

*Journal of***APPLIED CORPORATE FINANCE**

A MORGAN STANLEY PUBLICATION

In This Issue: Private Equity, Capital Structure, and Payout Policy

Private Equity: Past, Present, and Future	8	<i>An Interview with Steve Kaplan, University of Chicago</i>
Global Debt Markets in 2007: New Paradigm or the Great Credit Bubble?	17	<i>Edward I. Altman, New York University</i>
The Return of the Recap: Achieving Private Equity Benefits as a Public Company	32	<i>Anil Shivdasani, University of North Carolina, and Adrián Zak, Citigroup</i>
Share Repurchases and the Need for External Finance	42	<i>Matthew T. Billett, University of Iowa, and Hui Xue, Kansas State University</i>
The New Wave of Hybrids—Rethinking the Optimal Capital Structure	56	<i>Kevin Ryan, Jonathan Ross, and Jacqueline Yen, Morgan Stanley</i>
The Influence of Credit Ratings on Corporate Capital Structure Decisions	65	<i>Darren J. Kisgen, Boston College</i>
What is the Market Value of a Dollar of Corporate Cash?	74	<i>Lee Pinkowitz and Rohan Williamson, Georgetown University</i>
Mind the Information Gap: Putting New Selection Criteria and Deal Structures to Work in M&A	82	<i>Roberto Ragozzino, University of Illinois at Chicago, and Jeffrey J. Reuer, University of North Carolina</i>
Estimating the Cost of Risky Debt	90	<i>Ian A. Cooper, London Business School, and Sergei A. Davydenko, University of Toronto</i>
How Good are Private Equity Returns?	96	<i>Robert M. Conroy and Robert S. Harris, Darden School, University of Virginia</i>
Big is Better: Growth and Market Structure in Global Buyouts	109	<i>Peter Cornelius, Broes Langelaar, and Maarten van Rossum, AlPInvest Partners</i>
The Convergence of Public and Private Equity Markets: Cyclical or Structural?	117	<i>Jason Draho, Morgan Stanley</i>

What is the Market Value of a Dollar of Corporate Cash?

by Lee Pinkowitz and Rohan Williamson, Georgetown University*

A lot of public companies today are asking themselves the question, “How much cash do we really need to operate our business, and what’s the value to our shareholders of our having another dollar of cash on our balance sheet?”

In the financial economist’s “frictionless dream world” of perfect capital markets, as Merton Miller was fond of calling it, these questions would be “irrelevant,” a matter of indifference to companies and their investors. That is to say, in a tax-free economy where investors were fully informed about a company’s earnings prospects, where troubled companies could be reorganized quickly and costlessly, and where managers could always be counted on to make value-maximizing operating and investment decisions, a dollar of cash on the corporate balance sheet would have to be worth a dollar to investors—no more, no less.

But in the “real world” of taxes and major information and agency problems, the corporate cash decision can have considerable consequences for corporate values. In an article called “The Paradox of Liquidity,”¹ Stewart Myers and Raghuram Rajan described corporate cash holdings as a “double-edged sword.” For smaller, riskier companies with limited access to capital markets and promising investment opportunities, cash can serve as a value-preserving buffer against adverse outcomes (including the possibility of Chapter 11) as well as a low-cost means of funding growth opportunities. But there is also a clear downside for investors of excess corporate cash: the well-documented tendency of corporate managers in mature, cash-generating companies to retain excess cash instead of paying it out to shareholders—and then spend it on value-reducing projects such as diversifying acquisitions.² Economists refer to the loss in value attributable to such behavior as the “agency costs of free cash flow.”

Faced with these potential corporate uses and misuses of cash, investors should assign a value to a company’s cash

holdings based on their assessment of how management will eventually use the funds. To investigate this possibility, we recently conducted a study of the liquid assets—that is, cash plus marketable securities—of some 13,000 U.S. companies over a 40-year period (1965-2004) that attempts to determine the value that investors effectively attribute to such assets.³

The findings of our study suggest that, on average, shareholders value the marginal dollar of corporate cash at roughly its face value. At the same time, however, we find considerable variation among companies in the values assigned to their cash, with values ranging from virtually worthless to as much as \$1.60. And as discussed below, these values appear to vary in a “systematic,” or fairly predictable, way with certain corporate characteristics.

Our study also suggests that the value of cash differs significantly, and in fairly predictable ways, among different industries. In 15 of the 43 industries we examined, the marginal dollar of cash appears to have been valued at well below \$1.00. By contrast, in growth industries such as computer software and pharmaceuticals, the marginal dollar of cash appears to be worth significantly more than face value. Overall, we find that the liquid assets of riskier companies with significant growth opportunities tend to command premium values while higher cash holdings by mature firms with less volatile cash flows and limited investment opportunities appear to be penalized by market investors.

More on Why Companies Hold Cash (and How Investors Feel About It)

Before describing our study and its findings, we will say a bit more about possible corporate motives for holding cash. As already noted, cash holdings are often viewed by corporate managers as at worst “value neutral” or, in finance terms, zero net present value (NPV) investments. As such, each additional dollar of cash should increase the market value of the firm

* The authors thank the Capital Markets Research Center at Georgetown University, the Steers Faculty Research Fellowship, the Dean’s Leadership Fund, the Beit Faculty Research Fellowship, and the Holowesko Faculty Research Fellowship for financial support.

1. S. C. Myers, and R. G. Rajan, 1998, “The Paradox of Liquidity,” *Quarterly Journal of Economics* 108, 733-771.

2. See Michael Jensen, 1986, “Agency Costs of Free Cash Flow, Corporate Finance and Takeovers,” *American Economic Review*, Vol. 76, pp. 323-339.

3. While the subject of corporate liquid assets has been explored in the financial economics literature, most studies of the subject have attempted to explain why companies hold the levels of cash they do, and the effect of such decisions on corporate investment policy. For the most part, previous studies have used the level of corporate cash

holdings to determine whether managers waste cash or use it for purposes that increase firm value. See, for instance, C.S. Kim, D.C. Mauer, and A.E. Sherman, 1998, “The Determinants of Corporate Liquidity: Theory and Evidence,” *Journal of Financial and Quantitative Analysis* 33, 305-334; Harford, J., 1999, “Corporate Cash Reserves and Acquisitions,” *Journal of Finance* 54, 1969-1997; Opler, T., L. Pinkowitz, R. M. Stulz and R. Williamson, 1999, “The Determinants and Implications of Corporate Cash Holdings,” *Journal of Financial Economics* 52, 3-46; W. H. Mikkelson and M. Partch, 2003, “Do Persistent Large Cash Reserves Hinder Performance,” *Journal of Financial and Quantitative Analysis* 38, 275-294, and Hartzell, J. S. Titman, and G. Twite, 2005, “Why Do Firms Hold So Much Cash? A Tax-Based Explanation,” University of Texas working paper. »

by one dollar. But, as we also observed, the realities of taxes, informationally disadvantaged investors, and managers with incentives to hoard or waste cash on uneconomic projects suggest that companies can have too much cash—or, in some cases, too little. As an example of the latter, if a small, high-growth company with little or no debt capacity would incur large costs in raising outside equity on short notice (including major dilution associated with issuing undervalued equity), then holding a cushion of liquid assets could clearly preserve value by protecting management's ability to carry out its strategic plan. In such cases, investors may effectively assign a value of well above \$1.00 on the firm's marginal dollar of cash because it helps ensure that management will be able to fund its growth opportunities. But in a large, established company with stable cash inflows, few promising growth options, and well-developed access to capital markets, such a cushion of liquid assets often leads to unwise investments; and even when left on the balance sheet, such cash can create a false sense of well-being and blunt the drive for efficiency. For all these reasons, large cash holdings by mature companies tend to attract the attention of hedge funds and other active investors.

The implication, then, is that cash can have both benefits and costs to shareholders. Particularly for companies with limited access to capital markets, an additional dollar of cash can create value up to the point where it can be used to fund the firm's stock of positive-NPV projects. Beyond that point, the costs of holding cash begin to exceed the benefits, and additional cash becomes a drag on firm value.

Estimating the Market Value of Cash Holdings

In designing our tests of the market value of cash holdings, we reasoned that corporate managers, when making the trade-off between the benefits and costs of holding more cash, should (and in most cases do) aim to determine the optimal level by considering two main aspects of the business: (1) the nature and extent of its *investment opportunities* (including possibilities that academics sometimes refer to as “out-of-the-money growth options”) and (2) the *risk* stemming from both the volatility of the firm's current cash flow and uncertainty about when and how the growth opportunities will emerge. Stated as broadly as possible, the principle that ought to guide the corporate cash decision is whether the cash enables the

company to generate higher returns (adjusted for the level of risk) than if it were returned to shareholders. And as we noted earlier, shareholders effectively assess what companies are likely to do with their cash based on characteristics such as the firm's industry, the extent and promise of its growth opportunities, and the risks associated with them.⁴

The Hypotheses. Investors, of course, want companies with good investment opportunities to be able to fund them. But if financial slack can be valuable in firms with good investment opportunities, cash is likely to be wasted in those with few good investment projects. Thus, for most companies, the main determinant of the value of cash holdings should be the firm's investment opportunity set. We formulated our first hypothesis as follows: *The value of corporate cash should be positively related to the amount and quality of the firm's investment opportunities.*

Also potentially important in making the corporate cash decision is the predictability of the firm's investment opportunities. For companies with relatively predictable investment outlays, it is likely to be easier, and less costly, to raise outside capital to undertake investments. With stable capital expenditures, companies can either budget internal cash for projects or enter the capital markets ahead of time. By contrast, companies with relatively limited access to capital markets and less predictable investment opportunities—often referred to as “growth options”⁵—will likely want to hold extra cash to take advantage of such options when they materialize or come “into the money.” And this brings us to the second hypothesis that we were able to test: *The value of cash should be positively related to the uncertainty of a firm's investment program.*

The third hypothesis we tested has to do with another form of uncertainty—the risk of the current operating business itself. That possibility was expressed as follows: *The value of cash should be positively related to the volatility of the company's operating cash flow stream.*

The Model. To estimate the marginal contribution of a company's cash holdings to its value, we first needed a valuation model that expresses the value of the firm as a function of several key variables, including holdings of liquid assets. Building on a model developed by Gene Fama and Ken French in a 1998 article,⁶ we came up with the following regression:

More recent studies have begun to address the issue of the value of cash. See M. Faulkender and R. Wang, 2006, “Corporate Financial Policy and the Value of Cash,” *Journal of Finance* 61, 1957-1990, L. Pinkowitz, R. Stulz, and R. Williamson, 2006, “Does the Contribution of Corporate Cash Holdings and Dividends to Firm Value Depend on Governance? A Cross-country Analysis,” *Journal of Finance* 61, 2725-2751, and A. Dittmar and J. Mahrt-Smith, 2007, “Corporate Governance and the Value of Cash Holdings,” *Journal of Financial Economics* 83, 599-634.

4. The degree to which a firm has access to external capital and its governance structure are also characteristics that are likely to affect the value of cash holdings. For evidence along these dimensions, see Faulkender and Wang (2006) and Dittmar and Mahrt-Smith (2007) in footnote 3.

5. In the absence of outside funding on reasonable terms, the volatility of a company's

investment program would likely be driven by the variation in its annual cash flow. Firms with relatively stable cash flows are better able to determine how much will be available for unexpected investments. Both of these are consistent with a real option value-to-cash holdings. Option pricing theory shows that option values increase with the volatility of the underlying asset. In our case, the underlying asset is the investment program of the firm; hence, we expect cash to be less valuable for firms with more stable investment programs.

6. E. F. Fama and K. R. French, 1998, “Taxes, Financing Decisions, and Firm Value,” *Journal of Finance* 53, 819-843. Although this valuation regression is ad hoc in the sense that it is not a functional form that results directly from a theoretical model, it is well-suited for our purpose because it does a good job of explaining cross-sectional variation in firm values.

$$V_{i,t} = \alpha_i + \gamma_t + \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} + \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} + \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} + \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} + \beta_{16} dL_{i,t} + \beta_{17} dL_{i,t+1} + \varepsilon_{i,t} \quad (1)$$

where V is the market value of the firm calculated at fiscal year end as the sum of the market value of equity and the book values of short-term debt and long-term debt; E is earnings before extraordinary items plus interest, deferred tax credits, and investment tax credits; L is liquid asset holdings (cash plus marketable securities); NA is net assets (defined as total assets minus liquid assets); RD is research and development expense; I is interest expense; and D is common dividends paid. In this regression framework, the coefficient on the change in cash holdings, β_{16} , can be viewed as a measure of the market value shareholders place on a marginal dollar of cash.

In addition to our primary valuation model, we also used a model that replaces the lagging and leading *changes* in cash⁷ with the *levels* of cash.⁸ The model is as follows:

$$V_{i,t} = \alpha_i + \gamma_t + \beta_1 E_{i,t} + \beta_2 dE_{i,t} + \beta_3 dE_{i,t+1} + \beta_4 dNA_{i,t} + \beta_5 dNA_{i,t+1} + \beta_6 RD_{i,t} + \beta_7 dRD_{i,t} + \beta_8 dRD_{i,t+1} + \beta_9 I_{i,t} + \beta_{10} dI_{i,t} + \beta_{11} dI_{i,t+1} + \beta_{12} D_{i,t} + \beta_{13} dD_{i,t} + \beta_{14} dD_{i,t+1} + \beta_{15} dV_{i,t+1} + \beta_{16} L_{i,t} + \varepsilon_{i,t} \quad (2)$$

In this case the coefficient of interest, β_{16} , is the level of cash. For the rest of this article, we refer to the regression in equation (1) as reflecting the “change values” and the second regression as capturing the “levels values.”

General Findings. We tested our three hypotheses using 40 years (from 1965-2004) of annual data on 12,888 different companies. When we estimated the regression in equation 1, we found that the coefficient for the change in cash was \$1.04.⁹ This is pretty much what we would expect, since it confirms our intuition that if the majority of U.S. companies are holding roughly optimal levels of cash—or at least not departing too far from the optimum—then the marginal value of corporate cash holdings should be close to \$1.00. Thanks to the precision of the estimate (with a standard error of just \$0.06), the 90% confidence interval for the value of an extra dollar of cash falls within the narrow range of \$0.95 to \$1.14.

When we then estimated the regression in equation (2), the value of cash turned out to be \$0.94, with a standard error of nearly \$0.08 and a 90% confidence level stretching from \$0.81 to \$1.07. Based on these two estimates, on average, investors appear to value an additional dollar of cash at roughly its face value. However, let’s now look at how these values vary with differences in corporate characteristics.

How Values Vary with Firm Characteristics. Our three hypotheses led us to expect that the value of a company’s cash holdings would depend on the quality and predictability of its investment opportunities, and on the volatility of its operating cash flow. We attempted to test each of these predictions by developing “proxy variables,” or testable measures, for each of these three characteristics—for example, sales growth was one proxy we chose for quality of investment opportunities—and then dividing up our sample of companies on the basis of such proxies. For each proxy variable, we ranked a company as “high” if it was in the top 30% of all firms in the previous year, and “low” if in the bottom 30%. For example, a company that was among the top 10% of U.S. firms in sales growth rates in 1999 would have been ranked as high growth for the year 2000. The benefit of classifying companies in this way is that it allows them to change groups over time as their businesses change.

In Table 1 we report our findings on the value of liquid assets for those companies at the two ends of the distribution (while ignoring the middle 40% of all firms).¹⁰ As mentioned earlier, the results estimated with equation (1) are called “change values,” while those estimated using equation (2) are “level values.” (The bold italicized coefficients reported in the table are those that differ significantly from \$1.00 at the 5% level, while the asterisks indicate the level of significance for the *differences* between the values assigned to cash for high- and low-ranked firms.)

To test our first hypothesis—that companies with better investment and growth opportunities should have higher marginal valuations of their cash holdings—we came up with three different proxy variables for investment opportunities: sales growth rates, research and development (R&D) expenditures, and capital expenditures. While the use of sales growth is fairly obvious, companies that spend more on R&D or capital projects are also likely to have better growth opportunities than other firms.

Sales growth was defined as the one-year growth rate. Rather than classify companies according to their level of R&D expenditures, we simply divided the sample into those companies that reported positive R&D expenses and those that reported zero expenses for the year, (without excluding the middle 40%). Capital expenditures were expressed as a percentage of total assets to capture differences in firm size and scale.

Overall, the evidence summarized in the top panel of Table 1 is supportive of our hypothesis that cash holdings are more valuable for companies with better investment oppor-

7. In our notation system, for any variable “X,” we used X_t to represent 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 $t-1$ to year t , divided by the book value of assets in year t ($(X_t - X_{t-1})/Assets_t$). Similarly, dX_{t+1} indicates the change in the level of X from year t to year $t+1$, divided by the book value of assets in year t ($(X_{t+1} - X_t)/Assets_t$). In an effort to control for unobservable factors, the regression also includes firm-specific effects (α_i) as well as time effects (α_t).

8. See Pinkowitz, L., R. Stulz, and R. Williamson (2006) listed in footnote 3.

9. With panel data, the observations are unlikely to all be independent. To address this, we estimate all our standard errors clustering by firm.

10. The regressions are run using dummy variables for high, middle, and low ranking interacted with every independent variable. However, firm and time effects are assumed constant across the rankings groups.

Table 1 **Value of Cash Based on Firm Characteristics**

Low and High refer to the bottom or top 30% of the variable. Firms are re-ranked each year from 1965-2004. Change Value means that the coefficient is β_{16} from the regression model in equation (1). Level Value means that the coefficient is β_{16} from the regression model in equation (2). *, **, and *** indicate that the coefficient is larger than the other category at the 10, 5, and 1 percent levels respectively. Coefficients which are italicized and bold are significantly different from \$1.00 at the 5% level.

		Change Value	Level Value
H1: Investment Opportunities – A better investment set makes cash more valuable			
Sales Growth: Higher sales growth firms should have more valuable cash	Low Sales Growth	0.84 (0.101)	0.54 (0.092)
	High Sales Growth	1.08* (0.093)	1.09*** (0.105)
Research and Development: Firms which conduct R&D should have more valuable cash	No R&D	0.90 (0.082)	0.88 (0.091)
	Conducts R&D	1.09* (0.074)	0.99 (0.110)
Capital Expenditures: Firms which invest more should have more valuable cash	Low Capex	0.88 (0.093)	0.72 (0.098)
	High Capex	1.13* (0.103)	1.20*** (0.115)
H2: Uncertainty of Investment Program – Greater predictability makes cash less valuable			
Capital Expenditure Volatility: Firms with more variable capital investments should have more valuable cash	Low Capital Expenditure Volatility	0.72 (0.121)	0.50 (0.123)
	High Capital Expenditure Volatility	1.37 *** (0.153)	0.99*** (0.146)
H3: Uncertainty of Operating Cash Flow – Greater predictability makes cash less valuable			
Cash Flow Uncertainty: Firms with more uncertain cash flows should have more valuable cash	Low Cash Flow Volatility	0.51 (0.090)	0.49 (0.133)
	High Cash Flow Volatility	1.22 *** (0.111)	0.83** (0.149)

tunities. In both the change and level regressions, companies with higher sales growth had significantly higher values placed on their cash than firms with lesser sales growth. And the same was true of companies that reported R&D expenses (although the difference in this case was not statistically significant using the level regression). Lastly, in both regressions, the cash of companies with higher capital expenditures had a greater marginal value than cash of the firms with the lowest expenditures.

In our level regressions, when we used sales growth and capital expenditures to measure investment opportunities, the cash of companies with a more limited investment set appeared to be valued at a significant discount-to-face value. This is consistent with shareholder concern that managers will waste excess cash on value-reducing investments. On the other hand, we do not find cash valued at a statistically significant premium to face value in any of the tests of H1. Nonetheless, in five of our six tests of our first hypothesis,

we find that the cash of companies with better investment opportunities is valued at a significant premium to the cash of firms with lesser opportunities.

In addition to their statistical significance, the extent of the differences between the coefficients could be interpreted as indicating that the differences are economically large as well. Across the six tests, the *differences* in the marginal value of a dollar between the two groups ranged from a low of 11 cents to as much as 55 cents. What this suggests is that the marginal dollar of cash at a large, mature company could be worth as little as half what that dollar would be worth in a company with strong growth potential.

We tested our second hypothesis—that companies with more predictable, or less volatile, investment programs have lower valuations associated with their cash holdings—by classifying companies according to the standard deviation of their capital expenditures over the previous 10-year period.¹¹ As reported in the middle panel of Table 1, the value of cash

11. While we use a 10-year rolling window, we include companies with at least five years of data in that period. Otherwise, the 10-year window becomes very restrictive and we lose many firms.

holdings was significantly greater for companies with higher volatility in capital spending.

In support of our third hypothesis, we found very similar results when using the volatility of the firm's operating cash flow, which is not surprising since cash flow and capital expenditures tend to be strongly correlated. The coefficients are significantly larger in all four regressions reported in the bottom half of Table 1, suggesting that volatility in and uncertainty about both cash flow and investment have clear effects on the value of cash.

Again, in addition to the statistical significance, the economic import of the findings seems large, with differences in the coefficients that range from 0.33 to 0.71. For companies with low volatility in their cash flow or capital expenditures, we find that the value of the marginal dollar of cash is significantly less than \$1.00 in all the regressions. Moreover, in the change regressions, the value of cash is significantly greater than \$1.00 for high-volatility firms.

In sum, the evidence in Table 1 provides strong support for our second and third hypotheses. A company's cash holdings effectively provide it with the means of exercising a growth option, if you will, and that option is more valuable when the volatility of the underlying business and investment program is greater.

The Value of Cash in Different Industries

While the marginal dollar of cash is valued at roughly \$1.00 across all companies, that value appears to vary significantly with the volatility of the corporate cash flow stream and with the level and predictability of its investment opportunities. To further examine these cross-sectional differences, we divided our sample companies into 43 industries to see whether the value of cash is affected by a firm's line of business.¹² Given our three hypotheses and the results of our earlier tests summarized in Table 1, we expected to find that cash is more valuable in industries with more abundant, and less predictable, investment opportunities such as high-tech companies. At the same time, we expected that industries generating higher, and relative stable cash flows, would have lower values assigned to their marginal cash holdings.

For each of the 43 industries, we first determined the median leverage and cash/assets ratios for each of the 40 years in our sample period (1965-2004). Then, for all 43 industries, we calculated the means of the 40 annual medians. Table 2 reports summary statistics for each industry, including the number of companies and observations, the estimated value of an additional dollar of cash, and the statistical range of the estimate with a 90% confidence interval.¹³

As can be seen in Table 2, there is considerable variation

across the industries in each of the categories. First, in terms of the number of firms representing each industry, our sample of almost 13,000 companies contained as few as 17 firms in one industry ("tobacco") and as many as 1,080 firms in another (computer software). Leverage ratios differed sharply across industries, with debt ranging from roughly 8% of firm value for pharmaceuticals to 45% for "transportation" companies. The average level of cash ranged from a low of 2.7% of assets for the textile industry to a high of almost 20% of assets for pharmaceuticals.

Given such differences, it is interesting to examine whether the value of cash also varies by industry. As reported in Table 2, our estimates of the value of a dollar of cash range from -\$1.06 in the coal industry to \$1.61 for computer software companies.

When interpreting such coefficients, however, it's important to recognize that most of these estimates have a large standard error associated with them. To give a more accurate indication of the value of cash for an industry, the final column of Table 2 reports the 90% confidence interval for the value of cash, which is a direct function of the standard error from the regression. To give the reader a better sense of these confidence intervals, we depict them graphically in Figure 1.

As the figure should make clear, the precision of our cash estimates varies greatly by industry. For example, our estimate for the construction materials industry has the smallest confidence interval (of \$0.48) and is thus the most precise—while the tobacco industry is the least precise, with a confidence interval almost ten times as large (\$4.74). (The small sample size in the tobacco industry is probably the main reason for the lack of precision in the estimated coefficient.)

The industries that are shaded gray in both Table 2 and Figure 1 are those for which our estimated value of cash holdings is significantly greater than \$1.00, while the purple industries are those where cash appears to be valued reliably below \$1.00. Only the computer software and pharmaceutical industries have values of cash that are significantly larger than \$1.00, while 15 industries have cash valued at a discount. Although the 15 industries span the economy, most can be categorized as either commodities (such as coal, mining, and petroleum) or manufacturing (fabricated products, machinery, and shipbuilding).

The results of our industry analysis provide support for the hypotheses we presented earlier. Both the software and pharmaceutical industries can be categorized as growth industries, with considerable uncertainty about the timing of their investment projects. And the companies in these industries, as our first two hypotheses would suggest, are

12. The industry definitions actually represent 49 industry classifications and come from Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html). We are grateful to him for making them available. We were left with 43 industry categories after eliminating utilities and finan-

cial firms from our sample.

13. The regressions are run using dummy variables for each industry interacted with every independent variable. However, firm and time effects are assumed constant across the industry groups.

Table 2 **Statistics for 43 Different Industries**

Industry	Firms	Observations	Leverage	Cash/Assets	Value	Value Range
Agriculture	56	371	28.00%	7.34%	(0.34)	-1.02 to 0.35
Aircraft	64	869	30.49%	4.27%	0.73	0.16 to 1.29
Apparel	229	1,740	30.80%	4.59%	1.12	0.54 to 1.71
Automobiles and Trucks	225	2,307	33.61%	5.08%	0.64	0.19 to 1.10
Beer & Liquor	57	470	19.78%	8.77%	(0.54)	-1.68 to 0.60
Business Services	819	5,398	23.80%	7.75%	1.13	0.79 to 1.47
Business Supplies	194	2,290	29.99%	4.33%	0.92	0.54 to 1.30
Candy & Soda	41	302	32.17%	6.12%	0.89	-0.01 to 1.79
Chemicals	242	2,774	26.92%	4.43%	0.71	0.06 to 1.37
Coal	31	156	40.48%	5.72%	(1.06)	-1.72 to -0.39
Communication	541	3,459	36.96%	4.47%	0.45	0.18 to 0.72
Computer Software	1,080	5,235	15.27%	15.98%	1.61	1.33 to 1.89
Computers	436	3,088	14.04%	14.33%	1.19	0.81 to 1.57
Construction	215	1,793	42.64%	7.40%	0.89	0.53 to 1.24
Construction Materials	348	3,657	30.37%	4.85%	0.50	0.25 to 0.74
Consumer Goods	294	2,559	21.69%	6.13%	0.37	0.01 to 0.73
Defense	20	209	29.98%	6.16%	0.31	-0.19 to 0.81
Electrical Equipment	220	2,293	23.20%	5.59%	1.06	0.55 to 1.56
Electronic Equipment	767	6,800	16.56%	11.27%	1.08	0.78 to 1.38
Entertainment	300	1,840	37.87%	7.01%	0.27	-0.16 to 0.71
Fabricated Products	70	643	35.69%	3.94%	(0.22)	-0.60 to 0.17
Food Products	271	2,595	25.72%	5.02%	0.48	0.19 to 0.77
Healthcare	306	1,890	35.90%	6.65%	0.71	0.33 to 1.08
Machinery	530	5,251	23.63%	5.82%	0.29	-0.07 to 0.66
Measuring and Control Equip.	325	2,958	15.49%	8.69%	0.67	0.24 to 1.10
Medical Equipment	418	3,063	11.38%	10.32%	0.94	0.47 to 1.42
Non-Metallic and Industrial Metal Mining	83	712	21.41%	5.50%	0.12	-0.40 to 0.65
Personal Services	169	1,071	29.12%	6.52%	1.33	0.63 to 2.02
Petroleum and Natural Gas	773	5,923	25.14%	5.27%	0.59	0.26 to 0.92
Pharmaceutical Products	523	3,280	8.28%	19.40%	1.33	1.00 to 1.65
Precious Metals	115	749	15.88%	11.09%	0.64	0.13 to 1.14
Printing and Publishing	124	1,296	16.53%	6.45%	0.74	0.01 to 1.46
Recreation	165	1,161	29.99%	5.86%	1.18	0.43 to 1.92
Restaurants, Hotels, Motels	339	2,446	33.30%	7.42%	0.88	0.42 to 1.33
Retail	836	6,966	27.51%	5.82%	0.99	0.69 to 1.29
Rubber and Plastic Products	175	1,536	30.17%	4.86%	0.23	-0.2 to 0.67
Shipbuilding & Railroad Equip.	37	305	35.22%	3.95%	(0.62)	-1.42 to 0.18
Shipping Containers	55	593	34.88%	2.80%	1.02	0.09 to 1.94
Steel	235	2,470	36.62%	3.86%	0.59	0.12 to 1.05
Textiles	115	1,133	41.76%	2.69%	0.68	0.13 to 1.22
Tobacco Products	17	166	28.62%	5.88%	1.30	-1.07 to 3.67
Transportation	397	3,641	45.57%	6.10%	0.74	0.47 to 1.01
Wholesale	631	4,837	35.13%	3.94%	0.89	0.44 to 1.35

Figure 1 **Estimated Value of Cash for 43 Different Industries**

The estimated value of cash is represented by the black square.
 The purple lines provide the 90% confidence interval for the estimate.
 Industries whose names are in purple (gray) have a value of cash significantly less (greater) than \$1.00.
 Industries with names in black have values of cash not significantly different from \$1.00



precisely the types of firms where we would expect cash to have more value.

Moreover, the types of (15) industries where cash is valued below a dollar also seem consistent with our hypotheses. The industries are either relatively mature, low-growth industries such as agriculture, beer and liquor, coal, and shipbuilding and railroad equipment, or businesses with relatively stable cash flows or investment programs, such as food products, consumer goods, and fabricated products. These are the kinds of firms where we would expect investors to place lower values on a firm's cash because of the greater likelihood the cash will be wasted on low-return investment projects. Across those 15 industries, the average cash holdings range from 4-9% of total assets, which suggests that firms in some industries hold more than the value-maximizing amount of cash.

Conclusions

In this study we show that, on average, the market value of the marginal dollar of cash held by a company is approximately one dollar. At the same time, we also find substantial cross-sectional differences in the market value of cash, and provide

compelling evidence that cash values vary with differences in firm characteristics and industries.

Consistent with an option value associated with holding cash, companies with riskier operating cash flow and promising (though often uncertain) growth opportunities have higher values placed on each dollar of cash than firms with few growth opportunities and stable cash flows and investment programs. Finally, we show that the value of cash varies dramatically across industries, with software and pharmaceutical companies having the highest values of cash while companies in commodity and manufacturing industries have the lowest values.

LEE PINKOWITZ is Associate Professor of Finance and the Beit Faculty Research Fellow at the McDonough School of Business at Georgetown University.

ROHAN WILLIAMSON is Associate Professor of Finance, Area Coordinator, and the Holowesko Faculty Research Fellow at the McDonough School of Business at Georgetown University.

Journal of Applied Corporate Finance (ISSN 1078-1196 [print], ISSN 1745-6622 [online]) is published quarterly, on behalf of Morgan Stanley by Blackwell Publishing, with offices at 350 Main Street, Malden, MA 02148, USA, and PO Box 1354, 9600 Garsington Road, Oxford OX4 2XG, UK. Call US: (800) 835-6770, UK: +44 1865 778315; fax US: (781) 388-8232, UK: +44 1865 471775.

Information for Subscribers For new orders, renewals, sample copy requests, claims, changes of address, and all other subscription correspondence, please contact the Customer Service Department at your nearest Blackwell office (see above) or e-mail customerservices@blackwellpublishing.com.

Subscription Rates for Volume 19 (four issues) Institutional Premium Rate* The Americas[†] \$377, Rest of World £231; Commercial Company Premium Rate, The Americas \$504, Rest of World £307; Individual Rate, The Americas \$100, Rest of World £56, €84[‡]; Students** The Americas \$35, Rest of World £20, €30.

*The Premium institutional price includes online access to current content and all online back files to January 1st 1997, where available.

[†]Customers in Canada should add 6% GST or provide evidence of entitlement to exemption.

[‡]Customers in the UK should add VAT at 6%; customers in the EU should also add VAT at 6%, or provide a VAT registration number or evidence of entitlement to exemption.

**Students must present a copy of their student ID card to receive this rate.

For more information about Blackwell Publishing journals, including online access information, terms and conditions, and other pricing options, please visit www.blackwellpublishing.com or contact your nearest Customer Service Department.

Back Issues Back issues are available from the publisher at the current single-issue rate.

Mailing *Journal of Applied Corporate Finance* is mailed Standard Rate. Mailing to rest of world by DHL Smart & Global Mail. Canadian mail is sent by Canadian publications mail agreement number 40573520. **Postmaster** Send all address changes to *Journal of Applied Corporate Finance*, Blackwell Publishing Inc., Journals Subscription Department, 350 Main St., Malden, MA 02148-5020.

Journal of Applied Corporate Finance is available online through Synergy, Blackwell's online journal service, which allows you to:

- Browse tables of contents and abstracts from over 290 professional, science, social science, and medical journals
 - Create your own Personal Homepage from which you can access your personal subscriptions, set up e-mail table of contents alerts, and run saved searches
 - Perform detailed searches across our database of titles and save the search criteria for future use
 - Link to and from bibliographic databases such as ISI.
- Sign up for free today at <http://www.blackwell-synergy.com>.

Disclaimer The Publisher, Morgan Stanley, its affiliates, and the Editor cannot be held responsible for errors or any consequences arising from the use of information contained in this journal. The views and opinions expressed in this journal do not necessarily represent those of the Publisher, Morgan Stanley, its affiliates, and Editor, neither does the publication of advertisements constitute any endorsement by the Publisher, Morgan Stanley, its affiliates, and Editor of the products advertised. No person should purchase or sell any security or asset in reliance on any information in this journal.

Morgan Stanley is a full service financial services company active in the securities, investment management, and credit services businesses. Morgan Stanley may have and may seek to have business relationships with any person or company named in this journal.

Copyright © 2007 Morgan Stanley. All rights reserved. No part of this publication may be reproduced, stored, or transmitted in whole or part in any form or by any means without the prior permission in writing from the copyright holder. Authorization to photocopy items for internal or personal use or for the internal or personal use of specific clients is granted by the copyright holder for libraries and other users of the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, USA (www.copyright.com), provided the appropriate fee is paid directly to the CCC. This consent does not extend to other kinds of copying, such as copying for general distribution for advertising or promotional purposes, for creating new collective works, or for resale. Institutions with a paid subscription to this journal may make photocopies for teaching purposes and academic course-packs free of charge provided such copies are not resold. Special requests should be addressed to Blackwell Publishing at: journalsrights@oxon.blackwellpublishing.com.