	0.004	0.044	0.168

Table 3
Correlation Matrix

Compustat variable numbers are in parentheses. X_t is the level of variable X in year t divided by the level of assets in year t. dX_t is the change in the level of X from year t-2 to year t divided by assets in year t $((X_{t-2} - X_t)/A_t)$. dX_{t+2} is the change in the level of X from year t+2 to year t divided by assets in year t $((X_{t+2} - X_t)/A_t)$. M is (Market value of equity + short term debt + long term debt) (54*99 + 34 + 9). E is earnings defined as earnings before extraordinary items + interest + income statement deferred tax credits + investment tax credits (18 + 15 + 50 + 51). NA is net assets, which is defined as assets - cash (6 - 1). RD is research and development expense (46). When R&D is missing, it is set to zero. I is interest expense (15). D is common dividends (21). C is cash and marketable securities (1). The sample includes 9,701 firms representing 84,534 firm years from 1962-1997.

	M_t	E_t	dE_t	dE_{t+2}	dNA_t	dNA_{t+2}	RD_t	dRD_t	dRD_{t+2}	I_t	dI_t	dI_{t+2}	D_t	dD_t	dD_{t+2}	dM_{t+2}	C_t	dC_t
E_t	-0.023																	
dE_t	0.088	0.599																
dE_{t+2}	-0.007	-0.266	-0.253															
dNA_t	0.174	0.253	0.144	-0.098														
dNA_{t+2}	0.214	0.128	0.135	0.171	0.170													
RD_t	0.275	-0.289	-0.084	0.015	-0.034	-0.022												
dRD_t	0.192	-0.066	-0.135	-0.015	0.166	0.032	0.528											
dRD_{t+2}	0.236	0.054	0.091	-0.109	0.065	0.166	0.228	0.155										
I_t	-0.166	-0.125	-0.054	0.019	-0.181	-0.112	-0.128	-0.111	-0.090									
dI_t	-0.028	0.014	-0.034	-0.009	0.453	-0.015	-0.046	0.034	-0.018	0.285								
dI_{t+2}	0.087	0.028	0.056	0.006	0.238	0.582	-0.035	0.018	0.043	-0.143	0.013							
D_t	0.074	0.267	0.033	0.017	0.000	-0.029	-0.118	-0.051	-0.050	-0.300	-0.022	-0.039						
dD_t	0.105	0.204	0.101	0.001	0.139	0.053	-0.038	0.001	0.001	-0.168	-0.004	0.039	0.459					
dD_{t+2}	0.101	0.183	0.105	0.128	0.038	0.126	-0.042	-0.008	0.009	-0.146	-0.050	-0.002	0.203	0.200				
dM_{t+2}	0.099	-0.003	0.043	0.208	0.034	0.460	0.121	0.074	0.206	-0.052	-0.018	0.179	-0.020	0.030	0.108			
C_t	0.301	-0.086	0.009	-0.018	-0.084	0.080	0.311	0.186	0.180	-0.319	-0.101	-0.003	0.003	0.038	0.047	0.109		
dC_t	0.167	0.162	0.127	-0.067	0.011	0.130	0.021	0.122	0.126	-0.120	-0.025	0.048	-0.022	0.040	0.071	0.054	0.466	
dC_{t+2}	0.144	0.010	0.048	0.140	0.051	0.146	0.116	0.079	0.188	-0.021	0.000	0.043	-0.044	-0.006	0.048	0.405	-0.027	-0.066

Table 4
Regression Results for Market Value of the Firm

Compustat variable numbers are in parentheses. X_t is the level of variable X in year t divided by the level of assets in year t. dX_t is the change in the level of X from year t-2 to year t divided by total assets in year t $((X_{t-2} - X_t)/A_t)$. dX_{t+2} is the change in the level of X from year t+2 to year t divided by assets in year t $((X_{t+2} - X_t)/A_t)$. M is (Market value of equity + short term debt + long term debt) (54*199 + 34 + 9). E is earnings defined as earnings before extraordinary items + interest + income statement deferred tax credits + investment tax credits (18 + 15 + 50 + 51). NA is net assets, which is defined as assets - cash (6 - 1). RD is research and development expense (46). When R&D is missing, it is set to zero. I is interest expense (15). D is common dividends (21). C is cash and marketable securities (1). The dependent variable for the regressions is M_t. All regressions are run using the methodology of Fama and MacBeth. Each year cross-sectional regressions are run and the reported coefficients are the means of the time series of regression coefficients. The standard errors reported are from the time series of regression coefficients as well. The reported R^2 are the average of the R^2s from the cross-sectional regressions.

Fama MacBeth	Levels - M_t	Levels - M_t
Intercept	0.44 (0.060)	0.43 (0.059)
E_t	2.13 (0.735)	1.94 (0.729)
dE_t	0.00 (0.214)	-0.10 (0.227)
dE_{t+2}	0.57 (0.161)	0.38 (0.144)
dNA_t	0.72 (0.043)	0.73 (0.045)
dNA_{t+2}	0.30 (0.052)	0.33 (0.055)
RD_t	3.85 (0.423)	3.79 (0.421)
dRD_t	2.08 (0.718)	1.99 (0.712)
dRD_{t+2}	4.72 (0.489)	4.42 (0.495)
I_t	3.48 (0.509)	3.72 (0.519)
dI_t	-3.63 (0.893)	-4.03 (0.844)
dI_{t+2}	-1.23 (0.499)	-1.45 (0.491)
D_t	6.18 (0.836)	6.90 (0.813)
dD_t	5.67 (0.704)	5.56 (0.702)
dD_{t+2}	10.27 (0.921)	10.04 (0.914)
dM_{t+2}	-0.12 (0.046)	-0.15 (0.047)
C_t	**1.25** **(0.093)**	**1.19** **(0.095)**
dC_t		0.45 (0.084)
dC_{t+2}		0.71 (0.087)
N	36	36
Adjusted R^2	0.3631	0.3762

Table 5
Interacted Cash Coefficients - Various Regressions

All regressions are run using the methodology of Fama and MacBeth. Each year cross-sectional regressions are run and the reported coefficients are the means of the time series of regression coefficients. The standard errors, in parentheses, are computed from the time series of regression coefficients. Coefficients are shown which are the interaction between cash to assets and a dummy variable indicating firm characteristics. The dummy variables take the value of 1 if the firm has that characteristic in that year. Lowest and Highest refer to quintiles of the variable. Quintiles are re-ranked each year from 1962-1997. Regressions are run both including and excluding individual intercepts for each quintile as noted in the table heading. Subsample means that the regression is estimated using only the firms which have the particular characteristic noted. *, **, and *** indicate that the coefficient is larger than the other category at the 10, 5, and 1 percent levels respectively.

Regression Includes Changes in Lead and Lag Cash	No			Yes		
Interaction Intercepts	No	Yes	Subsample	No	Yes	Subsample
			Sales Growth			
Lowest Sales Growth	0.72	0.50	0.76	0.75	0.53	0.85
	(0.082)	(0.095)	(0.095)	(0.097)	(0.107)	(0.103)
Highest Sales Growth	2.21***	1.79***	1.46***	2.15***	1.74***	1.40***
	(0.185)	(0.157)	(0.133)	(0.185)	(0.162)	(0.155)
			Dividend Policy			
Dividend Paying	0.60	0.90	0.75	0.56	0.81	0.56
	(0.061)	(0.071)	(0.067)	(0.079)	(0.084)	(0.072)
No Dividends	2.30***	1.25***	1.20***	2.25***	1.15***	1.20***
	(0.212)	(0.153)	(0.129)	(0.211)	(0.151)	(0.113)
			Research and Development Expenditures			
Zero R&D expenditures	1.18	1.01	0.97	1.12	0.94	0.91
	(0.085)	(0.090)	(0.085)	(0.092)	(0.096)	(0.095)
Nonzero R&D expenditures	1.45***	1.93***	1.81***	1.40***	1.87***	1.55***
	(0.129)	(0.187)	(0.169)	(0.138)	(0.186)	(0.139)
			Capital Expenditures			
Lowest capital expenditures	0.82	0.68	0.82	0.75	0.61	0.73
	(0.086)	(0.090)	(0.094)	(0.094)	(0.100)	(0.095)
Highest capital expenditures	2.38***	1.86***	1.71***	2.32***	1.79***	1.63***
	(0.151)	(0.176)	(0.170)	(0.156)	(0.182)	(0.213)
			Investment Uncertainty			
Lowest Investment Volatility	0.66	0.86	0.73	0.59	0.78	0.63
	(0.093)	(0.103)	(0.115)	(0.093)	(0.097)	(0.135)
Highest Investment Volatility	1.90***	1.21**	1.13**	1.85***	1.18**	1.24***
	(0.149)	(0.140)	(0.123)	(0.157)	(0.147)	(0.162)
			Altman's Z-Score (1963 on)			
Less than 3.0	0.26	0.27	0.31	0.26	0.28	0.30
	(0.121)	(0.080)	(0.082)	(0.129)	(0.105)	(0.124)
Higher than 3.0	1.50***	1.52***	1.47***	1.44***	1.46***	1.33***
	(0.105)	(0.096)	(0.101)	(0.102)	(0.092)	(0.100)
			Interest Coverage Ratio (TIE ratio)			
Lowest (positive) TIE	0.69	0.89	0.70	0.65	0.83	0.72
	(0.146)	(0.132)	(0.108)	(0.154)	(0.134)	(0.123)
Highest (positive) TIE	1.87***	1.22**	1.00**	1.74***	1.07	0.63
	(0.126)	(0.124)	(0.148)	(0.112)	(0.119)	(0.147)
			Leverage			
Lowest leverage (nonzero)	1.42	1.26*	1.18*	1.34	1.18	0.93
	(0.111)	(0.111)	(0.131)	(0.101)	(0.106)	(0.134)
Highest leverage	1.61	0.95	0.91	1.60*	0.93	0.91
	(0.128)	(0.173)	(0.127)	(0.145)	(0.182)	(0.144)

Table 6
Interacted Cash Coefficients - Capital Market Access For High Growth Firms

All regressions are run using the methodology of Fama and MacBeth. Each year cross-sectional regressions are run and the reported coefficients are the means of the time series of regression coefficients. The standard errors, in parentheses, are computed from the time series of regression coefficients. Dual Interactions indicates that the regression is estimated using the full sample of data and the coefficient is the interaction between cash to assets and a dummy variable indicating firms with the highest sales growth and the noted characteristic. The dummy variables take the value of 1 if the firm has that characteristic in a particular year. Only High Growth means that the regression is estimated using only the subset of firms which were in the highest quintile of sales growth each year. Lowest and Highest refer to quintiles of the variable. Quintiles are re-ranked each year from 1962-1997. *, **, and *** indicate that the coefficient is larger than the other category at the 10, 5, and 1 percent levels respectively.

	Dual Interactions		Only High Growth	
Regression Includes Changes in Lead and Lag Cash	No	Yes	No	Yes
Large Firms	2.52**	2.41**	2.52***	2.32***
	(0.492)	(0.484)	(0.453)	(0.445)
Small Firms	1.25	1.23	0.97	0.84
	(0.227)	(0.235)	(0.223)	(0.242)
Dividend Paying	1.59	1.47	1.35	1.22
	(0.218)	(0.212)	(0.178)	(0.177)
No Dividends	1.75	1.67	1.28	1.22
	(0.228)	(0.244)	(0.229)	(0.257)
Lowest (positive) TIE	1.34	1.23	1.37	1.22
	(0.309)	(0.334)	(0.264)	(0.299)
Highest (positive) TIE	1.32	1.23	1.37	1.24
	(0.284)	(0.282)	(0.237)	(0.256)
Lowest leverage (nonzero)	1.50	1.49	1.45	1.39*
	(0.213)	(0.212)	(0.200)	(0.215)
Highest leverage	1.30	1.22	0.86	0.73
	(0.292)	(0.296)	(0.401)	(0.400)