Financial Constraints, Investment, and the Value of Cash Holdings

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Previous studies report that cash holdings are more valuable for financially constrained firms than for unconstrained firms. We examine (i) why this is so and (ii) why some constrained firms appear to hold too little cash. Our results indicate that greater cash holdings are associated with higher levels of investment for constrained firms with high hedging needs and that the association between investment and value is stronger for constrained firms than for unconstrained firms. These findings imply that higher cash holdings allow constrained firms to undertake value-increasing projects that might otherwise be bypassed. We further find that some constrained firms exhibit low cash holdings because of persistently low cash flows. Overall, our findings support the view that greater cash holdings of constrained firms are a value-increasing response to costly external financing. (*JEL* G32, G35)

Modigliani and Miller (1958) argue that in a frictionless environment, companies can fund all value-increasing investment opportunities. That is, investment and growth do not depend on the availability of internal capital. Once capital market imperfections are introduced, however, firms are not necessarily able to pursue all value-increasing investment opportunities. For example, in the models of Greenwald, Stiglitz, and Weiss (1984) and Myers and Majluf (1984), capital market frictions increase the cost of outside capital relative to internally generated funds. Consequently, some firms that have attractive growth opportunities invest less than the first-best optimum, leading to lower future growth and reduced operating performance and firm value. One way to mitigate these adverse effects is for firms with high costs of external finance (i.e., financially constrained firms) to rely more on internal financial resources: cash flow and cash holdings.

Cash holdings can be valuable when other sources of funds, including cash flows, are insufficient to satisfy firms' demand for capital.[1] That is, firms facing

We appreciate helpful comments received from an anonymous referee, Murillo Campello, Diane Denis, Mara Faccio, Mike Faulkender, Stu Gillan, John McConnell, Raghu Rau, Mike Weisbach (the editor), Jin Xu, and finance seminar participants at the University of Iowa, Ohio University, and Texas Tech University. Send correspondence to David J. Denis, Krannert Graduate School of Management, Purdue University, Rawls Hall, 100 S. Grant Street, West Lafayette, IN 47907-2076; telephone: 765-494-4434; fax: 765-496-7434. E-mail: djdenis@purdue.edu.

[1] Several prior studies have analyzed cash *flows*, as opposed to cash *holdings*, as an internal source of capital. We provide a brief review of these studies in Section 2.

doi:10.1093/rfs/hhp031 Advance Access publication May 2, 2009

external financing constraints can use available cash holdings to fund the necessary expenditures. Consistent with this view, several studies report that firms with greater difficulties in obtaining external capital accumulate more cash.[2] Similarly, Almeida, Campello, and Weisbach (2004) provide evidence that firms with greater frictions in raising outside financing save a greater portion of their cash flow as cash than do those with fewer frictions. Finally, recent studies by Faulkender and Wang (2006) and Pinkowitz and Williamson (2006) report evidence consistent with the view that cash holdings are more valuable for constrained firms than for unconstrained firms. Collectively, these studies support the view that higher cash holdings are more valuable for financially constrained firms.[3]

We extend this literature by analyzing two related questions. First, why are cash holdings more valuable for constrained firms? Second, if cash is more valuable for constrained firms, why do some of these firms appear to hold too little cash?

Using a sample of 74,347 firm-year observations between 1985 and 2006, we first confirm that the positive association between cash and value is stronger for financially constrained firms. In regressions of firm value on cash holdings and a set of control variables, we find that the coefficient on cash holdings is significantly greater for constrained firms than for unconstrained firms. These findings are robust to alternative methodologies for measuring firm value, to measures of abnormal cash holdings and changes in cash holdings, and to alternative methods of identifying financially constrained and unconstrained firms.

To address why cash is more valuable in constrained firms, we analyze the impact of cash on investment and the impact of investment on value for constrained and unconstrained firms. After attempting to account for the endogeneity of the level of cash holdings using the three-stage-least-squares (3SLS) methodology, we find that cash holdings are positively associated with net investment (capital expenditures net of depreciation) for financially constrained firms. More importantly, we find that the positive impact of cash on investment is particularly strong for constrained firms with high hedging needs, as defined in Acharya, Almeida, and Campello (2007).

We further find that the association between investment and firm value is significantly stronger for constrained firms than for unconstrained firms. Taken together, these findings are consistent with the view that cash holdings are more valuable to constrained firms because (i) cash allows constrained firms

[2] See Kim, Mauer, and Sherman (1998); Harford (1999); and Opler et al. (1999).

[3] An alternative view is that high cash holdings can increase agency problems in constrained firms. The evidence on this view is mixed. Harford (1999) and Dittmar, Mahrt-Smith, and Servaes (2003) provide support for the hypothesis that cash hoarding by firms is value reducing and can be a result of agency problems inside corporations, while Mikkelson and Partch (2003) argue that a policy of high cash holdings is not necessarily value reducing and may in fact be an operating necessity.

to increase investment, and (ii) the marginal investment of constrained firms is more strongly related to value than that of unconstrained firms.

We then investigate why some constrained firms have lower cash holdings despite the apparent benefits of holding more cash in these firms. On balance, our evidence supports the view that low internal resources and more costly external finance limit the available financial resources of low cash firms. Specifically, we find that constrained firms with low cash have significantly lower Altman's *z*-scores, interest coverage ratios, cash flow margins, and changes in cash flow margins than high cash constrained firms. Moreover, low cash firms exhibit persistently negative (and declining) free cash flow (operating cash flow net of capital expenditures and R&D) in the prior ten years. Although these firms do raise some external capital, this external capital is insufficient to meet their needs. As a result, relative to high cash constrained firms, low cash constrained firms exhibit significantly lower cash flow sensitivities of cash and significantly higher investment-cash flow sensitivities. In other words, the low cash firms essentially spend available cash flow on investment projects and are unable to build their cash reserves. In fact, their cash balances decline significantly over the preceding five-year period.

Our study contributes to other strands of the literature. First, it complements the evidence of Almeida, Campello, and Weisbach (2004) on the value of cash for constrained firms, and the sources of value increase. We demonstrate that cash is associated with greater investment for constrained firms and that the marginal investment of constrained firms is associated with greater value increase than that of unconstrained firms. Second, we contribute to the debate in the cash holdings literature on whether high cash holdings are value increasing. Our results suggest that, for financially constrained firms, high cash holdings are a value-increasing response to financing frictions.

The article proceeds as follows. The next section summarizes the related literature and describes the potential contribution of our study. Section 2 describes the data and confirms prior evidence on the value of cash holdings for constrained and unconstrained firms. Sections 3 and 4 examine the effect of cash holdings on investment and the association between investment and value, respectively. Section 5 provides evidence on the causes of low cash holdings of some constrained firms and Section 6 concludes.

1. Related Literature

Fazzari, Hubbard, and Petersen (1988) argue that when external financing is more costly than internal financing, changes in cash flow will be an important determinant of marginal capital spending for constrained companies and the sensitivity of investment to cash flow will increase in the degree of financial constraints. Although Fazzari et al. report evidence consistent with their hypothesis, the interpretation of their findings has been challenged on both theoretical and empirical grounds. Kaplan and Zingales (1997) question the validity of

investment-cash flow sensitivities as a measure of financial constraints. Using information from financial statements, they rank firms on the level of financial constraints and find that firms classified as less financially constrained actually exhibit greater investment-cash flow sensitivity. One explanation of the findings that they offer, favored also by Erickson and Whited (2000) and Alti (2003), is that Tobin's Q is a noisy proxy for marginal Q. If cash flow contains information about investment opportunities and the profitability of assets in place, less constrained firms are more likely to adjust investment in response to shocks to investment opportunities. Thus, they have higher investment-cash flow sensitivity.

Almeida, Campello, and Weisbach (2004) adopt an alternative approach to the question of whether costly external finance affects financial policies. Rather than focusing on the sensitivity of investment to cash flow, they focus on the cash flow sensitivity of cash. The intuition is that financially constrained firms should have a systematic propensity to save cash, whereas unconstrained firms should not exhibit this propensity. Using several criteria for sorting firms into financially constrained and unconstrained, Almeida, Campello, and Weisbach (2004) find that the cash flow sensitivity of cash is positive for financially constrained firms, but statistically insignificant for financially unconstrained firms.

Yet another strand of the literature studies the cross-sectional determinants of cash holdings. Opler et al. (1999) find that cash holdings are negatively related to the level and the availability of a bond rating. That is, companies with a bond rating below investment grade and those having no bond rating available hold more cash than firms that have an investment-grade bond rating. Similarly, Kim, Mauer, and Sherman (1998) and Harford (1999) report that cash holdings are positively associated with industry cash flow volatility. To the extent that firms with lower or no bond ratings and those that operate in industries with greater cash flow volatility face greater costs of external finance, the results support the view that financially constrained firms hold more cash than unconstrained firms.

Although the above findings are consistent with higher cash holdings of constrained firms being a value-increasing response to costly external financing, another possibility is that constrained firms hold high cash reserves due to value-reducing agency problems and empire-building behavior of the managers. As noted in the beginning of the article, several recent papers attempt to address the agency cost hypothesis and report mixed evidence. While studies by Harford (1999); Pinkowitz, Stulz, and Williamson (2006); Dittmar and Mahrt-Smith (2007); and Harford, Mansi, and Maxwell (2008) report evidence consistent with the agency cost view, Mikkelson and Partch (2003) find no evidence that cash-rich firms perform any worse than firms with low cash holdings. Consistent with the costly external financing view, Faulkender and Wang (2006) and Pinkowitz and Williamson (2006) report that the value of cash is greater for constrained than for unconstrained firms.

Our objective is to understand why cash is valued differently in constrained firms than in unconstrained firms. Consequently, we investigate whether the differential value of cash is related to investment policy, we analyze the marginal value of investment for constrained and unconstrained firms, and we investigate why some constrained firms have low cash holdings despite the apparent benefits of maintaining larger cash reserves.

2. Sample Selection and Data Description

The sample includes public companies in the United States with financial data available on Compustat's Industrial Annual P-S-T, Research, and Full Coverage files at any time over the period of 1985–2006. The sample period is limited by the availability of Compustat data on bond and short-term debt ratings that are used to construct measures of financial constraints. We require firms to have at least $25 million in total book assets in 1994 dollars. Also, in order to eliminate the possible effects of regulation, we exclude companies in the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. Finally, we exclude firm-years with nonpositive values for total book assets or cash holdings, or negative values for capital expenditures. These sample selection criteria result in 74,347 firm-year observations.

The literature has proposed a variety of ways of identifying the level of financial constraints facing firms. However, there is no general agreement on which measure is the best proxy for financial constraints. As described below, we perform our analysis using several alternative approaches for sorting firms into financially constrained and financially unconstrained.[4]

1. *Annual payout ratio*. Fazzari, Hubbard, and Petersen (1988) argue that unconstrained firms are more likely to have higher payout ratios, while constrained firms are likely to have lower payout ratios. Therefore, for each year, we assign those firms in the bottom (top) three deciles of the annual cash payout ratio distribution to the financially constrained (unconstrained) group. Following Almeida, Campello, and Weisbach (2004), payout ratio is defined as the ratio of dividends and common stock repurchases to operating income. Observations with a positive payout and zero or negative cash flow are assigned the highest payout ratio.[5]
2. *Firm size*. Under the assumption that smaller firms are younger and less well known, they will be more vulnerable to capital market imperfections. Therefore, each year we rank firms based on their book value of total assets.

[4] One measure that we do not use is the KZ-index of Kaplan and Zingales (1997) because prior studies indicate that this measure does a relatively poor job of characterizing the cross-sectional variation of cash policies for financially constrained versus unconstrained firms (see Almeida, Campello, and Weisbach 2004). For this reason, Faulkender and Wang (2006) do not use the KZ-index as a measure of financial constraints.

[5] We find similar results if we average the annual payout ratio over time or if we simply use a dividend dummy variable to separate unconstrained from constrained firms.

Table 1
Correlation of various classifications of financial constraints

	Financial constraint criteria		
	Payout ratio	Size	Bond ratings
Payout ratio	1		
(*p*-value)			
Size	0.3822	1	
(*p*-value)	(0.00)		
Bond ratings	0.1835	0.6582	1
(*p*-value)	(0.00)	(0.00)	
Paper ratings	0.2893	0.4277	0.4446
(*p*-value)	(0.00)	(0.00)	(0.00)

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of criteria used to categorize firm-years as financially constrained or unconstrained. Correlation coefficient estimates are reported with *p*-values in parentheses below.

We then assign those firms in the bottom (top) three deciles of the firm size distribution to the financially constrained (unconstrained) group. This approach is similar to that in Erickson and Whited (2000); Almeida, Campello, and Weisbach (2004); and Acharya, Almeida, and Campello (2007).

3. *Debt rating*. Following an approach similar to that in Whited (1992); Gilchrist and Himmelberg (1995); and Almeida, Campello, and Weisbach (2004), firms are classified as financially unconstrained if they have had their long-term debt rated by Standard & Poor's (S&P Long-term Senior Debt Rating is available on Compustat) and their debt is not in default (rating of "D" or "SD"). Firms are classified as constrained if they have debt outstanding that year, but have never had their public debt rated before (or the long-term debt rating is unavailable). Firms with no debt outstanding are classified as unconstrained.
4. *Paper rating*. We construct a similar criterion using the S&P Short-term Debt Rating available on Compustat. Firms are classified as financially unconstrained if they have had their short-term debt rated by S&P's and their debt is not in default. Firms are classified as constrained if they have debt outstanding that year, but have never had their short-term debt rated before (or the rating is unavailable). Firms with no short-term debt outstanding are classified as unconstrained.

Table 1 reports Pearson's correlation coefficients for the alternative measures of financial constraints. All correlation coefficients are statistically significant at the 0.01 level and range from 0.18 to 0.66. Although the high correlations imply that the measures are generally picking up similar information, it nonetheless appears that each measure picks up some unique information as well. We thus conduct our subsequent analysis using each of the alternative methods for classifying firms as financially constrained or unconstrained.

Table 2
Univariate comparison by financial constraints

		Financial constraint criteria							
		Payout		Size		Bond ratings		Paper ratings	
		Uncon. (A)	Constr. (B)	Uncon. (A)	Constr. (B)	Uncon. (A)	Constr. (B)	Uncon. (A)	Constr. (B)
Cash holdings	Mean	0.118	0.174	0.087	0.211	0.086	0.177	0.067	0.160
	Median	0.055	0.085	0.046	0.112	0.042	0.085	0.037	0.073
St. dev. cash	Mean	0.068	0.089	0.056	0.095	0.060	0.084	0.046	0.080
	Median	0.053	0.078	0.044	0.085	0.046	0.070	0.039	0.066
St. dev. cash chg.	Mean	0.083	0.131	0.067	0.134	0.076	0.117	0.045	0.111
	Median	0.054	0.091	0.045	0.094	0.049	0.077	0.037	0.072
Cash flow	Mean	0.067	0.027	0.080	0.019	0.065	0.042	0.101	0.044
	Median	0.085	0.064	0.087	0.066	0.076	0.078	0.102	0.074
Net investment	Mean	0.015	0.023	0.024	0.030	0.022	0.030	0.020	0.028
	Median	0.004	0.001	0.010	0.003	0.006	0.007	0.011	0.006
Size	Mean	3180	756	5675	65	4207	811	9407	1018
	Median	510	161	2126	54	1219	122	4933	176
Total debt	Mean	0.275	0.276	0.311	0.214	0.387	0.232	0.283	0.275
	Median	0.245	0.227	0.281	0.142	0.340	0.182	0.268	0.232
PPE	Mean	0.353	0.293	0.396	0.268	0.377	0.304	0.401	0.317
	Median	0.292	0.224	0.352	0.195	0.330	0.240	0.353	0.254
Market-to-book	Mean	2.914	2.758	2.926	2.751	2.934	2.782	3.275	2.776
	Median	1.991	1.819	2.050	1.795	2.019	1.848	2.354	1.847

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. Size is total book assets measured in 1994 dollars (adjusted for the CPI). Cash holdings, property, plant, and equipment, total debt, net investment, and cash flow are deflated by total book assets.

Table 2 presents univariate comparisons of firm characteristics for subsamples based on financial constraints.[6] Consistent with the hypothesis that cash provides important benefits to financially constrained firms, firms classified as financially constrained tend to hold more cash. For all classification criteria, the median and mean ratios of cash to total book assets are significantly higher for financially constrained firms. Median cash holdings range from 3.7 to 5.5% of assets for unconstrained firms and from 7.3 to 11.2% of assets for constrained firms. The pattern in our sample is similar to that reported by Almeida, Campello, and Weisbach (2004). For the four main financial constraint criteria that they use, median cash holdings for firms in their sample range from 10.5 to 21.9% for the constrained firms and from 4.1 to 5.1% for the unconstrained. The slight difference in values might be due to the fact that the authors limit their sample to manufacturing firms.

The variation of cash holdings is higher for constrained firms than for unconstrained firms. The mean and the median standard deviation of the level of cash holdings and of the change in cash holdings are greater for financially constrained firms for all the criteria. This is in line with the prediction of Myers

[6] Throughout the article, we winsorize all variables at the 1st and 99th percentiles so as to mitigate the influence of extreme values.

Table 3
Excess stock returns and changes in cash holdings

	Financial constraint criteria			
	Payout ratio	Size	Bond ratings	Paper ratings
Change in cash	0.953***	0.964***	1.017***	0.629***
	(8.77)	(7.58)	(10.40)	(4.30)
Constrained*change in cash	0.267***	0.287***	0.137**	0.511***
	(2.91)	(3.05)	(2.24)	(3.86)
Change in noncash assets	0.180***	0.188***	0.187***	0.187***
	(13.76)	(11.01)	(13.37)	(13.39)
Change in earnings	0.333***	0.374***	0.362***	0.361***
	(13.36)	(11.03)	(14.85)	(14.79)
Change in R&D	0.677***	0.729***	0.841***	0.841***
	(3.74)	(3.32)	(5.24)	(5.33)
Change in interest expense	−1.473***	−1.628***	−1.672***	−1.682***
	(8.96)	(6.81)	(10.70)	(10.73)
Change in dividends	3.406***	3.333***	3.618***	3.583***
	(10.62)	(7.22)	(14.05)	(14.01)
Net financing	−0.047*	−0.055*	−0.039	−0.039
	(1.82)	(1.80)	(1.66)	(1.67)
Leverage	−0.005	−0.006	−0.005	−0.005
	(0.95)	(1.11)	(1.19)	(1.06)
Lagged cash	0.278***	0.265***	0.261***	0.268***
	(9.87)	(7.97)	(10.32)	(10.39)
Change in cash*lagged cash	−0.300***	−0.371***	−0.288***	−0.281***
	(3.13)	(2.69)	(2.98)	(2.93)
Change in cash*leverage	−0.045***	−0.037	−0.048***	−0.053***
	(2.97)	(1.60)	(3.67)	(3.91)
Constrained dummy	0.043***	−0.023***	−0.013**	−0.037***
	(4.49)	(3.15)	(2.05)	(5.05)
Observations	23,094	17,109	31,366	31,366
Adjusted R^2	0.158	0.154	0.155	0.156

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. The dependent variable is stock return over fiscal year minus the return on a benchmark portfolio. The benchmark portfolios are twenty-five Fama-French value-weighted portfolios. The independent variables include change in cash, change in book assets net of cash, change in earnings before interest and extraordinary items, change in R&D expenses, change in interest expenses, change in dividends, lagged cash holdings, leverage, and net financing during fiscal year. All explanatory variables except leverage are standardized by lagged market equity. The FC dummy takes a value of 1 if a company is identified as financially constrained and 0 if a company is identified as financially unconstrained by the respective criterion. Regressions are estimated using OLS. Statistical significance is computed using heteroscedasticity and autocorrelation robust standard errors. ***, **, and * denote significance at the 1, 5, and 10% levels, respectively. Coefficient estimates are reported with *t*-statistics in parentheses below.

and Majluf (1984) that firms facing higher costs of external financing should accumulate internal resources and use them later to finance investment. Constrained firms also have lower cash flow, are smaller, hold fewer tangible assets, and have slightly lower market-to-book ratios than unconstrained firms.

In Table 3, we replicate the methodology of Faulkender and Wang (2006) to confirm the association between cash holdings and value for our sample firms. Specifically, we estimate a regression of annual abnormal stock return on the change in cash over the same year and several control variables. The coefficient on the change in cash can be interpreted as a measure of the value that investors put on a marginal dollar of cash. The control variables in the regression

include change in book assets net of cash, change in earnings before interest and extraordinary items, change in R&D expenses, change in interest expenses, change in dividends, lagged cash holdings, leverage, and net financing during the fiscal year. Like Faulkender and Wang (2006), we also include the interaction of the change in cash with lagged cash and leverage to account for the possibility that the marginal value of cash to shareholders is decreasing in the amount of cash that the firm has and decreasing in the amount of leverage. All explanatory variables except leverage are standardized by lagged market equity. The dependent variable is excess stock return over the fiscal year, computed as the stock return over the fiscal year minus the return on a benchmark portfolio. The benchmark portfolios are twenty-five Fama-French value-weighted portfolios, constructed by independently sorting stocks on size and book-to-market characteristics. To estimate the difference in the value of cash for constrained and unconstrained firms, we include an indicator variable equal to 1 for firms with greater financial constraints and an interaction of change in cash with this financial constraints dummy variable. The interaction measures the difference in the value of cash between constrained and unconstrained firms.

The results in Table 3 confirm that cash is more valuable for constrained firms. The interaction of the change in cash with the financial constraints dummy is positive and statistically significant for all criteria. The coefficient estimates imply that the marginal value of cash is between 14 and 51 cents higher in constrained firms than in unconstrained firms. These estimates are consistent with the economic magnitudes reported in Faulkender and Wang (2006).[7]

Therefore, overall our sample exhibits characteristics similar to those in prior studies. Specifically, we find that firms identified as likely to face financial constraints have lower cash flow, have higher cash holdings, are smaller, and have more intangible assets than firms identified as unconstrained. In addition, cash is positively associated with firm value and this association is stronger in firms that are likely to be financially constrained. In this sense, our data to this point support the view that a policy of greater cash retention by constrained firms, as documented by Opler et al. (1999) and Almeida, Campello, and Weisbach (2004), is more likely to be a value-increasing activity.

3. The Effect of Cash Holdings on Investment

Greater cash holdings might be more valuable to constrained firms because they allow the firm to invest when other sources of funds are costly, limited, or unavailable. In other words, under this hypothesis, greater cash holdings allow

[7] We also estimate the value of cash using the methodology of Pinkowitz and Williamson (2006) in which the market-to-book ratio is regressed on cash holdings and a set of control variables. In addition, we estimate models using a two-stage procedure in which we first estimate the firm's normal cash-to-assets ratio following the specification of Kim, Mauer, and Sherman (1998), and then use a measure of abnormal cash holdings in the second-stage regression. We find similar results using these alternative specifications; specifically, there is a significantly stronger positive association between value and cash for financially constrained firms than for unconstrained firms.

firms that experience external financial constraints to avoid underinvestment and reduced growth. To explore this hypothesis further, we examine whether greater cash holdings are associated with greater investment and whether this association is stronger for constrained than for unconstrained firms.

The estimation is complicated, however, by the possibility that the levels of both investment and cash holdings can be simultaneously determined by investment opportunities. First, firms with greater investment opportunities invest more and possibly require more cash holdings to support operations. Second, firms with more profitable investment opportunities can hold more cash to ensure the ability to fund their future investment opportunities and avoid the cost of underinvestment, even if they ultimately do not use the cash to invest. To account for the potential for spurious positive relation and simultaneous determination of investment and cash holdings, we estimate a 3SLS system of simultaneous equations. This setup allows us to examine the direct effect of cash holdings on investment after netting out the level of operating and precautionary cash held.[8]

The system consists of cash holdings and net investment models. Following Kim, Mauer, and Sherman (1998), we model cash holdings as a function of firm size (the log of the total market value of assets), the market-to-book ratio, leverage, industry cash flow volatility (median of the firm-level standard deviation of first differences in earnings before interest, taxes, depreciation, and amortization over the prior twenty years), the duration of the firm's cash cycle (average inventory age + average collection period − average payment period), operating cash flow, Altman's z-score, the return spread between a firm's investments and the return on Treasury bills, and the log of the growth rate of industrial production. Following Lang, Ofek, and Stulz (1996), we measure investment expenditures as net investment, defined as capital expenditures net of depreciation in the year following the measurement of the other independent variables. Our investment model includes the market-to-book ratio, operating cash flow, log of growth in sales over the previous two years, cash holdings, and calendar-year dummies as control variables. Net investment, cash flow, and cash holdings are deflated by total book assets. Both the investment and the cash models include industry fixed effects and the structure of standard errors allows for unstructured correlation across models.[9]

[8] Specifically, the 3SLS system of equations allows us to account for any correlation between the residuals of the cash and investment models that is due to unobserved influences on cash and investment. In an unreported Hausman specification test, we reject the consistency of OLS estimates relative to the 3SLS estimates. Relative to a two-stage approach, the 3SLS methodology provides a greater estimation efficiency.

[9] Note that industry fixed effects rather than firm fixed effects are more appropriate for the hypothesis that we are testing. That is, we test the hypothesis that greater cash reserves allow constrained firms to invest more than they would with less cash. Under the null hypothesis, therefore, constrained firms will rationally choose to have higher cash levels, but within a given firm, we do not expect year-to-year fluctuations in cash reserves to be associated with investment. To put it differently, if firms with higher cash holdings invest more, a firm fixed effects specification will fail to pick up this effect because it would disregard the higher level of investment as being a fixed effect. Consistent with this view, we find that specifications using industry fixed effects consistently yield higher adjusted R^2 statistics than those using firm fixed effects. Similarly, F-tests of the null hypothesis that

Table 4
Determinants of net investment

Financial constraint criteria	Payout ratio	Size	Bond ratings	Paper ratings
		Constrained firms		
Cash	0.053***	0.044***	0.032***	0.041***
	(7.22)	(5.45)	(5.92)	(7.72)
Cash flow	0.084***	0.081***	0.080***	0.077***
	(20.54)	(17.04)	(24.92)	(25.61)
Market-to-book	0.007***	0.006***	0.007***	0.007***
	(12.16)	(9.23)	(16.36)	(17.01)
Prior sales growth	0.006***	0.004***	0.005***	0.006***
	(13.64)	(6.42)	(14.29)	(17.67)
Observations	21372	10279	31297	43192
		Unconstrained firms		
Cash	0.021***	0.036**	−0.002	0.091***
	(2.83)	(2.44)	(0.18)	(3.25)
Cash flow	0.055***	0.061***	0.045***	0.073***
	(12.46)	(10.51)	(7.45)	(9.03)
Market-to-book	0.005***	0.006***	0.008***	0.004***
	(9.55)	(8.72)	(12.34)	(4.22)
Prior sales growth	0.002***	0.006***	0.006***	0.007***
	(4.32)	(12.32)	(13.02)	(5.70)
Observations	15,348	18,481	19,093	7198
p-value for difference in the coefficients on cash	0.00	0.63	0.00	0.08

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. The dependent variable is net investment, defined as capital expenditures net of depreciation in year $(t + 1)$. Net investment, cash, and cash flow are deflated by total book assets. Prior growth is measured as growth in sales for the past two years. Regressions are estimated using the 3SLS methodology, and include industry fixed effects and calendar-year dummies. Industry is defined at the two-digit SIC level. The unreported cash holdings model has cash-to-total assets as the dependent variable and firm size, market-to-book ratio, leverage, prior twenty-year industry cash flow volatility, duration of cash cycle, operating cash flow, likelihood of financial distress, return spread between a firm's investments and the return on Treasury bills, and log of the growth rate of industrial production as control variables. The structure of standard errors allows for unstructured correlation across models. *** and ** denote significance at the 1, 5, and 10% levels, respectively. Coefficient estimates are reported with z-statistics in parentheses below.

Identification of the system is achieved by excluding some of the explanatory variables that determine the need for cash holdings from the investment equation. The economic rationale for this identification strategy is that current investment is determined primarily by investment opportunities and available resources to fund those opportunities—cash flow and cash holdings—and not directly by other variables, such as industry cash flow volatility, the duration of the firm's cash cycle, and the growth rate in industrial production. We acknowledge, however, that despite our best efforts, we cannot claim to have completely solved the endogeneity issue.

The equations are estimated separately for constrained and unconstrained firms and, for brevity, Table 4 reports only the results of the investment equations. These results indicate that net investment is positively and significantly related to the level of cash holdings for constrained firms across all constraint

all fixed effects coefficients are equal to zero indicate that the null is always rejected at a higher confidence level in the industry fixed effects models.

criteria.[10] For unconstrained firms, the relation between net investment and cash is positive and significant for three out of the four constraint criteria. Moreover, the coefficient on cash is significantly greater for constrained than unconstrained firms for two of the four constraint criteria. For the paper ratings criteria, however, the coefficient on cash is actually greater for unconstrained firms. The estimates of cash coefficients for constrained firms are closely clustered between 0.032 and 0.053, while those for unconstrained firms are scattered from −0.002 to 0.091.

The findings in Table 4 thus provide mixed evidence on the hypothesis that cash holdings allow constrained firms to increase investment. Arguably, the reason for these mixed findings is that these baseline tests do not account for the possibility that cash holdings matter only for firms with high hedging needs (i.e., those for whom there is a low correlation between cash flow and investment opportunities). Moreover, an alternative interpretation of the significant findings in Table 4 is that the level of cash contains information about investment opportunities (e.g., managers' private information) over and above that in other variables. That is, cash affects investment not because cash *per se* is important, but because cash is a proxy for investment opportunities and future cash flow.

To provide further evidence on these issues, we follow an approach similar to that in Acharya, Almeida, and Campello (2007). Specifically, the authors argue that firms with a low or negative relation between cash flow and investment opportunities—those having high hedging needs—are more likely to rely on cash holdings to fund investment. In contrast, firms with a positive relation between cash flow and investment opportunities have a low hedging need and, therefore, have a lower need for precautionary cash holdings. Consequently, under the hypothesis that cash holdings allow constrained firms to increase investment, we expect that the positive relation between cash and investment will be stronger for constrained firms with high hedging needs than for constrained firms with lower hedging needs. Under the hypothesis that cash holdings reflect managers' private information about investment opportunities, we expect no difference in the investment/cash relation between firms with high and low hedging needs.

As noted in Acharya, Almeida, and Campello (2007), the identification of firms with high hedging needs is complicated by the fact that firm-level cash flows and investment are endogenously related. Therefore, what is required is a measure of the correlation between the firm's cash flows and a proxy for investment opportunities that is both exogenous to the firm's cash flows and not already included in our investment equation. As one such proxy, we compute for each firm-year the median sales growth over the following three years for firms operating in the same three-digit SIC industry. To measure hedging needs, we then estimate the correlation between this measure of industry growth and

[10] Results are similar when the current year's net investment is used as the dependent variable.

Table 5
Determinants of net investment for constrained firms with high and low hedging needs

	Correlation between cash flow and industry sales growth			
Hedging needs	Payout ratio	Size	Bond ratings	Paper ratings
		High hedging needs		
Cash	0.117***	0.065**	0.103***	0.094***
	(5.06)	(2.47)	(5.98)	(5.64)
Observations	2014	965	3392	4847
		Low hedging needs		
Cash	0.023	−0.031	0.006	−0.007
	(1.05)	(1.24)	(0.38)	(0.45)
Observations	2260	1057	3259	4609
p-value for difference	0.00	0.01	0.00	0.00

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. Firms with the statistically significant correlation of −0.2 or less between firm cash flow and investment opportunities are classified as having high hedging needs, and those with the statistically significant correlation of 0.2 or more as having low hedging needs. Three-digit SIC industry median sales growth over the next three years and next year's industry median net investment proxy for the firm's investment opportunities. The dependent variable is net investment, defined as capital expenditures net of depreciation in year $(t + 1)$. Net investment, cash, and cash flow are deflated by total book assets. Prior growth is measured as growth in sales for the past two years. Regressions are estimated using the 3SLS methodology, and include industry fixed effects and calendar-year dummies. Industry is defined at the two-digit SIC level. The unreported cash holdings model has cash-to-total assets as the dependent variable and firm size, market-to-book ratio, leverage, prior twenty-year industry cash flow volatility, duration of cash cycle, operating cash flow, likelihood of financial distress, return spread between a firm's investments and the return on Treasury bills, and log of the growth rate of industrial production as control variables. The structure of standard errors allows for unstructured correlation across models. *** and ** denote significance at the 1, 5, and 10% levels, respectively. Coefficient estimates are reported with *z*-statistics in parentheses below.

each firm's cash flow from operations. Firms with a statistically significant correlation of −0.2 or less are classified as having high hedging needs, and those with the statistically significant correlation of 0.2 or more as having low hedging needs.

Table 5 reports the results when we separately estimate our investment models for constrained firms with high and low hedging needs. The system of equations is identical to those estimated in Table 4. However, to conserve space, we report only the coefficients on cash holdings. These results indicate that the positive relation between investment and cash holdings for constrained firms is significantly stronger for firms with high hedging needs. In fact, the coefficient on cash holdings is statistically insignificant for firms with low hedging needs for all four constraint criteria. The difference between the cash coefficients for high and low hedging needs is inconsistent with the view that managerial information about investment opportunities is the sole driver of the positive relation between investment and cash for constrained firms. Rather, the difference between high and low hedging needs firms provides support for the hypothesis that greater cash holdings allow constrained firms with high hedging needs to invest when they otherwise would have been unable to do so.

4. Is Investment Associated with Greater Value in Constrained Firms?

In addition to its impact on the level of investment, greater cash holdings might be more valuable to constrained firms because the marginal profitability of investment is greater for constrained firms than for unconstrained firms. To provide evidence on this issue, we augment our Table 3 regressions with the interaction of the change in noncash assets and the indicator variable denoting firms with greater financial constraints.[11] Like Faulkender and Wang (2006), we interpret the coefficient on the change in noncash assets as the market's response to changes in investment. Consequently, the interaction of the change in noncash assets with the financial constraints indicator can be interpreted as a test of whether the market responds more favorably to investments made by constrained firms.

The results reported in Table 6 indicate that changes in noncash assets are positively related to excess stock returns for both constrained and unconstrained firms. In addition, we find that the interaction between the financial constraints indicator variable and changes in noncash assets is also significantly positive for all four constraint criteria. The findings in Table 6 thus indicate that the association between investment and value is generally stronger for constrained firms than for unconstrained firms. As such, they are consistent with the view that the marginal value of investment is greater for constrained firms than for unconstrained firms.

Nonetheless, we acknowledge that there are at least two alternative interpretations of these findings. First, the association between investment and value may not be causal. For example, Fama and French (1998) argue that the coefficients on the change in noncash assets can be interpreted as capturing information about changes in future profitability that are not captured by the direct measures of earnings contained in the regressions. It is possible that this future profitability is not caused by the changes in investment. Moreover, investment may contain more information about future profitability in constrained firms than in unconstrained firms. Second, even if the relation between investment and value is causal, it is possible that the causation runs from value to investment. That is, firms invest more when they expect greater future profits.

Although we cannot directly refute these alternative explanations, we offer two related pieces of evidence. First, because our specification tests the association between excess returns and changes in noncash assets, the results imply that stock prices change in response to changes in investment. Second, our findings in Tables 4 and 5 imply that changes in investment are driven in part by changes in cash holdings. If so, it seems implausible that the entire positive relation between investment and value is due to the market inferring information about future profitability that is not caused by the investment itself. Rather, the most plausible explanation seems to be that cash is more valuable

[11] We obtain qualitatively similar results if we adopt the procedure of Fama and French (1998) in which estimates of firm value and changes in firm value are regressed on levels and changes in a set of independent variables.

Table 6
Excess stock returns and investment

	Financial constraint criteria			
	Payout ratio	Size	Bond ratings	Paper ratings
Change in cash	0.942***	0.960***	1.014***	0.561***
	(8.43)	(7.13)	(10.10)	(4.15)
Constrained*change in cash	0.280***	0.306***	0.142**	0.582***
	(3.03)	(3.11)	(2.42)	(4.79)
Change in noncash assets	0.148***	0.105***	0.133***	0.056**
	(11.30)	(7.10)	(9.83)	(2.12)
Constrained*change in noncash assets	0.045***	0.156***	0.083***	0.139***
	(2.88)	(7.84)	(5.55)	(4.87)
Change in earnings	0.335***	0.384***	0.363***	0.359***
	(13.36)	(11.70)	(15.26)	(14.57)
Change in R&D	0.676***	0.697***	0.817***	0.835***
	(3.69)	(3.40)	(5.14)	(5.46)
Change in interest expense	−1.466***	−1.645***	−1.659***	−1.683***
	(8.97)	(6.80)	(10.55)	(10.93)
Change in dividends	3.444***	3.741***	3.708***	3.800***
	(10.67)	(8.04)	(14.42)	(14.59)
Net financing	−0.049*	−0.066**	−0.032	−0.042*
	(1.87)	(2.09)	(1.33)	(1.76)
Leverage	−0.004	−0.010*	−0.007	−0.004
	(0.81)	(1.75)	(1.47)	(0.96)
Lagged cash	0.276***	0.259***	0.259***	0.267***
	(9.76)	(7.90)	(10.37)	(10.34)
Change in cash*lagged cash	−0.305***	−0.380***	−0.292***	−0.287***
	(3.19)	(2.76)	(3.05)	(2.99)
Change in cash*leverage	−0.046***	−0.035	−0.048***	−0.052***
	(3.00)	(1.60)	(3.62)	(3.81)
Constrained dummy	0.044***	−0.025***	−0.015**	−0.041***
	(4.51)	(3.51)	(2.33)	(5.91)
Observations	23,094	17,109	31,366	31,366
Adjusted R^2	0.158	0.160	0.157	0.157

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. The dependent variable is stock return over fiscal year minus the return on a benchmark portfolio. The benchmark portfolios are twenty-five Fama-French value-weighted portfolios. The independent variables include change in cash, change in book assets net of cash, change in earnings before interest and extraordinary items, change in R&D expenses, change in interest expenses, change in dividends, lagged cash holdings, leverage, and net financing during fiscal year. All explanatory variables except leverage are standardized by lagged market equity. The FC dummy takes a value of 1 if a company is identified as financially constrained and 0 if a company is identified as financially unconstrained by the respective criterion. Regressions are estimated using OLS. Statistical significance is computed using heteroscedasticity and autocorrelation robust standard errors. ***, ** and * denote significance at the 1, 5, and 10% levels, respectively. Coefficient estimates are reported with *t*-statistics in parentheses below.

to constrained firms because (i) it allows them to increase investment, and (ii) this marginal investment is more valuable than that of unconstrained firms.

5. Why Do Some Constrained Firms Have Low Cash Holdings?

Although our findings suggest that cash holdings are more valuable to constrained firms because they allow them to increase investment in value-increasing projects, many constrained firms have surprisingly low cash reserves. For example, the median ratio of cash holdings to total assets for constrained

firms in the first quartile of abnormal cash holdings is 0.021, as opposed to the sample median of 0.058. Constrained firms at the 25th percentile of abnormal cash holdings have average abnormal cash holdings scaled by total assets equal to −0.076. It is puzzling why some constrained firms hold so little cash when there appears to be such a large benefit from greater cash holdings.

We consider several (not mutually exclusive) possible explanations for this puzzling behavior. One possibility is that low cash holdings are a result of potential or actual agency problems. If some managers tend to invest inefficiently, their boards of directors might limit the amount of cash at the disposal of managers in order to avoid the inefficient spending. Alternatively, entrenched managers might routinely waste cash reserves, leaving the firm with low cash holdings. A second possibility is that low cash constrained firms exhibit weaker financial health, so they are either unable to accumulate cash reserves and/or are forced to draw down on previous balances of cash. Third, it is possible that the costs of external finance are lower for some constrained firms than for others. If so, and if we measure "normal" cash holdings with error, the optimal cash holdings for firms with lower costs of external finance will simply be lower. Finally, some constrained firms may hold less cash because they choose to manage liquidity needs through means other than cash balances, for example, lines of credit (see Sufi 2009).

We begin our analysis of these possibilities by comparing the characteristics of low cash constrained firms with those of high cash constrained firms. Specifically, we partition the sample of constrained firms according to their abnormal cash holdings, where firms with the ratio of abnormal cash holdings to total assets below (above) the median are classified as low (high) cash firms. To test the agency explanation, we measure managerial incentives as the percentage of equity (common stock + options) held by the top executive officer (CEO ownership) and by top executive officers (insider ownership), as reported in S&P's Execucomp database.[12] We also test whether the low cash firms invest more than their high cash counterparts.

As reported in Table 7, CEO ownership and insider ownership are of similar magnitude for low and high cash constrained firms across all financial constraint criteria.[13] A Wilcoxon signed-ranks test fails to reject the equality of the distributions of CEO (insider) ownership for the low and high cash subsamples for two (three) out of the four financial constraint criteria. It thus appears that managers of low and high cash constrained firms have similar incentives. Furthermore, the average net investment is lower for low cash firms than for high cash constrained firms and the Wilcoxon test rejects the equality of the

[12] Because the S&P Execucomp data start in 1992 and include a limited number of firms, we check whether the main results hold for the firms with ownership data available from Execucomp. The results are similar to those obtained for the full sample.

[13] We report average values of all characteristics in Table 7. Because we find qualitatively identical results using median values, we do not report medians in the table, but instead conservatively report statistical significance by using the nonparametric Wilcoxon test.

Table 7
Univariate comparison of financially constrained firms

		Financial constraint criteria							
		Payout		Size		Bond ratings		Paper ratings	
Cash		Low (A)	High (B)	Low (A)	High (B)	Low (A)	High (B)	Low (A)	High (B)
CEO ownership	Mean	0.056	0.051	0.079	0.073	0.059	0.063*	0.052	0.054*
Insider ownership	Mean	0.096	0.088	0.130	0.125	0.101	0.105	0.089	0.092*
Net investment	Mean	0.024	0.025	0.027	0.035*	0.029	0.033*	0.028	0.031*
Cash flow	Mean	0.022	0.032*	0.012	0.026*	0.037	0.051*	0.040	0.050*
z-score	Median	3.362	3.758*	3.719	6.050*	3.994	5.460*	3.596	3.949*
Interest coverage	Mean	11.863	24.654*	11.663	26.886*	15.376	30.487*	13.590	24.605*
Three-year change in margin	Mean	−0.002	0.014*	0.000	0.021*	−0.004	0.008*	−0.003	0.008*
Value of debt issued	Mean	0.082	0.108*	0.103	0.163*	0.079	0.103*	0.078	0.093*
Value of equity issued	Mean	0.053	0.062*	0.056	0.064*	0.049	0.051*	0.055	0.061*
Analyst coverage	Mean	56.0	64.2*	22.9	28.8*	42.6	46.5*	53.1	57.2*

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. The sample includes financially constrained firms only. Firms with the ratio of abnormal cash holdings to total assets below (above) the median are classified as low (high) cash firms. Cash flow and net investment are deflated by total book assets. CEO ownership and insider ownership are the percentage of equity (common stock + options) held by the top executive officer and by top executive officers, respectively, as reported by S&P's Execucomp database. Analyst coverage is the number of annual analyst recommendations for a firm. The value of debt issues is long-term debt issuance net of reduction over total book assets. The value of equity issues is one-year change in the number of stocks outstanding adjusted for stock splits multiplied by the fiscal year close price. Three-year change in margin is the change in cash flow margin over the prior three-year period. Cash flow margin is income before extraordinary items plus depreciation and amortization over sales. *z*-score is Altman's (1968) *z*-score. Interest coverage is earnings before interest and tax divided by interest expense. Mean values of each variable are reported, except for *z*-score where we report the median due to extreme observations. * denotes that the value for high cash firms is significantly different from that of low cash firms at the 0.05 level using the Wilcoxon signed-ranks test.

distributions for three constraint criteria. Thus, there is little support for the view that low cash constrained firms exhibit greater incentive problems or agency problems of overinvestment than do high cash constrained firms.

There is evidence, however, that the low cash constrained firms exhibit weaker financial health than the high cash constrained firms. Average operating cash flow is lower for the low cash firms, as is the average growth in the cash flow margin. Moreover, low cash constrained firms exhibit lower Altman's *z*-scores and interest coverage ratios. Thus, a plausible explanation for the low cash holdings of some constrained firms is that poor financial performance has drained prior cash reserves and/or prevented the firm from building the appropriate level of cash reserves.

Finally, the evidence in Table 7 indicates that the volume of external debt and equity issues is lower in low cash constrained firms. We measure the value of debt issues as long-term debt issuance net of long-term debt reduction over total book assets. The value of equity issues is calculated as the one-year change in the number of shares outstanding (adjusted for stock splits) multiplied by

the fiscal year close price.[14] Using these measures, low cash firms issue less debt and less equity as a fraction of total book assets than high cash firms. Moreover, using the number of annual analyst recommendations for a firm to measure analyst coverage,[15] we find that low cash firms receive less analyst coverage than high cash firms. Under the assumption that firms with lower analyst coverage face greater information asymmetries between managers and outside investors, these findings imply that low cash firms face higher costs of external financing.[16]

To summarize, the abnormally low cash holdings of some constrained firms cannot be explained by incentive problems, agency costs of overinvestment, or lower costs of external finance. There is evidence, however, that the firms with low cash balances appear to be in a weaker financial condition than high cash constrained firms. This appears to inhibit their ability to maintain higher cash balances. Moreover, because Sufi (2009) shows that revolving lines of credit serve as a viable liquidity substitute only in firms that maintain high cash flow, the weak financial condition makes it less likely that the low cash balances can be explained by lines of credit serving as an alternative source of liquidity.

To provide further evidence on these issues, Figure 1 plots the evolution of cash flows and free cash flows (cash flow—capital expenditures—R&D) for the low cash constrained firms over the prior ten years.[17] These data show that the low cash firms exhibit declining cash flows and free cash flows over this period. Cash flows average nearly 8% of total assets in year −10, but fall to approximately 1.5% of total assets by year 0. Strikingly, free cash flows are negative over the entire period and fall from an average of around −4% of total assets in year −9 to −8% of total assets in year 0. Figure 1 also reports annual net investment and cash holdings for the low cash constrained firms. These data indicate that both investment and cash holdings are reasonably stable over years −10 to −4, but decline over years –4 through 0.

These findings imply that low cash constrained firms exhibit persistently low and declining cash flows relative to investment needs. This appears to prevent them from building cash reserves, which may, in turn, constrain them from undertaking some investment opportunities. Of course, the averages depicted in Figure 1 might obscure much of the cross-sectional variation in the association between cash flows, cash holdings, and investment. Thus, to provide more formal evidence on these ideas, we conduct two additional tests in which we

[14] Results are similar when the value of equity issues is calculated as the change in Treasury stock multiplied by the fiscal year close price.

[15] We obtained the data on analyst recommendations from the IBES database. Analyst coverage information is available for 24,840 firm-year observations.

[16] Brennan and Subrahmanyam (1995) and Chung and Jo (1996), among others, report evidence consistent with the hypothesis that analysts disseminate firm-specific information to investors. We obtain similar results if we use idiosyncratic stock return volatility as a measure of information asymmetry.

[17] The results in Figure 1 use payout and bond ratings as the measures of financial constraints. We find qualitatively similar patterns if we use our other measures of constraints.

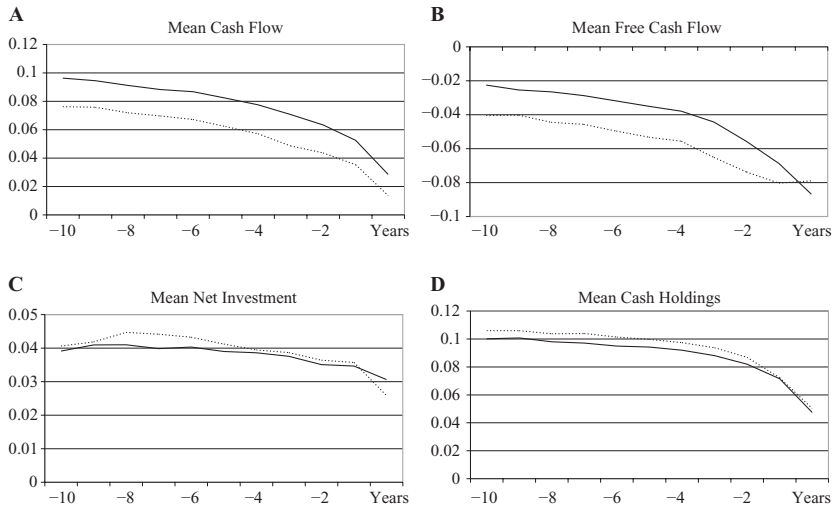

Figure 1
Characteristics of low cash constrained firms
Data are from Compustat for the period of 1985–2006. We exclude companies that belong to the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. Values reported are for low cash constrained firms. Dashed lines represent payout constraint criterion and solid lines represent bond rating constraint criterion. See the text for definitions of financial constraint criteria. Cash flow, free cash flow, net investment, and cash holdings are deflated by contemporaneous total book assets. Mean values of each variable are reported.

contrast the behavior of the low cash and high cash constrained firms. First, we estimate regressions of the sensitivity of cash holdings to cash flows as in Almeida, Campello, and Weisbach (2004). In the presence of low cash flows, it becomes very difficult for constrained firms with low cash balances to cover cash shortfalls through reductions in cash reserves. Thus, at this point, cash balances become less sensitive to cash flow. Consistent with this hypothesis, the results in panel A of Table 8 indicate that the cash flow sensitivity of cash is significantly lower for low cash constrained firms than for high cash constrained firms. Nonetheless, these findings are also consistent with the low cash firms managing liquidity through other means, such as lines of credit. Sufi (2009) finds that firms with available bank lines of credit exhibit lower cash flow sensitivities of cash.

To distinguish these hypotheses, we conduct a second test in which we replicate our 3SLS net investment regressions from Table 4 after partitioning the constrained firms into low cash and high cash subsamples. If low cash flow sensitivities of cash reflect an inability to build cash reserves, we expect the low cash firms to exhibit a high sensitivity of investment to cash flow. In contrast, if low cash flow sensitivities of cash are a reflection of firms managing liquidity through other means (e.g., lines of credit), we do not expect any difference between the investment-cash flow sensitivities of low cash and

Table 8
Determinants of changes in cash and net investment

	Payout			Size			Bond ratings			Paper ratings		
Cash	Low	High	*p*-value	Low	High	*p*-value	Low	High	*p*-value	Low	High	*p*-value
					Panel A: Cash flow sensitivity of cash							
Net cash flow	0.103***	0.265***	0.00	0.152***	0.262***	0.08	0.148***	0.324***	0.00	0.112***	0.242***	0.01
	(3.22)	(7.24)		(4.97)	(4.71)		(7.60)	(16.04)		(5.14)	(5.76)	
Capex	0.023	−0.035	0.16	0.038	−0.020	0.42	−0.010	−0.078***	0.04	0.006	−0.045*	0.07
	(0.98)	(1.03)		(1.15)	(0.31)		(0.57)	(2.95)		(0.41)	(1.94)	
Acquisitions	−0.018	−0.263***	0.00	−0.014	−0.242***	0.00	−0.010	−0.238***	0.00	−0.009	−0.212***	0.00
	(1.17)	(8.28)		(0.56)	(5.43)		(0.87)	(12.69)		(1.29)	(11.94)	
NWC change	−0.067***	−0.169***	0.00	−0.102***	−0.245***	0.00	−0.103***	−0.234***	0.00	−0.085***	−0.188***	0.00
	(3.38)	(6.02)		(4.44)	(5.77)		(8.07)	(12.52)		(6.85)	(9.21)	
Adj. R^2	2.37%	7.31%		3.52%	7.45%		3.86%	9.80%		2.86%	7.79%	
Observations	11,593	11,786		6549	5883		17,589	17,476		23,307	22,996	
					Panel B: Investment-cash flow sensitivity							
Cash flow	0.105***	0.085***	0.04	0.100***	0.081***	0.10	0.099***	0.083***	0.03	0.100***	0.076***	0.00
	(16.06)	(12.29)		(14.07)	(9.05)		(20.00)	(15.16)		(21.93)	(15.71)	
Cash holdings	0.087***	0.083***	0.87	0.093***	0.078***	0.60	0.061***	0.061***	1.00	0.094***	0.064***	0.08
	(3.80)	(7.83)		(3.77)	(5.64)		(3.64)	(7.55)		(5.99)	(8.98)	
Market-to-book	0.009***	0.005***	0.00	0.009***	0.005***	0.01	0.009***	0.005***	0.00	0.008***	0.005***	0.00
	(9.92)	(7.21)		(7.84)	(4.79)		(13.64)	(8.78)		(13.74)	(10.48)	
Lag (sales growth)	0.006***	0.006***	1.00	0.006***	0.003***	0.03	0.004***	0.006***	0.00	0.005***	0.006***	0.12
	(8.51)	(10.57)		(5.55)	(3.50)		(7.84)	(12.10)		(9.87)	(14.88)	
Observations	10,655	9865		5470	4277		15,879	14,207		21,864	19,944	

Data are from Compustat for the period of 1985–2006. We exclude companies from the financial (SIC 6000–6999) and utility (SIC 4910–4939) industries. We also exclude firms with total book assets less than twenty-five million in constant 1994 dollars and firm-years with nonpositive assets or cash holdings, or negative capital expenditures. See the text for definitions of financial constraint criteria. The dependent variable in panel A is the change in cash holdings. The dependent variable in panel B is net investment, defined as capital expenditures net of depreciation in year $(t + 1)$. The models are estimated separately for low cash and high cash constrained firms, where low (high) cash firms are defined as those with abnormal cash below (above) the median. Cash flow, capital expenditures, acquisitions, net working capital change, and cash holdings are deflated by total book assets. Prior growth is measured as growth in sales for the past two years. Regressions in panel A are estimated using firm fixed effects and clustered standard errors. Regressions in panel B are estimated using the 3SLS methodology, and include industry fixed effects and calendar-year dummies. Industry is defined at the two-digit SIC level. The unreported cash holdings model in panel B has cash-to-total assets as the dependent variable and firm size, market-to-book ratio, leverage, prior twenty-year industry cash flow volatility, duration of cash cycle, operating cash flow, likelihood of financial distress, return spread between a firm's investments and the return on Treasury bills, and log of the growth rate of industrial production as control variables. The structure of standard errors in panel B allows for unstructured correlation across models. *** and * denote significance at the 1, 5, and 10% levels, respectively. Coefficient estimates are reported with *t*-statistics (*z*-statistics) in parentheses in panel A (panel B) below.

high cash constrained firms. The results, presented in panel B of Table 8, show that the low cash constrained firms exhibit a significantly higher sensitivity of investment to cash flow than do the high cash constrained firms.

We interpret these collective findings as follows. Low cash constrained firms appear to be unable to build cash reserves due to low and declining cash flows. As a result, their cash balances are less sensitive to cash flows, while their investment expenditures are more sensitive to fluctuations in cash flows than are those of high cash constrained firms. In other words, because the low cash firms exhibit persistently negative free cash flows, but face high costs of external finance, they appear to essentially spend available cash flow on investment projects, leaving little for additions to their cash balance.

6. Conclusions

Previous studies have found that higher cash holdings are associated with a higher firm value and that this positive association is significantly stronger for financially constrained firms than for unconstrained firms. We extend this literature by analyzing (i) why cash holdings are more valuable for constrained firms, and (ii) why some constrained firms appear to hold too little cash. Our results indicate that higher cash holdings are associated with higher levels of investment for constrained firms with high hedging needs and that there is a significantly stronger positive association between investment and value for constrained than for unconstrained firms. We interpret these findings as consistent with the view that higher cash holdings of financially constrained firms are a value-increasing response to costly external financing. That is, higher cash holdings allow the firm to undertake positive net present value projects that would otherwise have been bypassed. Our findings are inconsistent with the view that constrained firms maintain higher cash balances to facilitate empire-building overinvestment.

If cash is so valuable for constrained firms, why do some constrained firms hold so little cash? Our analysis indicates that low cash constrained firms exhibit persistently low and declining free cash flows over a ten-year period. As a result, these firms are unable to build adequate cash reserves, and their investment expenditures become highly dependent on current cash flows.

Our findings complement and extend those in Almeida, Campello, and Weisbach (2004) and Faulkender and Wang (2006). While their findings indicate that constrained firms are more likely to save cash out of their cash flow, our findings show that this behavior is value increasing because it allows the firms to take on valuable investment opportunities. Together, the results of our study and that of Almeida, Campello, and Weisbach (2004) support the view that firms can mitigate the adverse effects of financial constraints by adopting a policy of greater cash retention.

In this sense, our findings also have implications for the literature on corporate payout policy. In the presence of costly external finance, payout policy is

relevant to stockholders because it impacts the ability of firms to undertake all future positive net present value projects. A payout that is too high constrains investment while a payout that is too low potentially creates agency problems of free cash flow. Our findings thus provide indirect support for life cycle-based theories of optimal payout policy in which younger, higher growth firms limit dividends in order to conserve cash, while more mature, lower growth firms increase payouts to mitigate overinvestment problems (see, for example, DeAngelo and DeAngelo 2006).

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