TWO ESSAYS ON THE VALUE OF CASH

A Dissertation

by

TIMOTHY KYLE TIPPENS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2012

Major Subject: Finance

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ABSTRACT

Two Essays on the Value of Cash. (August 2012)

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Chair of Advisory Committee: Dr. Shane A. Johnson

In the first essay, "The Source of Cash and Its Marginal Value," we study the relation between the source of firms' cash holdings and the value of the cash to shareholders. The marginal value of a dollar of cash holdings depends on the source of the dollar: $1.00 of cash has a value of $1.27 when it is from operations, $0.80 when from financing, and $0.46 when from investing. Within the same source, the marginal value of an added dollar of cash holdings is significantly higher than the absolute value of a subtracted dollar. Shareholders of financially constrained or distressed firms value incremental cash holdings from almost any source more highly than do shareholders of unconstrained or stronger firms, but differences in value remain across the sources of cash within each subsample. Agency costs and information asymmetry are two frictions that appear to have the largest impact upon the value of cash.

In the second essay, "Explanations for Diverging Values of Cash," we further explain the differing values of cash found in the first essay. Intertemporal relationships among the sources and uses of cash provide a rational basis for shareholders to assign different values of cash based on the source. Sources of cash provide information about likely uses of cash up to two to three years in the future, and many of the intertemporal relations are statistically and economically significant. Likewise, prior uses of cash relate significantly to later uses of cash. Past sources of cash inform investors about likely future sources, even up to five years into the future. The fact that different kinds of cash flows have predictive power for future cash flows helps explain the wide range of the values of cash associated with different sources.

DEDICATION

For Shannon

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I am indebted to my advisory committee for all of their suggestions and questions. Dr. Anwer Ahmed helped me along the way with some necessary course corrections. Dr. Neal Galpin seemed to have thought through every paper ever written in finance and economics, and pointed me toward the right ones. Dr. Scott Lee provided humor, an editor's eye, and suggestions about how to make better sense of everything. My chair, Dr. Shane Johnson, was diligent in helping me think through many aspects of the papers over two years. He is a gifted researcher who is comfortable discussing virtually any topic in finance.

I have a special sense of gratitude for Dr. Donald Fraser. God's providence may have been at work when my graduate assistantship assignment for the first fall semester was changed around, allowing me to work for Dr. Fraser for all five years eventually. Collaborating with him on research, helping him with his classes, and discussing the way things work in business schools and at journals were all enlightening and rewarding experiences. I will certainly miss his coming by to check on the "two young scholars."

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I owe my dear wife, Shannon, a lifetime of thanks. It was not easy to leave the house, friends, neighbors, and church that she loved, and then to have me disappear for long periods of time. At key times, she even took the girls on little trips to free up time for me to focus on my studies. I know it has not been an easy journey for her.

Finally, I acknowledge God's call as the impetus for this undertaking. This was his idea for some reason, and he has sustained me through it all, at every step of the way.

"Now to him who is able to do immeasurably more than all we ask or imagine, according to his power that is at work within us, to him be glory in the church and in Christ Jesus throughout all generations, for ever and ever! Amen." (Ephesians 3:20-21)

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1. INTRODUCTION

This dissertation is comprised of two essays, presented in Section 2 and Section 3. Section 2 is related to work by Galpin, Johnson, and Tippens (2011).

In the first essay, "The Source of Cash and Its Marginal Value," we ask whether the source of cash has any effect on its marginal value. Since cash is recorded in the statement of cash flows net of any direct frictions, one could argue that cash should have the same value to investors, no matter the source. Assuming a world without frictions, we hypothesize that cash could have different values to investors, depending on where the cash originated. We next consider three different scenarios in which three different frictions are introduced, and we make semi-quantitative predictions about the value of cash to investors under each scenario.

We attempt to answer four questions in the first essay. First, does the marginal value of cash differ based on its source? Second, are cash values symmetric for cash increases and decreases? Third, do the marginal values of different sources of cash and does the symmetry of the value of cash increases and decreases vary depending on a firm's financial constraints or its degree of financial distress? Fourth, which frictions appear to be the most significant ones affecting marginal values of cash?

Using a sample of more than 78,000 firm-year observations from 1987 to 2011, our results demonstrate that there are indeed significant differences in the marginal value of cash that relate to its source. We find that cash increases tend to be valued more

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This dissertation follows the style of the *Journal of Finance*.

highly than corresponding cash decreases. Financial constraints and distress both tend to cause the slope of the relation between changes in cash from all sources and firm value to be steeper. The asymmetry in the value of cash for increases and decreases is similar for all firms. Agency costs and information asymmetry appear to be the most influential frictions that affect the values of cash. Financially constrained and distressed firms are more acutely affected by these frictions. Even though we are able to answer several questions in the essay, the results generate even more questions. One of those is why cash is valued so differently depending on its source.

In the second essay, “Explanations for Diverging Values of Cash,” we delve deeper into this question of why cash can have such different values. Extant research has shown that the likely use of cash affects its marginal value. We connect the likely use of cash in the future to the earlier source of the cash, providing a rationale for why investors would look to the source of the cash to assign a marginal value to it. The eventual use of cash is linked to sources of cash up to two or three years prior to its use. In a similar way, prior uses of cash are linked to future uses of cash. Once the firm chooses to use cash for something, investors are provided with information about possible future uses as well. Finally, prior sources of cash are connected with future sources of cash in statistically and economically meaningful ways. All of these intertemporal linkages help us understand why there can be such divergence in the value of cash across different sources.

2. THE SOURCE OF CASH AND ITS MARGINAL VALUE

2.1 Introduction to Section 2

Extant research shows that the likely use of cash by a firm affects shareholders' valuation of the firm's cash holdings.[1] Faulkender and Wang (2006) find that the marginal value of cash holdings varies with a firm's cash levels, leverage, the method of payout, and the degree of financial constraints the firm faces. Dittmar and Mahrt-Smith (2007) find that poorly governed firms use excess cash in performance-reducing ways and that shareholders consequently attach much lower value to cash holdings in these firms.

We investigate whether the *source* of a dollar of cash holdings matters in its valuation. Statements of cash flows divide the sources of changes in cash holdings into those arising from operating, financing, and investing (or divesting) actions. The costs involved in generating an incremental dollar of cash holdings may vary across these sources. For example, the pecking order hypothesis suggests that managers prefer to use internally generated funds from operating activities, thereby avoiding the higher costs associated with financing actions such as equity offerings. Even so, a dollar change in cash holdings is recorded *net* of all direct frictions. Thus, it is straightforward to argue that the source should not matter when estimating the value of a dollar of cash holdings because we observe the dollar net of any frictions that affected it. On the other hand, one

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[1] I would like to thank seminar participants at Abilene Christian University, Baylor University (Hankamer), Kansas State University, Pepperdine University (Graziadio), and the University of Alabama in Huntsville for their helpful comments on early drafts of this essay. Any remaining errors are those of the author alone.

can argue that changes in cash holdings from various sources should have varying information content or indirect frictions that investors incorporate into the value they assign to cash holdings. Thus, whether the sources of changes in cash holdings matter is an empirical question.

We contribute to the research on the value of cash holdings by examining four main questions: First, does the marginal value of changes in firms' cash holdings depend on the source of those changes? Second, are the values of firms' cash holdings symmetric for cash increases and decreases? Third, do the marginal values of different cash sources and does the value symmetry of cash increases and decreases vary depending on a firm's financial constraints or level of financial distress? Finally, which frictions appear to have the most impact on marginal values of cash?

Ceteris paribus, a firm's cash holdings will increase when operating cash flows, financing cash flows, and/or investing cash flows are positive. Conversely, negative operating cash flows, cash distributions to security holders, and/or investing activities will lead to decreases in a firm's cash holdings. In the data, the ceteris paribus condition is nontrivial because the various sources and uses of cash often work in offsetting directions. For example, one might expect that operating cash flows are the largest driver of changes in a firm's cash holdings from one period to the next, and that cash holdings would typically rise when operating cash flows are positive. Empirically, however, during firm-years with positive operating cash flows, cash holdings still decline 44% of the time. Even during firm-years with both positive operating and financing cash flows, cash holdings fall 38% of the time due to investing activities. These simple statistics illustrate the variation in the underlying sources of changes in firms' cash holdings.

Using a sample of more than 78,000 firm-year observations from 1987 to 2011 and following the approach in Faulkender and Wang (2006) and Dittmar and Mahrt-Smith (2007), we find that the marginal value to shareholders of an incremental dollar of cash holdings varies depending on the source of the dollar: $1.00 of incremental cash holdings has a marginal value of $1.27 when it is from operating activities, but only $0.80 when from financing activities and $0.46 when from investing activities (each of these values differs significantly from the others). Thus, the marginal values of firms' cash holdings depend on the origin of the changes in cash holdings. The sources differ on dimensions such as information asymmetry, potential agency problems, taxes, transaction costs, and investment adjustment costs. The results imply that these factors influence the value of firms' cash holdings, and we seek to identify which factors affect valuations the most.

We also examine whether the marginal values of changes in firms' cash holdings are symmetric for increases and decreases in cash holdings. While an incremental dollar of cash is valued unconditionally at $1.12 in the sample, a one dollar net increase in cash holdings leads to a $1.32 value increase whereas a one dollar net decrease in cash holdings leads to a reduction in value of only $0.41. Consider investing cash flows. If firms invest and divest optimally, then both investment (cash outflows) and divestment (cash inflows) will either have no impact on firm value or increase firm value. We find that a dollar of cash invested reduces firm value by $0.39, suggesting that firms do not benefit from investment on average. Upon divesting, a dollar of cash added to the balance sheet increases firm value by $0.68. The increase and the decrease in cash holdings associated with these two investing activities are valued significantly differently from each other.

If firms finance optimally, then at least in a frictionless world, both increases and decreases in cash associated with financing activities should not affect firm value per share. We find not only that these financing activities affect firm value, implying the presence of frictions, but also that increases and decreases in cash holdings are valued differently. A new dollar of debt adds $0.56 in value, while a one dollar reduction in debt decreases value by $0.45 (the values differ significantly from each other). A new dollar of equity adds $1.25 in value, while a dollar of equity payout reduces value by $0.21 (statistically, the number is insignificantly different from zero). Even operating cash flows show differential values based on whether cash is added to or subtracted from the firm. One dollar from operations is worth $1.40, suggesting that changes in cash from operating activities are viewed as more than simple one-time cash flows. One dollar lost from operating activities reduces firm value by only $0.10, an amount not statistically distinguishable from zero.

Addressing our third question, the value of each source of cash is generally higher for financially weaker or constrained firms than for stronger or less constrained firms. In particular, shareholders of financially weaker or constrained firms attach significantly greater value to an incremental dollar of cash from financing or divesting activities than do shareholders of stronger or unconstrained firms. Shareholders of financially constrained firms value cash from operating activities more highly than do shareholders of unconstrained firms. Interestingly, the differences in the values of changes in cash holdings also exist for cash decreases as well. A dollar decrease in cash holdings has a greater impact on value for a financially weaker or constrained firm than for a stronger or unconstrained firm. The greater value impact for decreases in cash holdings means that firm value declines more for a given decrease in cash holdings. Within each subsample of firms, whether constrained or unconstrained, distressed or strong, the asymmetry in the value of cash between increases and decreases still holds in almost all cases. An increase in cash raises firm value more than a corresponding decrease in cash lowers firm value.

To address our final question, we first predict how the source of cash could affect its value even in a frictionless environment. Then, taking three frictions in turn, we make semi-quantitative predictions about how each friction would affect the value of cash from various sources. Comparing the empirical results to the predictions, we find only two results that are in line with a frictionless model. In most cases, agency costs and/or information asymmetry appear to have the greatest impact on marginal values of cash. Moreover, these frictions appear to afflict distressed or financially constrained firms even more than they affect other firms. Taxes, adjustment or transaction costs, or other factors may not be first-order concerns in causing differences in the value of cash, but in Section 3 we study in more detail how differing information content could help explain some of the differences.

In sum, by using models that allow the estimations of the value of cash to differ depending on its source, we are able to uncover new results that shed light on the nature of the frictions that different kinds of firms face. We also learn more about the value that shareholders place on various actions of the firm. The results also raise new questions. Why is cash valued so differently depending on its source? Why is investing so often associated with a decrease in firm value? Why is cash stemming from positive net operating cash flows or equity issues valued so highly?

We contribute to understanding the value of cash holdings by exploiting the large variation evident in the sources of changes in firms' cash holdings.[2] Our results show that the valuation of cash holdings is substantially more complex than is detected when using aggregated measures of changes in cash holdings. Our work also contributes to the literatures on investing and divesting activities and financing and payout activities. Our work is also related to efforts in the accounting literature to decompose earnings and cash flows (see Lipe (1986), Livnat and Zarowin (1990), and Barth, Cram, and Nelson (2001)).

2.2 Hypotheses Development

2.2.1 No Frictions

Ceteris paribus and given perfect markets, firms that experience an increase in cash holdings (without a corresponding decline in another asset account or a

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[2] In addition to Faulkender and Wang (2006) and Dittmar and Mahrt-Smith (2007), an incomplete list of other recent work in this area includes Gamba and Triantis (2008), Kalcheva and Lins (2007), Klasa, Maxwell, and Ortiz-Molina (2009), Masulis, Wang, and Xie (2009), Pinkowitz, Stulz, and Williamson (2006), and Pinkowitz and Williamson (2004).

corresponding increase in a liability account) should see their equity value rise by the amount of the cash increase. In such an environment, an increase in cash holdings would not provide any information content to investors, and there would be no agency costs or taxes to keep shareholders from benefiting fully from the increase in cash holdings. Regardless of the channel through which an increase in cash holdings came, as long as other accounts were not changed the increase would affect equity value the same way.

Yet many sources and uses of cash are tied to changes in other asset or liability accounts. For example, an additional dollar on the balance sheet that comes from issuing debt is associated with an increase in a liability account. Taking these mechanical relationships into account, while still ignoring the impact of frictions and assuming that firms act optimally, we can predict how changes in cash holdings derived from various activities will affect firm value. The effects of a change in cash on firm value may now differ depending on the channel.

If firms increase their cash holdings $1.00 because of operating activities, we would expect firm value to increase by about $1.00, as predicted earlier, since there is no corresponding change to any asset or liability account. With regard to investing activities, a firm would only invest another dollar in its capital stock (property, plant, equipment, or an acquisition) if the ex ante market value of that capital increase would be at least a dollar. (Otherwise, it would be optimal for the firm to continue to hold the dollar in cash and invest nothing.) This would mean that in the worst case, investing would not change firm value at all, but investing could actually increase firm value.

Likewise, a firm would disinvest[3] \$1.00 of its assets in place only if the value of the asset to the firm is less than or equal to its outside value of \$1.00. Similar to investing, disinvesting should have no effect on firm value in the worst case, and it should increase firm value in some cases.

For financing activities, when viewed from the perspective of market value per share, the results do not depend on whether funds are raised or paid out, or whether the financing is debt or equity.[4] In all cases, the expected impact on market equity (per share) is zero. This prediction follows from Modigliani and Miller (1958). New debt resulting in a cash increase is matched by a corresponding liability. From the perspective of the shareholder, there is no net effect on firm value. When debt is retired, the corresponding liability is extinguished as cash is paid out and thus shareholders see no impact on firm value then either. Ignoring signaling effects and still assuming optimal firm behavior, issuing equity simply raises the number of shares outstanding but has no effect on share prices. When shares are repurchased, the opposite effect occurs: the number of shares outstanding falls but there is no impact on share prices. When dividends are paid out, the share price falls by the amount of the dividend on the ex-dividend date, but the dividend return per share makes up the exact difference. Therefore there is still no impact to shareholders. The predictions for all of these changes in firm

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[3] In this dissertation, the terms “divest” and “disinvest” are used interchangeably. The terms are used to describe the action in which a firm disposes of assets in place.

[4] We frame the question in terms of the effects upon market value *per share* because that is the standard way to approach the question empirically in this line of literature (using stock returns to estimate the marginal value of cash). In untabulated results, we run some of our tests using changes in total market equity as the dependent variable and find some different coefficients, most notably for the equity issuance and equity payout variables as expected.

value, expressed in terms of partial derivatives of market equity value per share, are summarized in Table 2.1.

Table 2.1
Semi-quantitative Predictions: Marginal Values of Cash in an Environment without Frictions.

ME is market equity, *Dis* is the cash paid to the firm upon disinvesting, *V(Dis)* is the market value (to the firm's shareholders) of the firm's assets disinvested in the amount of *Dis*, *Inv* is the cost of an investment, *V(Inv)* is the market value (to the firm's shareholders) of the firm's investment with a cost of *Inv*. All variables are expressed in terms of "per share" values. To aid later interpretation of coefficients, partial derivatives of firm value with respect to cash used to invest and to pay out are also calculated from the perspective of the amount of investment and payout, respectively, i.e., these partial derivatives are calculated with respect to the absolute value of the change in cash.

Sources of Cash:	
Operating cash flow	∂ME/∂Cash ≈ 1
Disinvesting	V(Dis) ≤ Dis
	∂ME/∂Cash = (Dis-V(Dis))/Dis ≥ 0
Issuing debt or equity	∂ME/∂Cash ≈ 0
Uses of Cash:	
Investing	V(Inv) ≥ Inv
	∂ME/∂Cash = (V(Inv)-Inv)/(-Inv) ≤ 0
	Partial derivative with respect to *investment* instead of cash: ∂ME/∂Investment = (V(Inv)-Inv)/(Inv) ≥ 0
Retiring debt, or equity dividends/repurchases	∂ME/∂Cash ≈ 0

2.2.2 Financial Constraints and Financial Distress

When firms are unable to raise external financing freely to whatever level is optimal for the firm, the firm cannot implement its first-best investment plan. Multiple factors may prevent the firm from fully accessing the capital markets, some of which may be beyond the firm's control. One factor may be asymmetric information: capital providers may feel that they do not have as much information about the firm and its prospects as the managers have. A related issue could be that of agency costs: capital providers may be concerned that managers will not represent their best interests in managing the firm. There may be other causes as well, but the end result is that shareholders may value the constrained firm's actions in a different way than they would those of a relatively unconstrained firm. This may translate into different marginal values of cash for financially constrained as opposed to relatively unconstrained firms.

In a similar way, firms that have experienced difficulty in achieving or sustaining profitability may find their opportunity set shrinking. To the extent that these firms have existing debt or require debt in the future to fund their operations, they could be experiencing financial distress. Even all-equity firms are unable to operate indefinitely at a loss; such unprofitable firms could be considered financially troubled. Although the possible causes for financial distress or trouble are many, some of the frictions identified earlier can aggravate the situation. For example, managers of firms in distress may become more concerned about the impact of looming insolvency on their own careers. Even if agency costs had not been a problem before, the challenging environment may cause managers to fail to place the shareholders' interests above their own in managing the firm. As with financially constrained firms, shareholders may assign different marginal values of cash in distressed or troubled firms than they would in stronger firms. We seek to understand whether these differences are significant, and we also want to understand which frictions appear to be most relevant in constrained or distressed firms.

2.2.3 Three Hypothetical Scenarios with Distinct Frictions

We next consider the impact that specific frictions might have on firms' marginal values of cash. Specifically we isolate three different hypothetical scenarios in which a particular class of friction is the only significant one affecting the value of cash. The three classes of frictions are taxes, agency problems, and information asymmetry. These frictions are some of the most significant ones studied by researchers in finance.[5]

Under the Taxes Only scenario, taxes on dividends and capital gains keep shareholders from receiving the full amount of the firm's distributions. Therefore, cash from internal sources (operating and divesting) has lower values than under the frictionless scenario, and the values differ from the frictionless scenario by the amount of investors' dividend or capital gains marginal tax rates. The firm still issues and retires/repurchases debt and equity as in the optimal scenario, and these actions do not affect the value of the shares. Finally, to the extent that the firm makes investments in positive NPV projects that increase share value, the magnitudes of these increases are also muted by the amount of investors' marginal tax rates.

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[5] For an example of each of these, see Foley, Hartzell, Titman, and Twite (2007), Jensen (1986), and Myers and Majluf (1984), who focus on taxes, agency costs, and information asymmetry respectively.

With the Agency Only scenario, managers cannot be trusted to work in the interests of shareholders at all times. This causes cash sourced from operating activities to be worth less than it would be otherwise. The effect of divesting activities upon firm value is ambiguous: if the benefits to divesting are great enough or if the agency costs are low enough, divesting may increase firm value. However, in an environment fraught with agency conflicts, managers may divest assets for reasons that have little to do with maximizing shareholder value (see, for example, Bartov (1993)). In these cases, divesting may decrease firm value. With regard to financing, cash from debt issues may increase firm value. This is because of the potential screening and monitoring benefit provided by debtholders (see Jensen and Meckling (1976), Grossman and Hart (1982), and Jensen (1986) for early work in this area). Without screening and monitoring, debt issues have no impact on firm value. When the firm issues new equity, investors who participate are aware of the agency problems and still provide funds to the company. Therefore it is possible that investors who already own shares may find that their shares are worth more than they had previously thought.

The uses of cash under the Agency Only scenario differ from both of the other scenarios considered so far. When the firm invests, investors are concerned that some portion of the investments are undertaken for the wrong reasons, i.e., to provide private benefits for management. Thus at best, investing results in no change in firm value. At worst, investments destroy firm value. Debt retirements may also be viewed negatively: shareholders may view the retirement of debt as the loss of a monitoring benefit. If debtholders had not monitored the firm, however, then debt retirements do not affect firm value. Finally, equity payouts demonstrate the willingness of management to relinquish control of some assets and pay them out to shareholders instead of using them for private benefits. This may cause investors to revise upward their estimated likelihood of receiving future distributions from the firm. Therefore firm value may increase.

Finally, under the Information Only scenario, information asymmetry plagues shareholders. Management knows the true prospects of the firm before investors do, and shareholders interpret management's actions and the firm's results as signals about the firm's true prospects. Only under this scenario is a dollar of cash stemming from operating activities valued above $1.00. A dollar of internally generated operating cash flow keeps the firm from having to raise funds from other sources, and it may also provide news about the firm's future prospects. Divesting may raise or lower firm value. Divesting could mean that the firm's assets in place are not valued as highly as investors previously thought (a bad signal), but divesting could also mean that management is maximizing shareholder value appropriately. Debt issues also have an ambiguous effect on firm value. On one hand, the fact that management prefers debt over equity may imply that they feel that the firm's equity is underpriced (a good sign). On the other hand, the fact that the firm needs to raise cash via a debt issue may imply that operating cash flows were lower than expected, and the firm has to raise debt in order to continue operations. Equity issues could be a bad sign for investors, as it may mean that management believes the firm's shares are overvalued (as in Myers and Majluf (1984)).

Under the Information Only scenario, there is no clear prediction for the impact of investing on the value of cash. Investing could signal good prospects for the firm and a high productivity of assets, but especially in the case of acquisitions, investing activity could signal that assets in place are not productive enough. The retirement of debt has little effect on firm value in this scenario. Finally, equity payouts also do not have a clear prediction. Equity payouts convey the positive news that management is confident enough in the firm's prospects to return cash to investors (Easterbrook (1984)), but equity payouts may also convey the negative news that growth opportunities have diminished, triggering a distribution to shareholders by management. The predictions for the value of cash under each scenario for each type of cash source and use are summarized in Table 2.2.

We use these predictions to guide our tests. With our first test we seek to determine whether or not the various sources of cash do, in fact, have different marginal values. In a frictionless world, most coefficients should be close to or identical to zero, except for the coefficient on operating cash flow. With frictions, there will be more differences. Next, we consider whether the marginal values of cash increases are valued equivalently to cash decreases. We then study the impact of financial distress and financial constraints upon the marginal value of cash to see whether these special types of firms are viewed differently by shareholders. Finally, we hypothesize that each of the frictions previously discussed may play a role in affecting the marginal value of cash, and we seek to identify which frictions have the most impact by studying the values of cash within and between subsamples.

Table 2.2
Semi-quantitative Predictions: Partial Derivatives of Market Equity in Environments of Various Frictions.

The table provides the predictions for the partial derivative of market equity with respect to cash (for sources of cash). The predictions are expressed with respect to investing dollars for Investing (*); with respect to debt retirement dollars for Debt Retirement (†); and with respect to equity payout dollars for Equity Payout (‡). τ is the marginal tax rate for dividends or capital gains for the marginal investor.

	No Frictions	Taxes Only	Agency Only	Information Only
Sources of Cash				
Operating	1	<1 (N.F.*(1-τ))	<1	≥1
Divesting	≥0	≥0 (N.F.*(1-τ))	?	?
Debt Issue	0	0	≥0	?
Equity Issue	0	0	≥0	<0
Uses of Cash				
Investing*	≥0	≥0 (N.F.*(1-τ))	≤0	?
Debt Retirement†	0	0	≤0	0
Equity Payout‡	0	0	≥0	?

2.3 Methods

Studies of the value of firms' cash holdings generally have focused on the change in cash holdings (and short-term investments) from one period to the next. We examine questions about possible differences in cash valuation across sources of the changes in cash holdings; therefore we decompose the change in cash to differentiate among potential sources of cash. A simple decomposition derived from the statement of cash flows is the following:

$$\Delta C_{i,t} = CF\ from\,Operating_{i,t} + CF\ from\,Investing_{i,t} + CF\ from\,Financing_{i,t}, \tag{2.1}$$

where $\Delta C_{i,t} = Cash_{i,t} - Cash_{i,t-1}$ and the variables on the right side of the equation are the three key parts of the statement of cash flows. In most of this section, we make further distinctions by splitting net operating cash flows into negative and positive realizations and by breaking cash flows from investing and financing activities into their positive and negative components available in Compustat.[6] Financing cash flows are further divided into debt and equity components. Our primary decomposition of the change in cash is the following:

$$\begin{aligned}\Delta C_{i,t} = {} & OpCF_{i,t} \times 1_{[OpCF>0]} + OpCF_{i,t} \times 1_{[OpCF\leq 0]} - Invest_{i,t} + Divest_{i,t} + \\ & DebtIssue_{i,t} - DebtRetire_{i,t} + EqIssue_{i,t} - EqPayout_{i,t} + FinOther_{i,t},\end{aligned} \tag{2.2}$$

where $OpCF_{i,t}$ is net cash flow from operating activities, $1_{[\cdot]}$ is the indicator function, $Invest_{i,t}$ is the sum of capital expenditures and acquisitions, $Divest_{i,t}$ is the proceeds from the sale of property, plant, and equipment, $DebtIssue_{i,t}$ is the proceeds from the issuance of long-term debt, $DebtRetire_{i,t}$ is the reduction of long-term debt, $EqIssue_{i,t}$ is the proceeds from the issuance of stock, $EqPayout_{i,t}$ is the sum of stock repurchases and cash dividends, and $FinOther_{i,t}$ is the sum of other financing items that change cash balances.

We follow the methods of Faulkender and Wang (2006) to estimate the value of cash to shareholders. In a process similar to a long-term event study, they regress annual risk-adjusted returns on unexpected annual changes in cash and a number of control

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[6] One could break operating cash flow into its gross positive and negative components also, but unlike investing and financing cash flows, some of the components of operating cash flow are non-cash accruals that are used to adjust accounting earnings to a cash flow figure. Therefore we simply allow the coefficients on negative and positive realizations of net operating cash flow to differ.

variables. All explanatory variables (except for market leverage) are scaled by lagged market equity. This allows the estimated coefficient of the unexpected cash change variable to have a useful interpretation: it represents the market valuation of a marginal dollar of cash held by the firm.

In this dissertation, we break the "change in cash" variable into the nine components identified in equation (2.2). We focus on the estimated coefficients of these cash flow components. These coefficients can be interpreted as the market valuation of a marginal dollar of cash holdings originating from that specific cash flow. Faulkender and Wang emphasize the idea that they want to use unexpected changes in cash as their key measure, as opposed to simple period-to-period changes, since any expected changes in cash would already be incorporated into stock prices at the beginning of the period. After constructing three different proxies for the unexpected changes in cash, they find no significant differences between using these proxies and the simple period-to-period difference in the cash balance. Therefore they use the simpler measure throughout their paper. Given that we decompose the change in cash into nine components and cannot necessarily rely on their work to establish the fact that there are no substantial differences between the simpler and more complicated measures of cash flows, we follow modified versions of their techniques to construct proxies for all the unexpected cash flows. We find some quantitative differences among regressions using the four different approaches to estimate unexpected cash flows, but the inferences are essentially the same in each regression. Therefore we rely on the simpler cash flow measures for our analysis.

The dependent variable in the regressions is the risk-adjusted return for the stock over the fiscal year corresponding to the time period of the accounting variables on the right side of the regression equation. The risk-adjusted return for stock *i* is calculated by subtracting the return of stock *i*'s benchmark portfolio during fiscal year *t* from stock *i*'s raw return, where the benchmark portfolio is one of the 25 size and book-to-market portfolios defined by Fama and French (1993).[7] The benchmark portfolio return is value-weighted within each of the 25 portfolios based on market capitalization, and firms are assigned to a benchmark portfolio based on the intersection of independent sorts of market equity and book-to-market equity ratios. Calculating the excess return in this manner is meant to net out the risk-related expected return component of stock *i*'s realized return. Using raw returns instead of excess returns as the dependent variable does not substantially change the results, although the estimated coefficients are larger in magnitude with raw returns as the dependent variable.

Since there are other firm-specific factors correlated with cash flow that have an impact on firm value, we control for these as well. These factors relate to profitability and firm decisions regarding financing and investing activities. This list is the same one used by Faulkender and Wang, with one exception: their Net Financing (*NF*) variable is highly correlated (0.87) with our cash flow from financing activities variable

[7] Because the fiscal year-end of a firm can be any month while the Fama-French portfolios are formed at the end of June each year, a firm can have up to two different benchmark portfolios assigned to it during a given fiscal year. Therefore we compound the return of stock *i*'s assigned benchmark portfolio for each month across the 12 months of stock *i*'s fiscal year, and subtract this annualized return from stock *i*'s raw annual return to arrive at the excess return for that fiscal year for stock *i*.

(*FinCFNet*) since they are measuring very similar activities. In specifications that include *FinCFNet* or all of its components, we drop *NF* from the regression.

The extended regression model we use is this one:

$$\begin{aligned} r_{i,t} - R_{i,t}^{B} = \gamma_0 + \gamma_1 \frac{OpCF_{i,t}}{M_{i,t-1}} \times 1_{[\text{OpCF}>0]} + \gamma_2 \frac{OpCF_{i,t}}{M_{i,t-1}} \times 1_{[\text{OpCF}\leq 0]} + \gamma_3 \frac{Invest_{i,t}}{M_{i,t-1}} + \\ \gamma_4 \frac{Divest_{i,t}}{M_{i,t-1}} + \gamma_5 \frac{DebtIssue_{i,t}}{M_{i,t-1}} + \gamma_6 \frac{DebtRetire_{i,t}}{M_{i,t-1}} + \gamma_7 \frac{EqIssue_{i,t}}{M_{i,t-1}} + \\ \gamma_8 \frac{EqPayout_{i,t}}{M_{i,t-1}} + \gamma_9 \frac{FinOther_{i,t}}{M_{i,t-1}} + \gamma_{10} \frac{\Delta E_{i,t}}{M_{i,t-1}} + \gamma_{11} \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \gamma_{12} \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \\ \gamma_{13} \frac{\Delta I_{i,t}}{M_{i,t-1}} + \gamma_{14} \frac{\Delta D_{i,t}}{M_{i,t-1}} + \gamma_{15} \frac{C_{i,t-1}}{M_{i,t-1}} + \gamma_{16} L_{i,t} + \gamma_{17} 1_{[\text{OpCF}>0]} + \epsilon \end{aligned} \tag{2.3}$$

where $1_{[\cdot]}$ denotes the indicator function and $\Delta X_{i,t}$ indicates the change in variable X from fiscal year t-1 to year t. The dependent variable is the excess return, $r_{i,t} - R_{i,t}^{B}$, where $r_{i,t}$ is the raw return of firm i over its fiscal year t, and $R_{i,t}^{B}$ is stock i's assigned annualized benchmark return over the same year t. A dollar of cash holdings stemming from net positive operating cash flow (*OpCF*) is valued by investors at γ_1, whereas a dollar from net negative *OpCF* is valued at γ_2. The coefficients γ_3 through γ_9 can likewise be interpreted as the marginal value of cash holdings that come into or leave the firm through those sources or uses defined in equation (2.2). The remaining variables are control variables: $E_{i,t}$ is earnings before interest and extraordinary items, $NA_{i,t}$ is net assets (total assets minus cash), $RD_{i,t}$ is research and development expense, $I_{i,t}$ is interest expense, $D_{i,t}$ is common dividends, $C_{i,t-1}$ is cash and short-term investments at the end of year t-1, and $L_{i,t}$ is market leverage at the end of fiscal year t. All independent variables (except leverage and the indicator variable) are scaled by lagged market equity, $M_{i,t-1}$.

Our focus is on the magnitude and significance of the γ_1 through γ_8 coefficients in our base specification. We test whether they differ significantly from each other. We also test whether γ_1=γ_2, -γ_3=γ_4, γ_5=-γ_6, and γ_7=-γ_8.[8] To shed light on differences between distressed and non-distressed firms, and constrained and unconstrained firms, we split the sample according to the level of distress or financial constraints faced by the firm and compare the eight coefficients across the various subsamples. We also test for differences among the coefficients within each of the subsamples.

The regressions use pooled OLS, and the standard errors are clustered at both the firm and fiscal year level in order to achieve the most accurate inference, as discussed in Petersen (2009), Cameron, Gelbach, and Miller (2011), and Thompson (2011). We have 25 years of data and thousands of firms, so we can cluster on both time and firm dimensions. This method allows for the possibility that the residuals across the observations for the same firm may be correlated across years, as well as the concurrent possibility that the residuals across the observations for the same fiscal year may be correlated across firms. Both scenarios seem reasonable and are supported by a preliminary analysis. In untabulated results we perform our base regressions clustering errors only by firm and including time fixed effects. Some of the standard errors increase substantially when we use two-dimensional clustering (standard errors increase on variables of interest by a range of 30% to 165% versus the one-dimensional clustering),

[8] The minus signs in the coefficient tests are used to account for the fact that some variables are defined to increase as cash holdings increase (such as *Divest*), and some variables increase as cash holdings *decrease* (such as *Invest*).

which indicates correlation of residuals in both dimensions. To be conservative, we only report statistical significance based on standard errors clustered in two dimensions.

Although both sides of the regression model in equation (2.3) appear to wash out any unobserved effects since the equation is effectively defined in terms of differences, it is still possible that unobservable effects exist that are correlated with the independent variables as well as with abnormal returns. If this is the case, then the regression results suffer from omitted variable bias. However, if these unobservable factors are time invariant, fixed effects can be useful in eliminating this bias. Therefore in order to verify the robustness of our findings, in untabulated results we re-estimate all of our models using fixed effects regressions, using both firm and year fixed effects. This methodology uses only the time series variation within each firm to estimate the coefficients. Most of the magnitudes of the cash flow coefficients are larger in these results, but none of the prior inferences changes substantially. These results show that unobserved effects tend to attenuate the estimated cash flow coefficients, not magnify them.

2.4 Data and Summary Statistics

The data are from CRSP and Compustat. The sample begins in fiscal 1987, since Statement of Financial Accounting Standards No. 95 (1987) required firms to provide a detailed statement of cash flows beginning then. We begin gathering data prior to 1987, however, so that benchmark portfolios can be assigned using historical data on size and book-to-market once cash flow data become available in 1987. The sample includes data through the end of December 2011, for a total of up to 25 annual observations per firm.[9] Cash flow and firm financial data are on an annual basis. Stock returns include the impact of distributions, and the returns correspond to the same time period as the firm's fiscal year. The 25 benchmark portfolios formed from the intersection of independent sorts on size (market equity) into quintiles and book-to-market (book equity/market equity) into quintiles are from Kenneth R. French's website.[10] The website provides detailed instructions for defining the variables and assigning the benchmark portfolios using those breakpoints.

We exclude firm-year observations in which total assets or market equity values are nonpositive, or in which net assets (total assets minus cash) are negative. Using the historical SIC code in Compustat, we remove firms that are financials and utilities (SIC codes of 6000-6999 and 4900-4999, respectively) because the relations between cash flow components and firm value may be different for those firms. Finally, dependent and independent variables with realizations in the sub-1% and over-99% tails of the sample distribution of that variable are trimmed (i.e., set to missing) to reduce the impact of extreme observations, and any observations not containing all the basic variables required for at least one of the regressions are dropped. The final sample includes 78,370 firm-year observations for 10,540 unique firms.

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[9] Compustat data came from the FUNDA file dated 2/27/2012. Compared to fiscal 2010, fiscal 2011 has less than half the number of firm-year observations. This is because Compustat data was not yet available for all the firms with a December 2011 fiscal year-end, and firm-years with a fiscal year-end from January to May 2012 (still fiscal 2011 according to Compustat) would not have been included anyway since our matching CRSP data ends in December 2011.

[10] We thank Kenneth French for making these data available. The website is located at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

All dollar-related variables are converted to 2010 dollars using the "All Urban Consumers" Consumer Price Index from the Bureau of Labor Statistics. For the purposes of deflating variables by the lagged market value of equity, market equity is calculated as common shares outstanding times the share price at fiscal year-end. Table A-1 (in the Appendix) contains the Compustat Xpressfeed codes behind all variable constructions.

Cash flow from operating activities (*OpCF*) and cash flow from financing activities (*FinCFNet*) are taken directly from Compustat without modification. Cash flow from investing activities (*InvCFNet*) is calculated as net cash flow from investing activities plus three adjustments: plus any increase in investments, less any sale of investments, less any change in short-term investments. Cash flow from investing activities (IVNCF in Compustat) must be populated in order to calculate *InvCFNet*, but any missing observations for any of the three adjustment variables are set to zero. The reason for these adjustments is that "cash" is usually defined as "cash and short-term investments" in this literature, but the statement of cash flows is concerned specifically with explaining changes in the cash balance alone, ignoring short-term investments. In some firms, large amounts of cash move back and forth between cash and short-term investments. These movements can significantly affect the investing portion of the cash flow statement, even when the firm in question may be investing very little in non-financial assets.[11] Results using the unmodified cash flow from investing variable are

[11] For example, Cascade Microtech ended fiscal 2009 with $19.5 million in cash. However, during that year investing activities provided the firm with $15.4 million in cash (79% of the firm's ending cash balance), composed partly of "proceeds from sale of marketable securities" of $37.4 million less "purchase of marketable securities" of $20.3 million. In a study of changes in "cash and short-term investments,"

similar to those reported, although the coefficients on investing cash flow are smaller, and the R^2s of the models are slightly lower.

In most of the specifications we split *InvCFNet* and *FinCFNet* into their gross positive and negative components. To do this for the negative portion of investing cash flows (*Invest*), we sum capital expenditures and acquisitions. Any realizations of "investing activities–other" that have a negative value are added to this sum (after first converting the value to a positive figure to be consistent with the other measures). For the positive portion (*Divest*), we take the sum of sales of property, plant and equipment and any positive realizations of "investing activities–other."

Financing cash flows are decomposed into five items in total. Debt issuance (*DebtIssue*) is the sum of long-term debt issuance and any positive realizations of "changes in current debt." Debt retirement (*DebtRetire*) is the reduction of long-term debt plus any negative realizations of "changes in current debt" (after converting the value to a positive figure first). Equity issuance (*EqIssue*) is the proceeds from the sale of common and preferred stock. Equity payout (*EqPayout*) is the sum of the purchase of common and preferred stock and cash dividends. Finally, other financing (*FinOther*) is the sum of the excess tax benefit of stock options and "financing activities – other." In all these cases, missing variables are each treated as zeros.

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these relatively large transfers among cash and very liquid short-term securities are not meaningful. In this specific case, our method changes the raw \$15.4 million of positive investing cash flow in Compustat to \$1.7 million of negative investing cash flow (i.e., a use of cash): \$15.4 million - \$37.4 million + \$20.3 million = -\$1.7 million.

We take additional steps to clean the cash flow data. First, for many of the variables, their native sign in Compustat should be positive. We eliminate 164 observations for which this is not the case. Next we calculate the difference between each net cash flow variable (*InvCFNet* and *FinCFNet*) and the sum of its components. We require the absolute value of this difference to be no greater than 1×10^{-6} (recall that all variables have been scaled by lagged market equity).[12] We conduct this step because by treating all missing variables as zeros in the calculation of the gross cash flow components, we may inadvertently introduce large measurement errors in some cases where the missing variables are not innocuous. Only 133 observations which were otherwise valid are discarded in this step.[13] All remaining observations are then trimmed at the 1% and 99% levels as are the other variables.

For the control variables, we follow Faulkender and Wang (2006). Earnings are defined as income before extraordinary items plus interest expense, deferred tax credits and investment tax credits. Adjustments are set to zero if missing. Net assets are total assets less cash and short-term investments. Research and development expense, interest expense, and common dividends are set to zero if missing. Cash is "cash and short-term

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[12] Although one might prefer to require a difference of zero between the sum of the gross components of the cash flows and the reported net cash flows, rounding errors result in over half the sample having a non-zero difference. In over 99% of the cases, however, the absolute value of the difference is less than 1.8×10^{-7}, which approaches the precision of the data types used for storing the variables. The differences are relatively symmetric around zero from at least the 1st to the 99th percentiles, with a median difference of zero.

[13] If the net cash flow variable (*InvCFNet* or *FinCFNet*) associated with the gross components were missing, we would eliminate the observation since we could not be certain of the final net cash flow. In our sample, however, any observations that would have been eliminated in this step were already missing a key variable such as *OpCF*, so no additional observations were lost.

investments." Market leverage is defined as book debt divided by the sum of book debt and market equity. Net financing, when used, is defined as sales of stock, less purchases of stock, plus debt proceeds, less debt retirements, and missing variables within the calculation are set to zero.

Summary statistics for the final sample of 78,370 observations are reported in Table 2.3. The mean abnormal annual return is -1.3%, while the median is -8.9%, consistent with a right-skewed distribution. Cash flow from operating activities (*OpCF*) is clearly the largest net source of cash, on average bringing in the equivalent of 8.2% of the firm's prior-year market equity in the form of cash each year. Net cash flow from investing activities (*InvCFNet*) tends to be firms' largest use of cash on average, at -9.4% of prior-period equity value, with a median value of -5.4% of prior equity. The largest portion of *InvCFNet* is associated with capital expenditures and acquisitions (*Invest*). Divesting (*Divest*) supplies a relatively small amount of cash in most firm-years.

Cash flow from financing activities (*FinCFNet*) is almost as likely to be positive as negative (median= -0.1% of prior market equity). Although many firms have little movement in *FinCFNet* on a net basis, there are still large amounts of financing activity in the average firm-year. Debt issues bring in 13.6% of prior market equity in cash in the average firm-year, and debt reduction uses up almost the same amount (12.7%). However, these numbers reflect the influence of very large debt rollovers since both means are above the third quartile for each of their respective distributions. Cash flows related to equity financing tend to be less dramatic: stock issues bring in 2.8% of prior market equity in the average firm-year, while dividends and repurchases distribute 1.9% of lagged equity value. Once again, the medians are lower still. Both stock-related measures are close to 0.3% of lagged market equity in the median firm-year. Other financing items (*FinOther*) tend to be at or near zero.

Table 2.3
Summary Statistics.

This table provides summary statistics for the variables in the final sample of firm-years described in the text for the period 1987-2011. Variables are defined in detail in Table A-1. All variables except for $AbnRet_t$ and L_t are converted to real 2010 dollars and then deflated by the lagged market value of equity. Variables have each been trimmed at the 1% tails of each distribution. ΔX_t denotes the 1-year change of variable X from year t-1 to year t ($\Delta X_t = X_t - X_{t-1}$).

Variable	Description	Mean	1st Quartile	Median	3rd Quartile	SD	N
$AbnRet_t$	Benchmark-adjusted return	-0.0126	-0.3449	-0.0887	0.1974	0.5335	78,370
ΔC_t	Change in cash	0.0024	-0.0316	0.0001	0.0320	0.1114	77,952
$OpCF_t$	Operating cashflow	0.0821	0.0098	0.0744	0.1452	0.1609	75,064
$InvCFNet_t$	Investing cashflow (net)	-0.0943	-0.1227	-0.0542	-0.0186	0.1472	74,933
$Invest_t$	Investing cashflow (gross)	0.1152	0.0263	0.0648	0.1396	0.1526	74,845
$Divest_t$	Divesting cashflow	0.0206	0.0000	0.0005	0.0086	0.0661	74,953
$FinCFNet_t$	Financing cashflow	0.0194	-0.0476	-0.0010	0.0557	0.1803	75,168
$DebtIssue_t$	Debt financing-issuance	0.1359	0.0000	0.0109	0.1229	0.3225	73,096
$DebtRetire_t$	Debt financing-reduction	0.1270	0.0007	0.0211	0.1072	0.3075	73,096
$EqIssue_t$	Equity financing-issuance	0.0284	0.0002	0.0035	0.0124	0.0801	73,096
$EqPayout_t$	Equity financing-payout	0.0193	0.0000	0.0034	0.0288	0.0308	73,096
$FinOther_t$	Financing- other	-0.0010	0.0000	0.0000	0.0000	0.0165	76,079
ΔE_t	Change in earnings	0.0105	-0.0315	0.0051	0.0382	0.1750	78,370
ΔNA_t	Change in net assets	0.0222	-0.0600	0.0173	0.1097	0.3235	78,370
ΔRD_t	Change in Research & Dev.	-0.0002	0.0000	0.0000	0.0012	0.0185	78,370
ΔI_t	Change in interest expense	0.0003	-0.0023	0.0000	0.0028	0.0177	78,370
ΔD_t	Change in dividends	-0.0001	0.0000	0.0000	0.0000	0.0056	78,370
C_{t-1}	Lagged cash	0.1583	0.0317	0.0888	0.2051	0.1977	78,370
L_t	Market leverage	0.2081	0.0170	0.1422	0.3340	0.2159	78,370
NF_t	Net financing	0.0284	-0.0290	0.0006	0.0507	0.1695	78,164

Compared to Faulkender and Wang (2006), the distribution of the change in cash variable (ΔC) is similar. The mean and median are both close to zero. Lagged cash levels (C_{t-1}) measured at the mean or median are slightly lower than in their sample. Market leverage (L) declines substantially after 2002, helping explain the lower leverage in this sample (mean of 0.21 in this sample versus almost 0.28 in Faulkender and Wang). While firms increase their profitability over the sample period (ΔE>0), research and development expenditures (ΔRD), interest (ΔI), and dividends (ΔD) change very little during that time.

The summary statistics provide additional evidence for the idea that there is substantial variation in the components of the change in cash across firms and through time. The aggregate "change in cash" measure obscures this variability. From the table it is apparent that except for divesting and the equity-related financing measures, all of the cash flow components (both net and gross) have higher standard deviations than does the change in cash. Untabulated results confirm that this pattern also extends to the variation between firms as well as within firms across time.

Additional evidence of the variation in the components of the change in cash comes from Table 2.4. This table provides mean annual values from the statements of cash flows of all firm-years in the sample. The mean firm-year has positive operating cash flows of $381 million, and the firm invests a large proportion of that amount in capital expenditures and acquisitions. A smaller but still substantial amount of cash is raised through divesting activities. On the financing side, $244 million of old debt is retired, and an amount larger than this is raised via debt securities. Equity issues raise

$31 million in cash, while dividends and repurchases use up $134 million. When all items from all categories are summed, however, the net change in cash over the year is an increase of only $19 million for the mean firm, increasing the prior cash balance by about six percent. In studying the marginal value of cash, extant literature has focused its efforts on this $19 million.

Table 2.4
Statement of Cash Flows (Mean Values of the Sample).

This table presents the mean values of the components of the annual statements of cash flows for the whole sample (1987-2011). Values are expressed in 2010 millions of dollars. N=72,147 firm-year observations for which all variables are non-missing.

Operating Activities		
Net cash flows from operating activities		381
Investing Activities		
Capital expenditures/acquisitions	(321)	
Divestitures	54	
Other investing	(28)	
Net cash flows used in investing activities		(295)
Financing Activities		
Debt issuance	285	
Debt retirement	(244)	
Equity issuance	31	
Equity payout	(134)	
Other financing	(5)	
Net cash flows used in financing activities		(67)
Net increase in cash		19
Cash, beginning of year		311
Cash, end of year		330

Table 2.5
Pearson and Spearman Correlations.

Pearson (Spearman) correlations are below (above) the diagonal. Variables are defined in Table A-1. ΔX_t denotes the 1-year change of variable *X* from year *t-1* to year *t* ($\Delta X_t = X_t - X_{t-1}$).

N=72,675

	$AbnRet_t$	$ATadj_t$	ΔC_t	$OpCF_t$	$InvNet_t$	$Invest_t$	$Divest_t$	$FinCF_t$	$+Debt_t$	$-Debt_t$	$+Eqty_t$	$-Eqty_t$	ΔE_t	ΔNA_t	ΔRD_t	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t
$AbnRet_t$	1	0.13	0.22	0.25	-0.11	0.11	0.01	-0.03	-0.02	0.04	0.19	0.09	0.32	0.21	0.06	-0.07	0.09	0.01	-0.18	0.01
$ATadj_t$	0.01	1	0.10	0.33	-0.22	0.27	0.24	-0.15	0.23	0.18	-0.02	0.44	0.01	0.12	0.03	0.02	0.12	-0.16	0.25	-0.07
ΔC_t	0.22	0.01	1	0.30	0.09	-0.06	0.03	0.12	0.00	0.02	0.16	-0.01	0.16	-0.07	0.04	-0.03	0.04	-0.25	-0.05	0.15
$OpCF_t$	0.18	0.09	0.32	1	-0.42	0.46	0.22	-0.44	0.11	0.37	-0.16	0.31	0.15	-0.06	-0.03	-0.16	0.03	-0.10	0.26	-0.32
$InvCFNet_t$	-0.08	-0.03	0.10	-0.34	1	-0.91	-0.04	-0.23	-0.43	-0.30	0.04	-0.09	-0.02	-0.42	-0.03	-0.16	-0.03	0.07	-0.40	-0.22
$Invest_t$	0.08	0.04	-0.06	0.37	-0.92	1	0.28	0.14	0.48	0.41	-0.08	0.12	0.03	0.35	0.00	0.14	0.01	-0.07	0.50	0.14
$Divest_t$	-0.01	0.04	0.08	0.08	0.17	0.24	1	-0.17	0.21	0.31	-0.14	0.17	0.04	-0.10	-0.10	-0.04	-0.01	-0.07	0.31	-0.13
$FinCFNet_t$	0.04	-0.04	0.21	-0.43	-0.47	0.40	-0.16	1	0.31	-0.20	0.30	-0.36	-0.02	0.44	0.08	0.36	0.01	-0.06	0.01	0.84
$DebtIssue_t$	0.01	0.02	0.04	0.10	-0.37	0.41	0.12	0.26	1	0.56	-0.08	0.08	-0.02	0.24	-0.04	0.25	0.01	-0.29	0.63	0.29
$DebtRetire_t$	0.03	0.01	0.01	0.25	-0.16	0.24	0.20	-0.10	0.90	1	-0.08	0.04	0.05	-0.06	-0.09	-0.05	-0.03	-0.22	0.63	-0.15
$EqIssue_t$	0.17	-0.04	0.28	-0.18	-0.10	0.09	-0.01	0.45	0.02	0.05	1	-0.12	0.09	0.16	0.09	0.03	0.06	-0.02	-0.22	0.32
$EqPayout_t$	0.03	0.12	-0.04	0.20	0.00	0.02	0.05	-0.21	0.01	0.00	-0.09	1	-0.04	0.00	-0.02	-0.02	0.11	-0.08	0.08	-0.27
ΔE_t	0.23	-0.01	0.11	0.11	0.01	0.01	0.05	-0.05	0.00	0.04	0.04	-0.02	1	0.17	-0.07	0.01	0.05	0.00	-0.06	0.00
ΔNA_t	0.17	0.03	-0.06	-0.10	-0.47	0.39	-0.18	0.50	0.17	-0.06	0.12	0.00	0.10	1	0.17	0.29	0.15	-0.06	-0.02	0.39
ΔRD_t	0.04	0.01	0.06	0.05	-0.06	0.04	-0.05	0.04	0.00	-0.02	0.02	0.01	-0.14	0.14	1	0.05	0.06	0.00	-0.11	0.07
ΔI_t	-0.05	-0.01	0.00	-0.16	-0.21	0.18	-0.05	0.35	0.16	-0.02	0.01	-0.01	-0.03	0.31	0.03	1	0.02	-0.08	0.12	0.32
ΔD_t	0.05	0.00	0.01	0.00	-0.02	0.00	-0.05	0.03	-0.03	-0.04	0.02	0.03	0.01	0.10	0.02	0.01	1	-0.07	-0.07	0.02
C_{t-1}	0.04	-0.02	-0.28	-0.08	-0.01	0.02	0.02	-0.07	-0.08	-0.05	-0.01	-0.02	0.06	-0.06	-0.09	-0.05	-0.03	1	-0.21	-0.08
L_t	-0.23	0.08	-0.05	0.21	-0.34	0.42	0.22	0.07	0.43	0.38	-0.08	0.04	-0.08	-0.07	-0.03	0.10	-0.09	-0.07	1	0.00
NF_t	0.06	-0.01	0.22	-0.30	-0.46	0.40	-0.13	0.87	0.29	-0.04	0.48	-0.16	-0.03	0.44	0.04	0.32	0.03	-0.07	0.07	1

Pearson and Spearman correlations among the key regression variables are presented in Table 2.5. The idea that the overall change in cash does not move in lockstep with its constituent cash flows is further supported by the correlations between the change in cash and the net cash flows. The strongest connection is between *OpCF* and ΔC, with partial correlations of only 0.32 and 0.30 for Pearson and Spearman correlations, respectively. Correlations among the net cash flow variables are also not particularly high. The -0.47 Pearson correlation between *InvCFNet* and *FinCFNet* is the largest in magnitude among all Pearson cash flow correlations between the net cash flow variables. The corresponding Spearman correlation of only -0.23, however, implies that relatively large (absolute) values drive part of the Pearson correlation. Debt issues and reductions have a very high Pearson correlation (0.90), but this is driven by some of the most extreme firm-year observations of those variables. (Excluding the most extreme 5% of the observations causes the Pearson correlation to more closely resemble the Spearman correlation of 0.56.) Correlations between *Invest* and *DebtIssue* or *OpCF* are between 0.37 and 0.48 (both Pearson and Spearman), whereas the univariate relation between *Invest* and *EqIssue* is unclear: the correlation magnitudes are small and the signs differ between Pearson and Spearman.

2.5 Financial Distress and Financial Constraint Measures

To examine differences in cash valuation related to financial distress and financial constraints, we require methods to identify financially distressed or constrained firms and also financially strong or unconstrained firms. We use a simple method for determining whether or not a firm is facing distress. If net operating cash flow for the past two consecutive years was positive, the firm is considered to be strong or further from distress. If this cash flow for the past two years was negative, the firm is considered to be troubled or closer to distress. This method is similar in spirit to one used in Whited and Wu (2006), in which they remove firms from their sample that have had more than two quarters of negative sales growth. Their intent is to focus only on external financial constraints, and they want to avoid picking up any information about financial distress. In our case we examine both constraints and distress in separate analyses.

To identify whether a given firm is financially constrained or unconstrained, we rely upon four different classification schemes. Most other existing schemes produce classifications that are highly correlated with at least one of these four. We report results using all four methods.

1. Whited-Wu (2006) index: Using a GMM estimation of an investment Euler equation, Whited and Wu (2006) create a structural index to identify the degree to which a firm is financially constrained. We replicate their index for our sample and, for each year from 1987 to 2011, we sort firms by the index.[14] Observations in the top (bottom) tercile of each annual financial constraint index distribution are considered to represent financially constrained (unconstrained) firms. Firm-years in the middle tercile are discarded.

[14] Since Whited and Wu use quarterly data to construct their index, we modify their formula slightly to account for our annual data: we divide our annual cash flow figure by four. Since there is no obvious way to convert the sales growth figures from annual to quarterly numbers, we make no modification for those variables.

2. Hadlock-Pierce (2010) SA index: Hadlock and Pierce (2010) gather detailed qualitative information on a random sample of firms and use this information to categorize firms as financially constrained or unconstrained. They find that firm size, the square of firm size, and firm age are the most important predictors of the degree of financial constraint for a firm. We replicate their index and sort firms each year by the index. Observations in the top (bottom) tercile of each annual SA index distribution are considered to represent financially constrained (unconstrained) firms. Firm-years in the middle tercile are discarded.
3. Payout ratio: This method is used by Almeida, Campello, and Weisbach (2004), Faulkender and Wang (2006), and others. The payout ratio is measured as the sum of dividends plus stock repurchases divided by operating income before depreciation. Firms with high payout ratios are returning larger portions of their earnings to shareholders and are therefore considered less financially constrained. Each year firms are sorted by their payout ratios. Observations in the top (bottom) tercile of each annual payout ratio distribution are considered to represent financially unconstrained (constrained) firms, and firm-years in the middle tercile are discarded. We follow Li and Zhang (2010) and modify our calculation for observations in which operating income before depreciation is nonpositive. For these observations, if the numerator of the ratio is positive, we classify the firm as unconstrained; if the numerator of the ratio is zero, we classify the firm as constrained.
4. Long-term bond rating: This method is also used by Almeida, Campello, and Weisbach (2004), Faulkender and Wang (2006), and others. The motivation for this

method is that firms with debt outstanding that have received a long-term bond rating are likely to have better access to capital. This is because investors of all types may know more about the firm and its ability to pay off its debt. For this measure, we consider all firm-years with positive debt and a long-term credit rating (in Compustat) to be financially unconstrained. Firm-years with positive debt and no long-term credit rating are deemed financially constrained. Those without debt are discarded.

Within the full sample of observations, the lowest pairwise correlation between constraint indicators is between the payout ratio indicator and the long-term bond rating indicator at 0.29 (untabulated). The highest, at 0.98, is between the WW index indicator and the SA index indicator. The distress indicator has a weaker relation with the constraint indicators: the pairwise correlation ranges from 0.23 with the bond rating indicator to 0.53 with the SA index indicator.

2.6 Empirical Results

2.6.1 Results for the Full Sample

This section provides results for our first two questions. The maximum sample size is used in all regressions, so the sample sizes differ depending on which independent variables are in each specification. Table 2.6 contains results for the first set of regressions. Model 1 replicates Model I from Table II of Faulkender and Wang (2006). While their estimated coefficient for the change in cash is 0.751, ours is 1.118. Their sample covers 1971 through 2001, whereas our sample covers 1987 through 2011. Untabulated results analyzing the data by decade from 1971 to 2011 reveal that there is

Table 2.6
Full Sample Regressions.

The dependent variable is the FF-25 benchmark-adjusted abnormal return over the 12 months matching each fiscal year ($AbnRet_t$). Variables are defined in detail in Table A-1. All explanatory variables (except L_t) are scaled by prior-period market equity. *p*-values based on robust standard errors (clustered by both firm and fiscal year per Cameron, Gelbach, and Miller 2011 and Thompson 2011) are in parentheses below the coefficient estimates. Cashflow-related coefficients with the same superscript in the same column do not statistically differ from each other at the 5% level or better.

Variable	Description	**1**	**2**	**3**	**4**
ΔC_t	Change in cash	1.118			
		(0.000)			
$\Delta C_t \times \mathbf{1}_{[\Delta C>0]}$	Change in cash if >0		1.324		
			(0.000)		
$\Delta C_t \times \mathbf{1}_{[\Delta C\leq 0]}$	Change in cash if ≤0		0.410		
			(0.000)		
$OpCF_t$	Operating cashflow			1.271	
				(0.000)	
$OpCF_t \times \mathbf{1}_{[OpCF>0]}$	Oper. cashflow if >0				1.400[b]
					(0.000)
$OpCF_t \times \mathbf{1}_{[OpCF\leq 0]}$	Oper. cashflow if ≤0				0.100[a]
					(0.214)
$InvCFNet_t$	Investing cashflow (net)			0.464	
				(0.000)	
$Invest_t$	Investing cashflow (gross)				-0.394[c]
					(0.000)
$Divest_t$	Divesting cashflow				0.676
					(0.000)
$FinCFNet_t$	Financing cashflow			0.795	
				(0.000)	
$DebtIssue_t$	Debt financing-issuance				0.563
					(0.000)
$DebtRetire_t$	Debt financing-reduction				-0.449[c]
					(0.000)
$EqIssue_t$	Equity financing-issuance				1.245[b]
					(0.000)
$EqPayout_t$	Equity financing-payout				-0.213[a,c]
					(0.186)
$FinOther_t$	Financing-other				0.511
					(0.000)

Table 2.6 Continued

Variable	Description	**1**	**2**	**3**	**4**
ΔE_t	Change in earnings	0.510	0.503	0.507	0.451
		(0.000)	(0.000)	(0.000)	(0.000)
ΔNA_t	Change in net assets	0.314	0.318	0.214	0.257
		(0.000)	(0.000)	(0.000)	(0.000)
ΔRD_t	Change in Research & Dev.	0.914	0.930	0.751	0.934
		(0.000)	(0.000)	(0.000)	(0.000)
ΔI_t	Change in interest expense	-2.369	-2.279	-1.805	-1.337
		(0.000)	(0.000)	(0.000)	(0.000)
ΔD_t	Change in dividends	1.718	1.697	1.535	1.314
		(0.000)	(0.001)	(0.000)	(0.001)
C_{t-1}	Lagged cash	0.270	0.153	0.217	0.153
		(0.000)	(0.000)	(0.000)	(0.000)
L_t	Market leverage	-0.423	-0.427	-0.617	-0.734
		(0.000)	(0.000)	(0.000)	(0.000)
NF_t	Net financing	-0.094	-0.125		
		(0.027)	(0.002)		
	Dummy ($\mathbf{1}_{[\Delta C>0]}$)		0.061		
			(0.000)		
	Dummy ($\mathbf{1}_{[OpCF>0]}$)				0.086
					(0.000)
	Intercept	0.019	-0.021	-0.007	-0.134
		(0.034)	(0.032)	(0.483)	(0.000)
N Obs		77,792	77,792	74,555	72,426
Adj. R-squared		0.166	0.172	0.195	0.226

an upward secular trend in this coefficient.[15] The other coefficients are identical in sign and similar in magnitude and significance, except for net financing, which is positive for Faulkender and Wang and negative in our sample.

In Model 2 we allow the cash change coefficient to differ based on the sign of the change in cash in order to determine whether cash increases and decreases have the same value. There is an apparent kink in the slope of the relation between the change in cash and benchmark-adjusted returns at zero change in cash. Net cash increases are valued 91 cents higher than are net cash decreases, and the difference is statistically significant. The very low coefficient on changes in cash when they are negative (0.41) implies that investors lower their valuations of the firm by only a fraction of the amount of a decrease in cash.

Model 3 decomposes the change in cash into its three main constituent net cash flows as in equation (2.1). The results show that a dollar of cash generated from operating activities is valued more highly than the other two components at $1.27. Thus an incremental dollar of cash from operations provides more than a single dollar of value to the firm. We conjecture that the value differential is related to the signaling to investors of information about the likelihood of future operational cash flows (caused by information asymmetry), and/or by relieving the firm of the need to raise costly external financing. Cash derived from net investing (a positive value for which would mean the firm divested more assets than it invested) receives the lowest valuation at $0.46, and

[15] Bates, Chang, and Chi (2011), Chung, Jung, and Park (2011), and Keefe and Kieschnick (2011) study this fact in detail.

cash generated from financing activities is in the middle at \$0.80. All of these coefficients differ significantly from each other (*p*-values of the three differences are less than 0.0001). These results show that the origin of the change in cash is important to investors' valuation of the cash. These three sources of cash differ from each other in fundamental ways regarding transaction or adjustment costs, agency costs, and information asymmetry, which suggests that these dimensions affect the valuation of the firm's cash holdings.

Recall from the summary statistics in Table 2.3 that operating cash flows are usually cash inflows to the firm, investing cash flows are usually cash outflows, and financing cash flows are about as likely to be inflows as outflows in a given firm-year. The results from Models 2 and 3 along with these distributional facts imply that investors' cash valuations may further depend on the sign of the cash flow, not just its category. In addition, changes in debt and equity are related to a firm's market value in different ways. Therefore in Model 4 we further disaggregate the investing and financing cash flows and we allow the operating cash flow coefficients to vary depending on the sign of the net cash flow. Net investing is split into gross investing and divesting, and net financing is split into debt, equity, and other financing, where debt and equity are each further split into "issuance" (both debt and equity) and "reduction" (debt) or "payout" (equity) variables.

Surprisingly, negative realizations of net operating cash flow hardly change firm value at all, with a \$0.10 decline in firm value for every \$1.00 of operating cash flow loss (*p*-value of 0.21). Positive realizations receive a much higher value of \$1.40.

Investing activities (on a gross basis) lower firm value by $0.39 for every invested dollar, but a dollar coming from divesting is valued at $0.68. A dollar generated from issuing debt is worth $0.56, but a dollar from equity issuance, valued at $1.25, is statistically equivalent to a dollar of net positive operating cash flow (indicated by the matching superscripts for those coefficients). Statistically there is no significant difference in value among a dollar used to invest, a dollar used to reduce debt principal, or a dollar used to pay a dividend or repurchase stock—all three reduce firm value. The adjusted R^2 increases again, now up to 0.226 in Model 4, demonstrating the improved fit of the model.

Thus, investors place different values on most of a firm's cash holdings based on its sources and uses. The differences are both statistically and economically significant. Cash inflows related to operating activities are worth approximately twice the amount that investors attribute to divesting or debt issuance cash inflows. Contrary to the expectations of the results in a frictionless world, the influx of dollars from debt and equity issues raises firm value while the outflow of dollars to reduce debt lowers firm value. (Equity payouts have no significant effect, but the point estimate is also negative.) These deviations from perfect markets expectations imply that agency costs, financial constraints, or other factors have an impact on how investors value different cash flows in the firm. Addressing our fourth question, results for Model 4 appear most consistent with agency costs and information asymmetry being the most significant frictions in the sample of all firms. Information asymmetry could result in operating cash flows having a value over $1.00, and agency costs could explain some of the nonzero values associated with financing activities and the negative impact of investing. Divesting and equity payout coefficients are close to those predicted for the frictionless scenario.

Regarding our second question, the results imply that investors have asymmetric valuations of cash increases and decreases for each of the three main cash sources. The differences are both statistically and economically significant. In the most extreme case, there is a $1.30 difference in value per dollar of negative versus positive net operating cash flows.

One other interesting result from Model 4 in Table 2.6 is that investing cash flows appear to reduce firm value. For every $1.00 of incremental investment in the mean firm-year, firm value is reduced by 39 cents. If firms invest optimally, firm value should not be reduced by investment, but it could be increased. We conjecture that although some firms may be investing optimally, others may be underinvesting or overinvesting. To test this idea, we divide investing cash flows into terciles to allow the possibility of a non-linear relation between investing and firm value. The results are shown in Table 2.7, but the control variables are untabulated. Model 1 replicates Model 4 of Table 2.6 for ease of comparison. Model 2 reveals that the third tercile of investing cash flows (with the largest amounts of investing) is responsible for the negative impact upon firm value in Model 1. Firms with smaller to moderate amounts of investing (terciles 1 and 2) have either a very positive relation between investing cash flows and firm value (tercile 1), or no statistically significant relation between investing cash flows and firm value (tercile 2, with a *p*-value of .93). For firms in the first tercile, an incremental dollar of investing is associated with an increase in firm value of almost four

Table 2.7
Regressions with Investing Terciles.

The dependent variable is the FF-25 benchmark-adjusted abnormal return over the 12 months matching each fiscal year (*AbnRet*$_t$). Variables are defined in detail in Table A-1. All explanatory variables are scaled by prior-period market equity. Unreported control variables are the same as those in Model 4 of Table 2.6, plus dummy variables for investing terciles 1 and 2. *p*-values based on robust standard errors (clustered by both firm and fiscal year per Cameron, Gelbach, and Miller 2011 and Thompson 2011) are in parentheses below the coefficient estimates. Cashflow-related coefficients with the same superscript in the same column do not statistically differ from each other at the 5% level or better, but for models 2-4, only differences among investing tercile coefficients are tested.

Variable	Description	1	2	3	4	*p*-value
	Subsample:	All	All	WW Index Unconstr.	WW Index Constr.	(3=4)
$OpCF_t \times \mathbf{1}_{[OpCF>0]}$	Oper. cashflow if >0	1.400[b]	1.403	1.241	1.432	0.05
		(0.000)	(0.000)	(0.000)	(0.000)	
$OpCF_t \times \mathbf{1}_{[OpCF\leq 0]}$	Oper. cashflow if ≤0	0.100[a]	0.133	-0.125	0.250	0.00
		(0.214)	(0.083)	(0.302)	(0.010)	
$Invest_t$	Investing cashflow (gross)	-0.394[c]				
		(0.000)				
$Invest_t$	Tercile 1 (smallest)		3.857	1.929	4.382	0.01
			(0.000)	(0.002)	(0.000)	
$Invest_t$	Tercile 2		-0.015	0.252	-0.325[a]	0.08
			(0.928)	(0.328)	(0.349)	
$Invest_t$	Tercile 3 (largest)		-0.599	-0.336	-0.645[a]	0.00
			(0.000)	(0.000)	(0.000)	
$Divest_t$	Divesting cashflow	0.676	0.700	0.514	0.672	0.15
		(0.000)	(0.000)	(0.000)	(0.000)	
$DebtIssue_t$	Debt financing-issuance	0.563	0.615	0.405	0.712	0.00
		(0.000)	(0.000)	(0.000)	(0.000)	
$DebtRetire_t$	Debt financing-reduction	-0.449[c]	-0.496	-0.298	-0.546	0.00
		(0.000)	(0.000)	(0.000)	(0.000)	
$EqIssue_t$	Equity financing-issuance	1.245[b]	1.265	1.076	1.392	0.00
		(0.000)	(0.000)	(0.000)	(0.000)	
$EqPayout_t$	Equity financing-payout	-0.213[a,c]	-0.280	-0.058	-0.668	0.01
		(0.186)	(0.083)	(0.711)	(0.010)	
$FinOther_t$	Financing-other	0.511	0.500	0.226	0.656	0.14
		(0.000)	(0.000)	(0.071)	(0.007)	
Controls?		Yes	Yes	Yes	Yes	
N Obs		72,426	72,426	26,410	21,681	
Adj. R-squared		0.226	0.233	0.225	0.230	

dollars (3.857). The relation between investing and firm value therefore has an inverted U-shape: firms in the first tercile appear to be underinvesting, while firms in the third appear to be overinvesting.

Models 3 and 4 analyze subsamples based on financial constraints as defined by the Whited-Wu index.[16] These models show that the difference between the first tercile and the third tercile of investing cash flows is more acute for firms with greater financial constraints. That is, the inverted U-shape is steeper for firms with greater financial constraints. The differences in coefficients between the subsamples for the first and third terciles of investing cash flows are statistically significant at conventional levels. Financially constrained firms that make relatively small investments may have binding constraints that prevent them from pursuing some profitable projects. An apparent agency cost problem afflicting firms in the third investing tercile appears to be more severe for firms facing financial constraints, or perhaps the constrained firms in the third tercile have overpaid for financing compared to the unconstrained firms.

2.6.2 Alternative Methods of Calculating Unexpected Cash Flows

In order to verify our results, we consider additional ways of measuring unexpected cash flows. Thus far we have been using the full amount of the cash flows with the implicit assumption that investors have no specific expectations for cash flows in the upcoming year. In this section, we consider three alternative methods for

[16] In later results (Table 2.10) we show that there is less of a difference in the *Invest* coefficients between the constraint subsamples when using the Whited-Wu financial constraint measure. That is why we use that measure here: there is less of a chance of finding differences between the subsamples using it. Differences using the other measures (untabulated) are similar to these.

estimating the cash flow expectations in place at the beginning of each fiscal year, since those expectations should already be reflected in the stock price. Then we subtract these expectations from the realized values in order to calculate the eight unexpected cash flows for each firm-year.[17] For this purpose, we follow the spirit of Faulkender and Wang (2006), who consider three alternative measures of the expected changes in cash.

The first method is to use the average cash flow realizations of each benchmark portfolio as the expected cash flows for each firm. Since the benchmark portfolio stock return is weighted by the market capitalization of each firm, we also use market values of equity to weight each firm in the benchmark portfolio to arrive at the portfolio's average realized cash flows. Then to determine the unexpected cash flow for each of the eight cash flow components for each firm, we subtract the benchmark portfolio's average cash flow from the firm's realized cash flow and consider the difference to be the unexpected cash flow for that component.

The second and third measures of unexpected cash flows are modifications of those used by Almeida, Campello, and Weisbach (2004) to calculate unexpected changes in cash. Both measures involve separately regressing each of the realized cash flow measures on the lagged value of that measure along with other lagged variables that represent cash flow changes, investment opportunities, size, and in the third measure, other sources and uses of cash. The second measure (labeled "ACW(1)") follows this

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[17] We consolidate the *OpCF* measure into a single variable instead of splitting it based on its sign, leaving eight cash flow components. Since we take differences between realized and expected cash flows in order to calculate unexpected cash flows, trying to maintain separate *OpCF* variables based on sign would be cumbersome.

specification, used in eight separate regressions for the eight separate cash flow components:

$$CF_{i,t} = \alpha_0 + \alpha_1 CF_{i,t-1} + \alpha_2 TotalCashFlow_{i,t-1} + \alpha_3 Q_{i,t-1} + \alpha_4 LogAssets_{i,t-1} + \varepsilon_{i,t}, \quad (2.4)$$

where *CF* represents each of the eight cash flow components in turn (*OpCF*, *Invest*, *Divest*, *DebtIssue*, *DebtRetire*, *EqIssue*, *EqPayout*, *FinOther*), *TotalCashFlow* is income before extraordinary items plus depreciation less total dividends, *Q* is the market value of assets divided by the book value of assets, and *LogAssets* is the natural log of total book assets. Each of the cash flow variables is scaled by the lagged market value of assets as opposed to the market value of equity as is done in the rest of Section 2. The regressions control for industry fixed effects at the two-digit SIC level and generate predicted cash flow amounts for each cash flow component for each firm-year. These predicted or expected cash flows are subtracted from the realized cash flows to calculate the unexpected portion of the cash flow component.

The third and final measure of unexpected cash flows (labeled “ACW(2)”) uses this expanded regression specification:

$$\begin{aligned} CF_{i,t} = {} & \alpha_0 + \alpha_1 CF_{i,t-1} + \alpha_2 TotalCashFlow_{i,t-1} + \alpha_3 Q_{i,t-1} + \alpha_4 LogAssets_{i,t-1} + \\ & \alpha_4 CAPX_{i,t-1} + \alpha_5 Acquisitions_{i,t-1} + \alpha_6 \Delta NWC_{i,t-1} + \alpha_7 \Delta ShortDebt_{i,t-1} + \varepsilon_{i,t}, \end{aligned} \quad (2.5)$$

where capital expenditures, acquisitions, changes in net working capital, and changes in short term debt, all of which are scaled by lagged market value of assets, are included in addition to the variables explained in equation (2.4). Again we control for industry fixed effects, and the predicted cash flows from these regressions are subtracted from the realized cash flows to calculate the unexpected portion of each cash flow component.

Table 2.8 shows the results of using these alternative definitions of unexpected cash flows in model 4 from Table 2.6 (with the additional modification that *OpCF* is also collapsed into one variable). The first column ("Raw") uses the cash flows as reported as the measure of unexpected cash flows, implicitly assuming that all cash flows are expected to be zero. With only a couple of exceptions, the results show strong similarities among all four approaches. The magnitudes and significance of most of the variables are similar across the four approaches, and in each case, cash flows associated with an inflow of cash are valued more highly than the corresponding outflow (in absolute value terms). The exceptions are with the "Portfolio Average" approach in Model 2. A dollar of *Divest* is worth about 30 cents less than under the other approaches, and the increase in value associated with divesting is not statistically very different from the decrease in value associated with investing. A dollar of equity payout also decreases firm value by 60 to 80 cents more than the same action analyzed using a different approach. In this case, too, equity issues and payouts seem to have a similar effect on firm value after accounting for the sign of the cash flow. Considering the number of coefficients and differences we test in each regression, the differences are relatively minor. Therefore we use the raw method to estimate the unexpected cash flows in the remainder of Section 2.

Table 2.8
Regressions with Alternative Measures of Unexpected Cash Flows.

The dependent variable is the FF-25 benchmark-adjusted abnormal return over the 12 months matching each fiscal year (*AbnRet$_t$*). "Raw" models treat the full amount of cash flows as unexpected; the other models calculate unexpected cash flows as explained in the text and in Table A-1.Variables are defined in detail in Table A-1. All explanatory variables (except L_t) are scaled by prior-period market equity. *p*-values based on robust standard errors (clustered by both firm and fiscal year) are in parentheses below the coefficient estimates. Cashflow-related coefficients with the same superscript in the same column do not statistically differ from each other at the 5% level or better.

		1	2	3	4
		Raw	PF Avg.	ACW(1)	ACW(2)
$OpCF_t$	Operating cashflow	1.144	1.037	1.135	1.15
		(0.000)	(0.000)	(0.000)	(0.000)
$Invest_t$	Investing cashflow (gross)	-0.328[a]	-0.256[a]	-0.209[a]	-0.194[a]
		(0.000)	(0.000)	(0.000)	(0.000)
$Divest_t$	Divesting cashflow	0.678	0.377[a,b]	0.635	0.638
		(0.000)	(0.000)	(0.000)	(0.000)
$DebtIssue_t$	Debt financing-issuance	0.555	0.501[b]	0.444	0.458
		(0.000)	(0.000)	(0.000)	(0.000)
$DebtRetire_t$	Debt financing-reduction	-0.425	-0.463	-0.320[b]	-0.340[b]
		(0.000)	(0.000)	(0.000)	(0.000)
$EqIssue_t$	Equity financing-issuance	1.347	1.278[c]	1.363	1.371
		(0.000)	(0.000)	(0.000)	(0.000)
$EqPayout_t$	Equity financing-payout	-0.106[a]	-0.913[c]	-0.284[a,b]	-0.322[a,b]
		(0.528)	(0.000)	(0.084)	(0.043)
$FinOther_t$	Financing-other	0.501	0.114	0.610	0.711
		(0.000)	(0.595)	(0.000)	(0.000)
ΔE_t	Change in earnings	0.472	0.504	0.459	0.462
		(0.000)	(0.000)	(0.000)	(0.000)
ΔNA_t	Change in net assets	0.238	0.207	0.255	0.251
		(0.000)	(0.000)	(0.000)	(0.000)
ΔRD_t	Change in Research & Dev.	0.768	0.733	0.947	1.017
		(0.000)	(0.000)	(0.000)	(0.000)
ΔI_t	Change in interest expense	-1.431	-1.775	-1.375	-1.363
		(0.000)	(0.000)	(0.001)	(0.002)
ΔD_t	Change in dividends	1.489	1.290	1.624	1.668
		(0.000)	(0.024)	(0.000)	(0.000)
C_{t-1}	Lagged cash	0.203	0.247	0.192	0.189
		(0.000)	(0.000)	(0.000)	(0.000)
L_t	Market leverage	-0.696	-0.572	-0.688	-0.695
		(0.000)	(0.000)	(0.000)	(0.000)
	Intercept	-0.046	0.086	0.032	0.033
		(0.000)	(0.000)	(0.001)	(0.001)
N Obs		72,426	72,420	67,962	63,526
Adj. R-squared		0.215	0.196	0.215	0.217

2.6.3 Distressed or Troubled Firms

We next turn to questions of differences between subsamples of firms based on past accounting performance. Model 4 of Table 2.6 revealed the unexpected result that investors in firms with operating cash flow losses value an incremental dollar of cash from operating activities much less than do investors in firms with positive operating cash flow. In this section we would like to find out if financial distress is a factor in this result. Therefore we split the sample based on whether firms have experienced two or more years of consecutive operating cash flow losses (referred to as troubled or distressed firms) or gains (referred to as stronger firms, or firms further from distress). Firms without consecutive gains or losses are dropped from this analysis. In one set of regressions (models 1 and 2 of Table 2.9), we determine firms' distress status by looking at the operating cash flows in the contemporaneous year of the regression and the year before. In the second set (models 3 and 4), we lag the accounting results one year before assigning firms to a gain or loss category. The goal of these regressions is to determine whether all types of cash are valued less in troubled or distressed firms.

Model 1 in Table 2.9 uses the subsample of "gain" firms, and Model 2 uses the subsample of "loss" firms, both assigned contemporaneously with the regression. Since the sign of *OpCF* is used to sort firms in these two models, it is not possible to allow for different coefficients for *OpCF* within each subsample based on the sign of the variable. *OpCF* and *Invest* are the only two cash flow variables whose estimated coefficient is higher in magnitude for the stronger firms, but the difference in *Invest* between the subsamples is not statistically significant. The large difference between the *OpCF*

Table 2.9
Firms with Consecutive Gains and Firms with Consecutive Losses.

The dependent variable is the FF-25 benchmark-adjusted abnormal return over the 12 months matching each fiscal year. Variables are defined in detail in Table A-1. Firms in columns 1 and 3 have two or more years of positive operating cash flow; those in columns 2 and 4 have two or more years of negative operating cash flow. In columns 1 and 2, operating cash flow from years t-1 and t are used to determine the profitability trend. In columns 3 and 4, we use years t-2 and t-1. All explanatory variables (except L_t) are scaled by prior-period market equity. *p*-values based on robust standard errors (clustered by both firm and fiscal year) are in parentheses. Cash flow coefficients with the same superscript in the same column do not statistically differ from each other at the 5% level or better.

	1	2		3	4	
Indicator year:	Contemporaneous		*p*-value	1-year lag		*p*-value
	2+ yr gain	2+ yr loss	(1=2)	2+ yr gain	2+ yr loss	(3=4)
$OpCF_t \times \mathbf{1}_{[OpCF>0]}$	1.416			1.397	1.396[a]	0.99
	(0.000)			(0.000)	(0.000)	
$OpCF_t \times \mathbf{1}_{[OpCF\leq 0]}$		0.462		-0.371[a]	0.459	0.00
		(0.000)		(0.001)	(0.000)	
$Invest_t$	-0.362[a]	-0.280[a]	0.47	-0.338[a]	-0.554[b]	0.03
	(0.000)	(0.001)		(0.000)	(0.000)	
$Divest_t$	0.568	0.857[b]	0.02	0.545[b]	0.897[c]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtIssue_t$	0.445	0.844[b]	0.00	0.454[b]	0.912[c]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtRetire_t$	-0.355[a]	-0.570[c]	0.06	-0.360[a]	-0.707[b]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqIssue_t$	1.206	1.437	0.02	1.200	1.426[a,d]	0.02
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqPayout_t$	-0.238[a]	-0.362[a,c]	0.74	-0.188[a]	-0.908[b,d]	0.07
	(0.158)	(0.223)		(0.237)	(0.018)	
$FinOther_t$	0.301	0.896	0.14	0.316	1.427	0.00
	(0.041)	(0.010)		(0.038)	(0.000)	
ΔE_t	0.522	0.341		0.511	0.369	
	(0.000)	(0.000)		(0.000)	(0.000)	
ΔNA_t	0.245	0.233		0.223	0.270	
	(0.000)	(0.000)		(0.000)	(0.000)	
ΔRD_t	1.146	0.859		0.823	0.951	
	(0.000)	(0.000)		(0.002)	(0.000)	
ΔI_t	-1.858	0.152		-1.586	-0.190	
	(0.000)	(0.765)		(0.000)	(0.713)	
ΔD_t	1.467	1.544		1.599	0.970	
	(0.000)	(0.374)		(0.000)	(0.638)	
C_{t-1}	0.084	0.298		0.084	0.343	
	(0.042)	(0.000)		(0.033)	(0.000)	
L_t	-0.785	-0.741		-0.756	-0.810	
	(0.000)	(0.000)		(0.000)	(0.000)	
Dummy ($\mathbf{1}_{[OpCF>0]}$)				0.039	0.146	
				(0.014)	(0.000)	
Intercept	-0.028	-0.200		-0.074	-0.200	
	(0.025)	(0.000)		(0.000)	(0.000)	
N Obs	50,080	10,252		50,047	10,394	
Adj. R-squared	0.228	0.175		0.228	0.200	

coefficients in the two groups is similar to the difference between the two *OpCF* coefficients in Model 4 in Table 2.6. For the three inflow components of the investing and financing cash flows, however, there are meaningful differences that point in the opposite direction. *Divest*, *DebtIssue* and *EqIssue* all have higher estimated coefficients for the more troubled sample of firms than for the subsample of stronger firms. Also, within each subsample of firms, the inflow cash flow components always have steeper slopes than the matching outflows, and the differences are statistically significant.

Except for *OpCF* and *Invest*, the results indicate that regardless of the source, an incremental dollar of cash is valued more highly in poorly performing firms. These results also support the idea that cash flow sign asymmetry is not driven entirely by the level of distress a firm faces, as inflows and outflows continue to be valued differently in both subsamples. The lower valuation of operating cash flows in troubled firms is a puzzle that we next address by assigning firms to gain/loss subsamples using lagged accounting data.

In models 3 and 4, we use accounting data from years *t*-2 and *t*-1 to assign firms to the gain or loss categories. Some of the troubled firms (as of the end of year *t*-1) are now able to generate positive operating cash flows in year *t*, and some stronger firms have lost money on an operating basis in year *t*. Notably, there is no real difference between the stronger and weaker firms in the way that shareholders value a dollar of net positive operating cash flow. In both cases, it is valued very highly (at $1.40). A dollar of net negative *OpCF*, however, has a very different value between the groups. For stronger firms, an incremental dollar of operating cash flow (or reducing the *OpCF* loss by $1.00) actually reduces firm value (by $0.37). For the troubled firms, who are now in at least their third year of operating losses, reducing the loss by a dollar increases firm value by $0.46 (differences are statistically significant). One possible explanation of the difference is that managers of stronger firms are more likely to attempt to minimize losses by engaging in real earnings management (see, for example, Burgstahler and Dichev (1997) and Roychowdhury (2006)). Managers who cut R&D, overproduce in order to lower the cost of goods sold, or slash discretionary expenses that may be crucial to the business may be taking short-term actions to stop losses with long-term negative effects on value. Managers of troubled firms may have less opportunity or desire to engage in such activities after years of losses, resulting in a higher coefficient on net negative operating cash flow. Most of the other coefficients in models 3 and 4 follow the general pattern from models 1 and 2: troubled or distressed firms have higher values of cash (steeper slopes in relation to firm value) in all cases. Cash inflows also increase firm value more than the corresponding outflows decrease firm value.

We conclude from this table that financial distress is associated with shareholders valuing each dollar more highly than in a relatively strong firm, no matter the source of the dollar, and we also find that minimizing losses in stronger firms reduces firm value on average. Minimizing losses in distressed firms still does not increase value as much as increasing profit does. Also, within each subsample firms maintain the same value asymmetry with regard to cash increases and decreases, with cash increases attracting a value higher in magnitude than the corresponding cash decrease. Finally, comparing the results for distressed and stronger firms leads to the conclusion that, among the major classes of frictions we study, agency costs have more of an impact on distressed firms than on stronger firms, with the exception of firms experiencing an operating loss.

2.6.4 Impact of Financial Constraints

In this section we consider the impact of financial constraints upon shareholders' valuations of the changes in cash, seeking to understand if constraints have a different effect than distress. As described in the methods section, we use four different methods to classify firms as financially constrained, unconstrained, or neither. In Table 2.10, we present the results of comparisons across the constrained and unconstrained subsamples for the four schemes. Panel A contains the results for the Whited-Wu and the SA indexes, and Panel B contains the results for the Payout Ratio and the Bond Rating methods.

With few exceptions, the marginal values of cash for the financially constrained firms are significantly greater than for the unconstrained firms. There is a significant difference in valuation of the positive net operating cash flows between the two groups. In all cases the constrained subsample exhibits a greater valuation of cash, and this difference is significant at the .02 level or better for three of the four constraint measures. The lowest difference between the groups for positive *OpCF* is 16 cents, and the highest is 44 cents. Thus financial constraints have an effect on net positive operating cash flows that is not apparent with financial distress. Net negative operating cash flows tend to be valued somewhere near zero in most cases, even though there are still some differences between the unconstrained and the constrained subsamples. The negative and significant coefficients for the unconstrained firms using the SA Index or the bond rating

Table 2.10
Financially Unconstrained vs. Constrained Subsamples.

The dependent variable is the FF-25 benchmark-adjusted abnormal return over the 12 months matching each fiscal year. Variables and financial constraint types are defined in Table A-1. All explanatory variables (except L_t) are scaled by prior-period market equity. *p*-values based on robust standard errors (clustered by both firm and fiscal year) are in parentheses. Cash flow coefficients with the same superscript in the same column do not statistically differ from each other at the 5% level or better.

Panel A: Whited-Wu Index and SA Index Extreme Terciles

	1	2		3	4	
	WW Index Unconstr.	WW Index Constr.	*p*-value (1=2)	SA Index Unconstr.	SA Index Constr.	*p*-value (3=4)
$OpCF_t \times \mathbf{1}_{[OpCF>0]}$	1.261[b]	1.419[a]	0.10	1.289	1.512[a]	0.02
	(0.000)	(0.000)		(0.000)	(0.000)	
$OpCF_t \times \mathbf{1}_{[OpCF\leq 0]}$	-0.150[a]	0.218	0.00	-0.443[a]	0.256	0.00
	(0.215)	(0.031)		(0.000)	(0.020)	
$Invest_t$	-0.219[a]	-0.356[b]	0.09	-0.211[a]	-0.414[b]	0.02
	(0.000)	(0.000)		(0.000)	(0.000)	
$Divest_t$	0.488	0.671[c]	0.09	0.503	0.641[c]	0.24
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtIssue_t$	0.372	0.663[c]	0.00	0.395	0.736[c]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtRetire_t$	-0.271[a]	-0.496[d]	0.00	-0.287[a]	-0.540[b]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqIssue_t$	1.053[b]	1.393[a]	0.00	1.007	1.412[a,d]	0.00
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqPayout_t$	-0.071[a]	-0.637[b,d]	0.01	-0.139[a]	-0.950[b,d]	0.00
	(0.668)	(0.013)		(0.367)	(0.001)	
$FinOther_t$	0.231	0.631	0.17	0.206	0.915	0.03
	(0.068)	(0.010)		(0.129)	(0.001)	
ΔE_t	0.485	0.401		0.454	0.434	
	(0.000)	(0.000)		(0.000)	(0.000)	
ΔNA_t	0.119	0.319		0.113	0.348	
	(0.000)	(0.000)		(0.000)	(0.000)	
ΔRD_t	0.758	0.803		0.329	1.094	
	(0.008)	(0.000)		(0.382)	(0.000)	
ΔI_t	-1.078	-0.932		-1.265	-0.757	
	(0.003)	(0.049)		(0.000)	(0.131)	
ΔD_t	1.193	2.010		0.999	3.758	
	(0.025)	(0.008)		(0.069)	(0.000)	
C_{t-1}	0.097	0.209		0.125	0.215	
	(0.035)	(0.000)		(0.003)	(0.000)	
L_t	-0.793	-0.736		-0.816	-0.801	
	(0.000)	(0.000)		(0.000)	(0.000)	
Dummy ($\mathbf{1}_{[OpCF>0]}$)	-0.009	0.099		-0.013	0.107	
	(0.673)	(0.000)		(0.444)	(0.000)	
Intercept	0.003	-0.186		0.009	-0.182	
	(0.904)	(0.000)		(0.649)	(0.000)	
N Obs	26,410	21,681		27,187	21,286	
Adj. R-squared	0.222	0.223		0.238	0.224	

Table 2.10 Continued

Panel B: Payout Ratio and Bond Rating Measures						
	5	**6**		**7**	**8**	
	Payout Ratio Unconstr.	Payout Ratio Constr.	*p* -value (5=6)	Bond Rating Unconstr.	Bond Rating Constr.	*p* -value (7=8)
$OpCF_t \times \mathbf{1}_{[OpCF>0]}$	1.096[a,b]	1.535[a]	0.00	1.241	1.426	0.02
	(0.000)	(0.000)		(0.000)	(0.000)	
$OpCF_t \times \mathbf{1}_{[OpCF\leq 0]}$	0.098	0.047	0.64	-0.297[a,b]	0.068	0.01
	(0.345)	(0.640)		(0.029)	(0.438)	
$Invest_t$	-0.212	-0.444	0.00	-0.193[a]	-0.354[a]	0.01
	(0.002)	(0.000)		(0.000)	(0.000)	
$Divest_t$	0.439[c]	0.806	0.00	0.502	0.668[b]	0.06
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtIssue_t$	0.457[c]	0.643	0.00	0.461	0.595[b]	0.01
	(0.000)	(0.000)		(0.000)	(0.000)	
$DebtRetire_t$	-0.385	-0.520	0.03	-0.322[b]	-0.476[c]	0.01
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqIssue_t$	1.080[a]	1.359[a,b]	0.01	0.877	1.174	0.01
	(0.000)	(0.000)		(0.000)	(0.000)	
$EqPayout_t$	1.046[b]	-2.295[b]	0.00	-0.256[a,b]	-0.325[a,c]	0.58
	(0.000)	(0.010)		(0.100)	(0.076)	
$FinOther_t$	0.319	0.832	0.06	0.241	0.425	0.35
	(0.134)	(0.000)		(0.158)	(0.003)	
ΔE_t	0.359	0.433		0.354	0.448	
	(0.000)	(0.000)		(0.000)	(0.000)	
ΔNA_t	0.169	0.294		0.057	0.274	
	(0.000)	(0.000)		(0.019)	(0.000)	
ΔRD_t	0.684	0.862		-0.409	0.799	
	(0.002)	(0.000)		(0.401)	(0.000)	
ΔI_t	-1.169	-1.338		-1.145	-1.251	
	(0.007)	(0.004)		(0.005)	(0.009)	
ΔD_t	2.179	-0.680		0.243	1.749	
	(0.000)	(0.514)		(0.669)	(0.000)	
C_{t-1}	0.078	0.197		0.262	0.183	
	(0.043)	(0.000)		(0.000)	(0.000)	
L_t	-0.615	-0.802		-0.980	-0.826	
	(0.000)	(0.000)		(0.000)	(0.000)	
Dummy ($\mathbf{1}_{[OpCF>0]}$)	0.069	0.099		-0.023	0.070	
	(0.000)	(0.000)		(0.364)	(0.000)	
Intercept	-0.208	-0.136		0.084	-0.114	
	(0.000)	(0.000)		(0.003)	(0.000)	
N Obs	23,609	26,246		17,253	44,059	
Adj. R-squared	0.193	0.244		0.281	0.243	

methods imply a real earnings management explanation similar to the one for "gain" firms mentioned previously.

With regard to the gross components of the investing and financing cash flows, the differences in valuation between the two kinds of firms are similar under the different constraint schemes. Decreases in cash (*Invest*, *DebtRetire*, and *EqPayout*) lower firm value more in constrained firms than in unconstrained firms. The differences are usually statistically significant, and the significant differences range from 14 to 81 cents per dollar of cash.[18] In a similar way, increases in cash (*Divest*, *DebtIssue*, and *EqIssue*) increase firm value more in constrained firms than in unconstrained firms. The differences for debt and equity issues are all statistically significant, and they range from 13 to 41 cents per dollar of cash. These results indicate that a marginal dollar of any kind of cash is more highly valued by the investors of constrained firms.

The differences in value between the constrained and unconstrained firms with regard to *Invest* are an unexpected result. Jensen (1986) posits that, due to agency problems, the existence of free cash flow in a firm can lead to suboptimal investment. If this principle were the overriding factor in the valuation of investment cash flows, we would expect investment by unconstrained firms to enhance firm value less (or destroy firm value more) than investment by constrained firms, assuming unconstrained firms have more free cash flow. Instead we find a *more negative* coefficient on *Invest* for constrained firms than for unconstrained firms. This means that $1.00 of investing by

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[18] We ignore the $3.34 difference for *EqPayout* for the Payout Ratio method because there are only 293 observations out of over 26,000 in the constrained subsample in which *EqPayout* is nonzero.

constrained firms lowers firm value by 14 to 23 cents more than the same dollar of investment at an unconstrained firm would. Table 2.7 showed also that this effect was concentrated in the third investing tercile since for the first tercile, investing by constrained firms added more value than the same investment by unconstrained firms. In that table, investing by constrained firms (in the third tercile) is associated with a firm value decrease of 31 cents more than the same dollar investment at an unconstrained firm. Although agency costs may still be important for unconstrained firms, the results suggest that agency costs may affect investment value more for firms facing financial constraints.

Next we consider the differences in coefficient estimates within each subsample. In five of eight subsamples, in both constrained and unconstrained firms, net positive *OpCF* is valued statistically equivalently to *EqIssue* with a significance threshold of .05. This was also the case in the base model (Model 4 in Table 2.6). It appears that firms needing to raise funds could tap the equity markets to receive the same benefits as they would if they used internally-generated operating income. In order to try to remove the possible effect of stock price run-ups on this result, we test this result in different ways (all untabulated). In two regressions, a lagged return term is included, and in one of those cases it is also interacted with the *EqIssue* term. Neither of these qualitatively changes the prior results. We also use quarterly data and rerun the regressions. The data are much noisier at the quarterly level, but *OpCF* is still valued statistically equivalently to *EqIssue* much of the time.

In many cases *Divest* and *DebtIssue* are also statistically equivalent, implying that constrained firms that need to raise cash can do so via divestitures or outside debt financing at approximately the same cost. In other cases *Invest*, *DebtRetire*, *EqPayout*, and the negative realizations of *OpCF* are statistically equivalent or near the conventional .05 threshold. In almost all cases, the gross cash flow component that represents a cash inflow adds more value to the firm than its matching outflow component takes away from firm value. For example, in Model 7, $1.00 of *Divest* adds 50 cents to firm value, while $1.00 of *Invest* takes away 19 cents of firm value. The only exceptions to this rule are with equity cash flows in constrained firms using the SA Index or the payout ratio measures: in these firms, using conventional statistical cutoffs, cash raised through equity issues is valued approximately the same as cash paid out through stock repurchases or dividends. Another exception is with unconstrained firms using the payout ratio measure: $1.00 of equity issuance adds to firm value approximately as much as $1.00 of equity repurchases/dividends subtracts from firm value. Other than these findings, there appear to be no systematic differences between constrained and unconstrained firms when it comes to differences in the values of coefficients within subsamples.

These results provide support for the proposition that the existence of financial constraints is not responsible for cash flow sign asymmetry. In almost all cases, investors still place a significantly higher value on positive cash flows than on negative ones. Also, when considering our semi-quantitative predictions about the effect frictions might have upon values of cash, it appears that financially constrained firms tend to be more affected by agency costs than are unconstrained firms. Net positive operating cash flows point to a larger effect of information asymmetry upon constrained firms, since increases in cash holdings stemming from operating activities are valued so much higher in constrained firms.

2.7 Discussion

In this essay, we contribute to the literature on the value of cash holdings by showing that the source of the dollar is important to investors in valuing the dollar. Disaggregating the change in cash into its constituent parts provides us with a richer understanding of how investors value the firm's cash holdings. Even before disaggregating the change in cash into its constituent cash flows, we find that net decreases in cash are valued asymmetrically from net increases: an incremental dollar of cash conditional on an overall decline in the cash balance is worth only $0.41, but an incremental dollar conditional on an overall cash increase is worth $1.32.

The range in valuations of an incremental dollar of cash is large: a dollar increase in cash holdings attributable to operating activities is valued at $1.27, a dollar increase attributable to financing is worth $0.80, and a dollar increase attributable to investing is worth $0.46. Allowing for the possibility of asymmetric valuations based on the sign of the cash flow produces an even wider variation: an incremental dollar of cash due to net positive operating cash flow is valued at $1.40, whereas an incremental dollar for a firm with net negative operating cash flow is valued at a statistically insignificant $0.10.

We also study the impact of financial distress and financial constraints on the value of cash. Financially troubled or constrained firms experience more sensitive reactions to virtually all components of a firm's change in cash. In the most extreme case, investors of distressed firms value a dollar of cash from debt financing 46 cents higher than they would in a relatively strong firm (the valuation is approximately twice as much in a distressed firm). A dollar coming from net positive operating cash flow is valued up to 44 cents higher within a financially constrained firm as opposed to an unconstrained firm. Also, within each of these subsamples, the differences between many of the cash flow coefficients continue to be statistically significant, and there continue to be asymmetric values of cash depending on the sign of the cash flow.

Many of the marginal values of cash are most consistent with agency costs having an impact on their value. To the extent that cash holdings sourced from operating activities are valued above $1.00, information asymmetry appears to be at work. Taxes may only have a second-order affect. Other factors such as transaction or adjustment costs may also contribute to the different marginal values of cash holdings that we document. The results enrich our understanding of how investors value firms' cash holdings.

3. EXPLANATIONS FOR DIVERGING VALUES OF CASH

3.1 Introduction to Section 3

In Section 2 we demonstrate that there are significant differences in the marginal value of cash depending on its source. In Section 3 we further investigate why differences exist among the values of cash. We find that prior sources and uses of cash provide important information to shareholders about likely future uses and sources of cash. Our results show that certain categories of cash outlays are significantly related to specific types of cash inflows from two or three years prior, suggesting that the source of cash informs investors about the likely use of cash. Similarly, we also find that certain prior uses of cash tell investors something about future uses of cash. Extending the logic further, we find that the sources of cash inflows today help explain variations in the sources of future cash inflows.

Extant literature shows that the likely use of cash can affect its value as viewed by shareholders (Faulkender and Wang (2006), Dittmar and Mahrt-Smith (2007)). The likely use of cash provides one rationale for different sources of cash being valued differently. For example, we find that $1.00 of operating cash flow in the prior year is linked to 3.6 cents of incremental spending on capital expenditures and 6.4 cents of R&D in the current year. A dollar of debt issuance in the prior year, by contrast, is related to 2 cents less spending on capital expenditures and 1.3 cents less R&D in the current year. Focusing on prior uses of cash, $1.00 of R&D spending last year is associated with 36 cents less spending on acquisitions in the current year, while $1.00 of R&D spending in the prior year results in over 90 cents of R&D spending in the current year. Finally, prior sources of cash are also informative: operating cash flow today can provide information about operating cash flows even five years into the future.

Some of the literature on investment-cash flow sensitivities explores the intertemporal relationships among cash flows and investment. Gatchev, Pulvino, and Tarhan (2010) emphasize that financial policies are (contemporaneously) interdependent as well as intertemporal. Dasgupta, Noe, and Wang (2011) and Lewellen and Lewellen (2011) analyze the impact of lagged cashflow on investment, finding that cashflow may have a more significant effect on future investment than on contemporaneous investment. Almeida and Campello (2010) note that investment and financing decisions are linked, especially within financially constrained firms. Even more than other firms, these firms are concerned about being able to fund investments in the future, modifying their activities today in order to maximize the firm's future flexibility. Finally, in a study of the reasons for issuing equity, Kim and Weisbach (2008) determine that many firms spend a large proportion of their externally raised cash on R&D and capital expenditures over the next 1-4 years.

These studies and others show that some firm behavior can best be understood in light of these intertemporal relationships among categories of cashflow and investment. We connect firms' actions and outcomes over time to the expectations of investors in order to explain why different sources of cash attract such different values.

3.2 Hypotheses Development

3.2.1 Future Uses of Cash Linked to Prior Sources of Cash

Beginning with the idea that investors may value different sources of cash in different ways because of what the sources reveal about the likely future uses of cash, we form our first null hypothesis:

H1: The future uses of cash are unrelated to the sources of the cash.

Jagannathan, Stephens, and Weisbach (2000) find that higher operating cash flows tend to be distributed to shareholders via dividends, whereas one-time non-operating cash flows are likely to be distributed through share repurchases. Faulkender and Wang (2006) show that cash holdings that are likely to be used for repurchases are more highly valued than cash holdings that are likely to be distributed as dividends. Using these findings, and assuming that divesting cash flows are likely to be one-time events, we formulate two alternative hypotheses:

H1a: Increases in cash related to operating cash flows lead to dividend increases instead of share repurchases.

H1b: Increases in cash related to divesting cash flows lead to share repurchases instead of dividend increases.

Jensen and Meckling (1976) study the agency costs of debt and show that managers may have an incentive to reallocate wealth from the debtholders to the shareholders. Debtholders rationally anticipate this incentive and assume the worst case when deciding the amount they will pay and the covenants they will require in order to purchase debt securities. Opler and Titman (1994) find that highly levered firms engaging in substantial R&D activities suffer the most when downturns occur. These and other papers focus on how the nature of an investment project may help determine the source of capital for the project. If debt is most useful for firms with more stable operations and less valuable growth options, then this leads to additional alternative hypotheses:

H1c: Increases in cash from debt issues lead to lower future acquisitions and R&D.

H1d: Increases in cash from equity issues lead to higher future acquisitions and R&D.

Almeida and Campello (2010) conclude that, especially for constrained firms, internal and external financing can be complements rather than substitutes. The additional costs of external financing are not as important to these firms as is the possibility of constraints affecting investment in either the current or some future period. Constrained firms attempt to minimize future as well as current constraints. This insight leads to the last alternative hypothesis:

H1e: Increases in cash within financially constrained firms lead to future increases in investment within those firms.

To the extent that constrained firms look to future investing needs in order to decide how to raise and preserve cash today more so than unconstrained firms do, this could help explain the larger magnitudes of the values of cash assigned by investors of constrained firms. Each dollar of cash inflow for a constrained firm would have greater implications for likely future uses of cash, affecting its value today more significantly.

3.2.2 Future Uses of Cash Linked to Prior Uses of Cash

Just as prior sources of cash may provide information about future uses of cash, prior uses of cash can be seen as negative sources of cash that may also provide information about future uses. The null hypothesis is therefore:

H2: The future uses of cash are unrelated to prior uses of cash.

If uses of cash are serially correlated, then the use of cash in period t provides information to investors about the likely use of cash in period t+1. One alternative hypothesis is then:

H2a: Decreases in cash associated with a specific use of cash are positively autocorrelated.

Firms making acquisitions may be signaling that they do not have the assets in place to pursue a certain line of business and are instead growing inorganically. In contrast, firms making investments in R&D and/or capital expenditures are possibly committing themselves to a path of organic growth. Since investment plans may take years to complete and firms must limit the number of projects they can undertake during a period of time, uses of cash associated with one of these approaches may inform investors about likely future uses of cash. Two alternative hypotheses are therefore:

H2b: Decreases in cash due to acquisitions are associated with lower future R&D expense and/or capital expenditures.

H2c: Decreases in cash due to R&D expense and/or capital expenditures are associated with lower future acquisitions.

3.2.3 Future Sources of Cash Linked to Prior Sources of Cash

Current sources of cash may also reveal information to investors about future sources of cash. For example, the level of operating cash flows may indicate the current and future productivity of existing assets; higher productivity of the firm's assets could translate to higher future operating cash flows. These anticipated future operating cash flows can then affect the value of cash today. The null hypothesis is therefore:

H3: The future sources of cash are unrelated to the prior sources of cash.

If sources of cash are serially correlated, then sources of cash in period t provide information to investors about possible sources of cash in period t+1. One alternative hypothesis is then:

H3a: Increases in cash associated with a specific source of cash are positively autocorrelated.

3.3 Methods and Data

In order to test these hypotheses, we perform pooled OLS, Tobit, and logit regressions. The dependent variables are sources or uses of cash in the form of continuous or binary variables, and the explanatory variables are contemporaneous and various lags of sources and/or uses of cash. Since the firm's investment opportunity set is a relevant factor in determining the firm's uses (and sources) of cash, we also control for investment opportunities with the lagged market-to-book assets ratio.

One specification used to test H1 is the following:

$$Use_{i,t} = \gamma_0 + \gamma_1 OpCF_{i,t} + \gamma_2 \sum_{s=t-2}^{t-1} OpCF_{i,s} + \gamma_3 Divest_{i,t} + \gamma_4 \sum_{s=t-2}^{t-1} Divest_{i,s} + \gamma_5 DebtIssue_{i,t} + \gamma_6 \sum_{s=t-2}^{t-1} DebtIssue_{i,s} + \gamma_7 EqIssue_{i,t} + \gamma_8 \sum_{s=t-2}^{t-1} EqIssue_{i,s} + \gamma_9 \sum_{s=t-2}^{t-1} Use_{i,s} + \gamma_{10} MktAssets_{t-1} + \varepsilon_{i,t}, \qquad (3.1)$$

where *Use* is replaced by a different use of cash in each model, the other variables are the same ones defined and described in Section 2 and in Table A-1, and all variables are scaled by the lagged book value of assets (total assets at *t*-1). All variables are trimmed (deleted) below the first and above the 99^{th} percentiles. As in Section 2, standard errors are clustered at both the firm and year levels.

The five uses of cash in the study are acquisitions, capital expenditures, stock repurchases, change in dividends, and research and development expense (R&D). If the variable for the use of cash is missing, the observation is not used in any regression requiring that use of cash. We use a Tobit model as an added specification in some cases where acquisitions, stock repurchases, or dividend changes are the dependent variable. In most firm-years, there are zero acquisitions, stock repurchases, or dividend changes, so the observable variable can be thought of as left censored at zero. OLS models with censored dependent variables provide inconsistent estimates, but by assuming the existence of a latent dependent variable, the Tobit model overcomes this problem.

The sources of cash we focus on are the four listed on the right side of equation (3.1): operating cash flow, divesting cash flow, debt issuance, and equity issuance. In some tables we augment the set of explanatory variables by estimating coefficients for each lag of each variable separately, and we add additional lags (up to *t*-5). For the logit regressions, the dependent variable takes the value of one if the underlying variable of interest is in the top quartile of the observations within the firm's 3-digit SIC code. Otherwise the dependent variable is zero. This method ensures that differences among industries do not drive the results.

Table 3.1 contains summary statistics. The number of observations is lower than in Section 2 because in most cases at least two lags of each variable are required in order to remain in the sample. Most means and standard deviations are smaller than those of the sample used in Section 2. We use the maximum sample size for each regression, so the number of observations in each model changes depending on the specific variables included in the regression.

3.4 Empirical Results

3.4.1 Uses of Cash Linked to Sources

We first test the null hypothesis that future uses of cash have no relation to prior sources. Table 3.2 shows the results of regressions based on equation (3.1), with five different uses of cash regressed onto contemporaneous and lagged sources of cash. Model 1 reveals that debt issuance one to two years prior results in a smaller amount of acquisitions, but equity issuance can precede higher amounts of acquisitions. The coefficient of -0.048 on lagged debt issuance can be interpreted to mean that for every $1.00 in debt issuance in the prior two-year period, acquisitions will decrease by 4.8 cents. Since acquisitions are typically much lower than debt issuance, this is an economically meaningful effect. Uses of cash for acquisitions are positively autocorrelated in a significant way, as are all of the other uses of cash in the table. Since

Table 3.1
Summary Statistics.

This table provides summary statistics for the variables described in the text for the period 1987-2011. Variables are defined in detail in Table A-1. All variables are converted to real 2010 dollars and then deflated by the lagged book value of assets. Variables have each been trimmed at the 1% tails of each distribution.

Variable	Description	Mean	1st Quartile	Median	3rd Quartile	SD	N
$OpCF_t$	Operating cashflow	0.0610	0.0152	0.0796	0.1392	0.1471	67,490
OpCF	Aggregate lags 1-2	0.0959	0.0366	0.1459	0.2418	0.3008	67,490
$Divest_t$	Divesting cashflow	0.0122	0.0000	0.0006	0.0074	0.0326	67,490
Divest	Aggregate lags 1-2	0.0255	0.0000	0.0033	0.0199	0.0654	67,490
$DebtIssue_t$	Debt financing-issuance	0.0999	0.0000	0.0141	0.1078	0.1992	67,490
DebtIssue	Aggregate lags 1-2	0.1696	0.0000	0.0727	0.2195	0.2863	67,490
$EqIssue_t$	Equity financing-issuance	0.0441	0.0001	0.0035	0.0166	0.1470	67,490
EqIssue	Aggregate lags 1-2	0.0732	0.0012	0.0106	0.0480	0.1799	67,490
Acq_t	Acquisitions	0.0239	0.0000	0.0000	0.0083	0.0698	63,867
Acq	Aggregate lags 1-2	0.0386	0.0000	0.0000	0.0405	0.0776	61,470
$CAPX_t$	Capital expenditures	0.0611	0.0198	0.0403	0.0773	0.0663	66,163
CAPX	Aggregate lags 1-2	0.1162	0.0466	0.0861	0.1519	0.1036	65,526
$Repurch_t$	Stock repurchases	0.0130	0.0000	0.0000	0.0079	0.0312	62,313
Repurch	Aggregate lags 1-2	0.0239	0.0000	0.0000	0.0218	0.0519	60,176
ΔD_t	Change in dividends	0.0002	0.0000	0.0000	0.0000	0.0045	66,012
ΔD	Aggregate lags 1-2	0.0003	0.0000	0.0000	0.0000	0.0066	59,786
RD_t	Research & development	0.0733	0.0060	0.0360	0.1057	0.0964	41,311
RD	Aggregate lags 1-2	0.1472	0.0132	0.0709	0.1998	0.2167	40,530
MTB_{t-1}	Lagged Mkt/Book Assets	1.8253	1.0602	1.4070	2.0789	1.3027	66,686

Table 3.2
Regressions of Uses of Cash onto Aggregate Lagged Sources.

Models 2, 5, and 7 are estimated via Tobit models; all others use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	2	3	4	5	6	7	8
Dependent Variable:	Acquisitions	Acquisitions	CAPX	Stk Repurch	Stk Repurch	Change in Divs	Change in Divs	R&D
OpCF: contemporaneous	0.061***	0.136***	0.064***	0.022***	0.051***	0.003***	0.012***	-0.083***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OpCF: aggregate lags 1-2	0.003	0.056***	0.023***	0.008***	0.040***	0	0.009***	0.071***
	(0.210)	(0.000)	(0.000)	(0.000)	(0.000)	(0.408)	(0.000)	(0.000)
Divest (+): contemp.	0.049***	0.093***	0.063***	0.024***	0.045***	-0.001**	0.002	-0.063***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)	(0.227)	(0.000)
Divest (+): agg. lags 1-2	-0.008*	-0.026*	-0.003	-0.001	-0.001	0	0	-0.049***
	(0.099)	(0.093)	(0.493)	(0.612)	(0.825)	(0.182)	(0.840)	(0.000)
DebtIssue (+): contemp.	0.140***	0.244***	0.057***	0.003***	0.003**	0	0.001**	0.010***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.039)	(0.295)	(0.022)	(0.000)
DebtIssue (+): agg. lags 1-2	-0.048***	-0.095***	-0.020***	-0.005***	-0.011***	-0.000***	-0.001***	-0.012***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EqIssue (+): contemp.	0.039***	0.065***	0.051***	0.002	-0.011***	0.000**	-0.006***	0.041***
	(0.000)	(0.000)	(0.000)	(0.277)	(0.004)	(0.016)	(0.000)	(0.000)
EqIssue (+): agg. lags 1-2	0.005**	-0.015*	0.018***	0.001	-0.009***	0	-0.014***	0.030***
	(0.035)	(0.073)	(0.000)	(0.420)	(0.009)	(0.155)	(0.000)	(0.000)
Dep. Var: agg. lags 1-2	0.164***	0.500***	0.362***	0.241***	0.402***	0.070***	0.299***	0.387***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.001***	0.003***	0.004***	0.003***	0.003***	0.000***	0.000***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.003***	-0.118***	-0.001	-0.001	-0.040***	-0.000***	-0.009***	0
	(0.000)	(0.000)	(0.276)	(0.176)	(0.000)	(0.001)	(0.000)	(0.999)
N Obs	58,829	58,829	64,235	57,653	57,653	58,311	58,311	39,442
Adj. R^2	0.161		0.461	0.234		0.031		0.763

66% of the firm-year observations in model 1 involve zero acquisitions, we use a Tobit model in column 2 to check our results. Although most of the signs and significance are the same as in model 1, model 2 now shows that lagged operating cash flow from the prior two years is positively related to acquisition activity, and lagged equity issuance is weakly negatively related to it.

Model 3 shows some of the same inferences for capital expenditures that are observed in model 2 for acquisitions. One different finding is that equity issuance in prior years is positively related to future capital expenditures. In model 4, operating cash flow from prior years is positively associated with stock repurchases in the future, and model 5 (using a Tobit model) adds the result that earlier equity issues are associated with lower future stock repurchases. In contrast to model 6 using OLS, model 7 (Tobit) suggests that operating cash flow from prior years is positively related to future dividend increases. Model 8 shows statistically strong relations between R&D and all lagged sources of cash flow. Lagged operating cash flow and equity issuance are positively related to R&D, while lagged divesting and debt issuance are negatively related to R&D. The point estimate of 0.071 for lagged operating cash flow means that a one standard deviation increase in lagged operating cash flow is associated with a 29% increase in mean R&D, or a 59% increase in median R&D.[19]

In Table 3.3, we disaggregate the lagged sources of cash and add lags up to *t*-5 to the model. As in the previous table, we use both OLS and Tobit models to analyze

[19] For the impact on mean R&D: (0.30×0.071)/0.0733=0.29; for median R&D: (0.30×0.071)/0.036=0.59.

Table 3.3
Regressions of Uses of Cash onto Five Lags of Sources.

Models 2, 5, and 7 are estimated via Tobit models; all others use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	2	3	4	5	6	7	8
Dependent Variable:	Acqui-sitions	Acqui-sitions	CAPX	Stk Repurch	Stk Repurch	Change in Divs	Change in Divs	R&D
OpCF: contemporaneous	0.069***	0.143***	0.057***	0.023***	0.052***	0.002***	0.009***	-0.037***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OpCF: 1 lag(s)	0.007	0.059***	0.036***	0.024***	0.067***	0.002***	0.009***	0.064***
	(0.116)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OpCF: 2 lag(s)	0.001	0.031***	-0.005	0.003	0.020***	-0.000*	0.002***	0.011**
	(0.679)	(0.006)	(0.174)	(0.334)	(0.000)	(0.084)	(0.001)	(0.028)
OpCF: 3 lag(s)	-0.001	0.007	-0.008***	-0.005***	-0.007*	0	0.002**	-0.004
	(0.809)	(0.582)	(0.000)	(0.000)	(0.059)	(0.148)	(0.039)	(0.394)
OpCF: 4 lag(s)	-0.006**	-0.020**	-0.008***	-0.002**	-0.007**	-0.000*	0.003***	-0.008
	(0.018)	(0.038)	(0.000)	(0.029)	(0.044)	(0.052)	(0.000)	(0.167)
OpCF: 5 lag(s)	-0.001	-0.002	-0.003	-0.001	-0.007**	0	0.004***	0.001
	(0.780)	(0.846)	(0.233)	(0.384)	(0.011)	(0.590)	(0.000)	(0.920)
Divest (+): contemp.	0.066***	0.144***	0.040***	0.031***	0.049***	-0.001	0.002	-0.052***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.139)	(0.146)	(0.000)
Divest (+): 1 lag(s)	-0.009	-0.032	0.012	0.015***	0.033***	0	0.001	-0.036***
	(0.250)	(0.221)	(0.213)	(0.000)	(0.001)	(0.893)	(0.393)	(0.004)
Divest (+): 2 lag(s)	-0.019**	-0.049*	-0.017**	-0.013***	-0.014*	-0.001***	-0.001	0
	(0.022)	(0.079)	(0.016)	(0.000)	(0.087)	(0.003)	(0.600)	(0.995)
Divest (+): 3 lag(s)	0.001	-0.025	-0.007	-0.006	-0.016*	0	-0.001	-0.01
	(0.948)	(0.325)	(0.108)	(0.186)	(0.081)	(0.691)	(0.613)	(0.118)
Divest (+): 4 lag(s)	0.004	-0.011	-0.002	-0.010**	-0.029***	0	0	0.003
	(0.632)	(0.553)	(0.607)	(0.021)	(0.000)	(0.189)	(0.673)	(0.586)
Divest (+): 5 lag(s)	0.005	0.019	0.008	0	-0.008	0	0	-0.014**
	(0.690)	(0.412)	(0.431)	(0.969)	(0.270)	(0.489)	(0.852)	(0.030)

Table 3.3 Continued

	1	2	3	4	5	6	7	8
Dependent Variable:	Acquisitions	Acquisitions	CAPX	Stk Repurch	Stk Repurch	Change in Divs	Change in Divs	R&D
DebtIssue (+): contemp.	0.163***	0.274***	0.046***	0.003**	0.002	0	0	0.016***
	(0.000)	(0.000)	(0.000)	(0.022)	(0.351)	(0.630)	(0.465)	(0.000)
DebtIssue (+): 1 lag(s)	-0.082***	-0.151***	-0.019***	-0.008***	-0.014***	-0.001***	-0.001*	-0.013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.090)	(0.000)
DebtIssue (+): 2 lag(s)	-0.027***	-0.054***	-0.013***	-0.003**	-0.003	0	-0.002***	-0.005*
	(0.000)	(0.000)	(0.000)	(0.044)	(0.191)	(0.232)	(0.000)	(0.057)
DebtIssue (+): 3 lag(s)	-0.018***	-0.037***	-0.008***	0	-0.001	0	0	-0.002
	(0.000)	(0.000)	(0.000)	(0.965)	(0.881)	(0.471)	(0.540)	(0.339)
DebtIssue (+): 4 lag(s)	-0.004	-0.015*	0	0.001	-0.001	0	0	-0.004**
	(0.214)	(0.082)	(0.967)	(0.608)	(0.621)	(0.399)	(0.567)	(0.036)
DebtIssue (+): 5 lag(s)	-0.008***	-0.031***	-0.001	0.001	-0.005**	0	0	-0.005**
	(0.006)	(0.000)	(0.342)	(0.450)	(0.025)	(0.346)	(0.205)	(0.016)
EqIssue (+): contemp.	0.049***	0.082***	0.046***	0	-0.019***	0	-0.004***	0.040***
	(0.000)	(0.000)	(0.000)	(0.883)	(0.000)	(0.769)	(0.000)	(0.000)
EqIssue (+): 1 lag(s)	0.018***	0.019	0.033***	0.003	-0.011*	0	-0.008***	0.023***
	(0.001)	(0.221)	(0.000)	(0.356)	(0.092)	(0.431)	(0.000)	(0.001)
EqIssue (+): 2 lag(s)	0.003	-0.031**	0	0.002	-0.01	0	-0.014***	-0.003
	(0.392)	(0.028)	(0.886)	(0.172)	(0.130)	(0.990)	(0.000)	(0.630)
EqIssue (+): 3 lag(s)	-0.005	-0.051***	-0.012***	-0.002	-0.019***	0	-0.016***	-0.005
	(0.296)	(0.001)	(0.000)	(0.355)	(0.001)	(0.491)	(0.000)	(0.413)
EqIssue (+): 4 lag(s)	-0.004	-0.045***	-0.011***	-0.001	-0.015***	0	-0.017***	-0.012*
	(0.139)	(0.001)	(0.000)	(0.616)	(0.009)	(0.159)	(0.000)	(0.078)
EqIssue (+): 5 lag(s)	-0.006***	-0.042***	-0.007**	0	-0.013***	0	-0.015***	-0.008*
	(0.004)	(0.000)	(0.014)	(0.875)	(0.008)	(0.519)	(0.000)	(0.088)
Dependent Var.: 1 lag(s)	0.182***	0.522***	0.687***	0.372***	0.542***	0.115***	0.329***	0.915***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dependent Var.: 2 lag(s)	0.125***	0.373***	0.039***	0.094***	0.162***	0.02	0.197***	-0.045
	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)	(0.324)	(0.000)	(0.281)
Dependent Var.: 3 lag(s)	0.073***	0.262***	0.050***	0.058***	0.111***	-0.014	0.096***	-0.013
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.388)	(0.000)	(0.570)
Dependent Var.: 4 lag(s)	0.051***	0.197***	0.051***	0.027***	0.062***	0.006	0.123***	-0.015
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.594)	(0.000)	(0.285)
Dependent Var.: 5 lag(s)	0.034***	0.136***	0.018***	0.021***	0.051***	-0.020*	0.051**	0.035
	(0.000)	(0.000)	(0.010)	(0.005)	(0.000)	(0.096)	(0.011)	(0.136)
Lagged Mkt/Book Assets	0.001**	0.004***	0.002***	0.003***	0.003***	0.000***	0.000***	0.005***
	(0.023)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.003**	-0.112***	-0.001	-0.002**	-0.035***	-0.000***	-0.007***	-0.001
	(0.016)	(0.000)	(0.290)	(0.023)	(0.000)	(0.002)	(0.000)	(0.502)
N Obs	33,267	33,267	39,379	33,170	33,170	35,659	35,659	23,847
Adj. R^2	0.183		0.540	0.288		0.038		0.832

acquisitions, stock repurchases, and dividend changes. The Tobit model in column 2 shows that operating cash flows from up to two years prior have a positive (and significant) effect on acquisitions. In models 1-3, debt issues from three to four years prior are related negatively to acquisitions and capital expenditures. Past equity issues have a mixed effect on acquisitions, but equity issues the previous year are positively related to capital expenditures. Models 4 and 5 show that proceeds from divesting from the prior year are partially paid out in the form of stock repurchases. No such relation exists in models 6 and 7 for lagged divesting and dividend changes. These results support alternative hypothesis H1b. The fact that each of the five lags of operating cash flow in model 7 has a positive and significant relation to dividend increases lends some support to alternative hypothesis H1a. Finally, model 8 reveals that operating cash flows from both one and two years before are positively and significantly related to R&D.

The results from logit regressions are in Table 3.4. The dependent variables take the value one if the firm's use of cash is in the top quartile for its industry; otherwise the dependent variable is zero. These results provide qualitatively similar results to those in Table 3.2 and Table 3.3. Defining the indicator variables by industry confirms that the prior results are not driven solely by industry effects.

Summarizing the results, we reject the null hypothesis that future uses of cash are unrelated to the sources of cash. There are often statistically and economically significant relations between lagged sources of cash and the uses of cash. In some cases there is information in cash flows up to three to five years prior to the use of cash. For alternative hypothesis H1a, we do not find much evidence that lagged operating cash

Table 3.4
Logit Regressions of Cash Use Indicators onto Aggregate Lagged Sources.

The dependent variable equals one if the underlying variable is in the top quartile of all observations in the firm's 3-digit SIC code. All variables are defined in Table A-1, and all independent variables are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	2	3	4	5
Dependent Variable:	1[Acq in top industry quartile]	1[CAPX in top industry quartile]	1[Stk Repurch in top industry quartile]	1[ΔDivs in top industry quartile]	1[R&D in top industry quartile]
OpCF: contemporaneous	1.339***	2.540***	1.658***	2.755***	-1.086***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OpCF: aggregate lags 1-2	1.037***	1.485***	1.697***	2.099***	2.439***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Divest (+): contemp.	0.19	1.637***	1.211**	0.555	-6.427***
	(0.676)	(0.004)	(0.013)	(0.311)	(0.000)
Divest (+): aggregate lags 1-2	-0.329	-0.426	-0.038	-0.182	-3.639***
	(0.247)	(0.195)	(0.859)	(0.507)	(0.000)
DebtIssue (+): contemp.	2.310***	1.943***	-0.025	0.191***	1.175***
	(0.000)	(0.000)	(0.757)	(0.008)	(0.000)
DebtIssue (+): aggregate lags 1-2	-1.092***	-0.851***	-0.459***	-0.270***	-0.845***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EqIssue (+): contemp.	0.323***	1.833***	-1.073***	-2.225***	1.346***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
EqIssue (+): aggregate lags 1-2	-0.108	0.936***	-0.517***	-4.645***	0.814***
	(0.463)	(0.000)	(0.010)	(0.000)	(0.002)
Continuous Dep Var: aggregate lags 1-2	7.756***	14.253***	16.699***	107.492***	21.581***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.071***	0.151***	0.087***	0.032	0.259***
	(0.000)	(0.000)	(0.002)	(0.284)	(0.000)
Intercept	-1.826***	-4.152***	-1.806***	-1.853***	-6.081***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N Obs	58,829	64,235	57,653	58,311	39,442
Pseudo R^2	0.104	0.315	0.159	0.139	0.650

flows are positively related more to dividend increases as opposed to share repurchases. There is some support for H1b only in Table 3.3: only there do share repurchases appear to be positively related to prior divesting. Hypothesis H1c finds support in all three tables discussed so far, as lagged debt issuance is negatively related to both acquisitions and R&D. There is some support for the R&D prediction of H1d in all tables, but acquisitions are not always significantly linked to lagged equity issuance in a positive way.

The intertemporal linkages among cash flows uncovered so far provide some explanations for why cash from different sources can be valued so differently. For example, recall from Section 2 that $1.00 of cash stemming from debt issuance is worth 56 cents (in model 4 of Table 2.6), which is much higher than the amount of zero predicted in a frictionless environment. A dollar used for investing lowers firm value by 39 cents (acquisitions are part of investing but are not analyzed separately in Section 2). The results in Section 3 demonstrate that lagged debt issuance is related to lower acquisitions for the next few years. If acquisitions can lower firm value, and increased debt hampers future acquisitions, then a dollar of debt provides additional value to the firm by limiting future (value-destroying) acquisitions. In untabulated results, we split the sample into the lowest and highest terciles of investing activity and separately perform regressions similar to those in Table 3.3. These results shed further light on this connection: lagged debt issuance is most negatively associated with future acquisitions for firms in the third investing tercile, the firms for which investing lowers firm value significantly (shown in Table 2.7).

Recall also that \$1.00 sourced from operating cash flow is valued highly at \$1.40. Lagged operating cash flow is positively related to future acquisitions only for firms in the first investing tercile, those for which investing contributes relatively more value to the firm. Therefore these results help explain why both debt issuance and operating cash flows can be valued so highly, as they respectively decrease the likelihood of value-destroying acquisitions and increase the likelihood of value-enhancing acquisitions.

Alternative hypothesis H1e requires a subsample of financially constrained firms, and we also compare the results for constrained firms with the results for unconstrained firms. The results using the SA index are in Table 3.5. There is not much evidence supporting H1e for acquisitions. Funds from prior sources of cash are not positively and significantly related to acquisitions for either constrained or unconstrained firms.[20] Capital expenditures, however, provide some support for the proposition. Lagged operating cash flow and lagged divesting are both positively and significantly related to capital expenditures only for constrained firms (in model 4). The same is true for lagged operating cash flow and R&D—the positive relation exists only for constrained firms (model 6). These results show that constrained firms may be using prior cash sources to fund future investments in a more systematic way than unconstrained firms do, helping explain the larger values of cash within constrained firms.

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[20] In untabulated results using Tobit models, there is a positive and significant (*p*-value=.003) coefficient on lagged operating cash flow only for constrained firms, so this does support the alternative hypothesis. The coefficient for unconstrained firms is just under zero and insignificant.

Table 3.5
Regressions of Uses of Cash onto Aggregate Lagged Sources for Constrained/Unconstrained Firms.

All regressions use pooled OLS. Models 1, 3, and 5 contain firm-years in the "least constrained" tercile as defined by the SA Index (Hadlock and Pierce 2010), and the other models contain the "most constrained." All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

	1	2		3	4		5	6	
Subsample (by SA Index):	Unconstr.	Constr.		Unconstr.	Constr.		Unconstr.	Constr.	
Dependent Variable:	Acqui-sitions	Acqui-sitions	*p*-value (1=2)	CAPX	CAPX	*p*-value (3=4)	R&D	R&D	*p*-value (5=6)
OpCF: contemporaneous	0.103***	0.031***	0.00	0.096***	0.049***	0.00	0.012	-0.108***	0.00
	(0.000)	(0.000)		(0.000)	(0.000)		(0.105)	(0.000)	
OpCF: aggregate lags 1-2	-0.011	0.002	0.07	-0.001	0.020***	0.00	-0.002	0.073***	0.00
	(0.119)	(0.297)		(0.895)	(0.000)		(0.530)	(0.000)	
Divest (+): contemp.	0.119***	0	0.00	0.057***	0.047**	0.69	-0.008	-0.123***	0.00
	(0.000)	(0.976)		(0.000)	(0.023)		(0.264)	(0.000)	
Divest (+): aggregate lags 1-2	-0.019***	0	0.05	-0.021***	0.013**	0.00	-0.027***	-0.061**	0.21
	(0.007)	(0.969)		(0.001)	(0.031)		(0.000)	(0.019)	
DebtIssue (+): contemp.	0.195***	0.079***	0.00	0.045***	0.072***	0.00	0.017***	-0.001	0.05
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.928)	
DebtIssue (+): aggregate lags 1-2	-0.066***	-0.024***	0.00	-0.017***	-0.020***	0.39	-0.007***	-0.016***	0.11
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.001)	
EqIssue (+): contemp.	0.121***	0.022***	0.00	0.085***	0.043***	0.01	0.031***	0.034***	0.72
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EqIssue (+): aggregate lags 1-2	0.012	0.001	0.28	0.050***	0.008***	0.00	0.023***	0.025***	0.73
	(0.252)	(0.516)		(0.000)	(0.000)		(0.000)	(0.000)	
Dep. Var.: aggregate lags 1-2	0.188***	0.087***	0.00	0.428***	0.260***	0.00	0.513***	0.342***	0.00
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
Lagged Mkt/Book Assets	0.001	0.001*	0.97	0.002***	0.004***	0.07	0.004***	0.008***	0.00
	(0.404)	(0.059)		(0.009)	(0.000)		(0.000)	(0.000)	
Intercept	0	0.006***		-0.005***	0.007***		-0.006***	0.015***	
	(0.847)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
N Obs	22,235	16,851		25,428	17,555		14,486	12,356	
Adjusted R^2	0.242	0.066		0.573	0.316		0.826	0.714	

Table 3.6
Regressions of Uses of Cash onto Aggregate Lagged Uses.

Models 2, 5, and 7 are estimated via Tobit models; all others use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Dependent Variable:	Acquisitions	Acquisitions	CAPX	Stk Repurch	Stk Repurch	Change in Divs	Change in Divs	R&D
Acquisitions: contemp.			0.019***	-0.008**	-0.004	0.001***	0.006***	0.052***
			(0.000)	(0.039)	(0.438)	(0.002)	(0.000)	(0.000)
Acquisitions: agg. lags 1-2	0.136***	0.456***	-0.012***	-0.001	0.023***	0	0.002**	-0.024***
	(0.000)	(0.000)	(0.000)	(0.810)	(0.000)	(0.957)	(0.033)	(0.000)
CAPX: contemp.	0.046***	0.140***		0.003	0.006	0.004***	0.011***	0.080***
	(0.000)	(0.000)		(0.590)	(0.555)	(0.000)	(0.000)	(0.000)
CAPX: agg. lags 1-2	-0.053***	-0.234***	0.358***	-0.009**	-0.021***	-0.002***	-0.004***	-0.067***
	(0.000)	(0.000)	(0.000)	(0.023)	(0.002)	(0.000)	(0.000)	(0.000)
Stk Repurch: contemp.	-0.041**	0.085***	0.006			0.006***	0.017***	-0.020*
	(0.041)	(0.009)	(0.589)			(0.000)	(0.000)	(0.062)
Stk Repurch: agg. lags 1-2	0.066***	0.221***	-0.026***	0.259***	0.452***	-0.001	0.007***	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.291)	(0.000)	(0.668)
Chg in Divs: contemp.	0.362***	1.308***	0.560***	0.359***	0.821***			-0.207**
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)			(0.025)
Chg in Divs: agg. lags 1-2	0.253***	1.135***	0.212***	0.247***	0.648***	0.053***	0.353***	-0.080*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.057)
R&D: contemp.	0.132***	0.546***	0.085***	-0.010*	-0.014	-0.002**	-0.008**	
	(0.000)	(0.000)	(0.000)	(0.061)	(0.336)	(0.016)	(0.014)	
R&D: aggregate lags 1-2	-0.073***	-0.403***	-0.069***	-0.009***	-0.052***	0	-0.020***	0.381***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.627)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.001***	0.001	0.006***	0.003***	0.004***	0.000***	0.001***	0.008***
	(0.007)	(0.256)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.019***	-0.069***	0.009***	0.005***	-0.029***	0	-0.007***	0.003**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.181)	(0.000)	(0.026)
N Obs	27,354	27,354	27,354	27,354	27,354	27,354	27,354	27,354
Adjusted R^2	0.046		0.388	0.222		0.024		0.776

3.4.2 Uses of Cash Linked to Prior Uses

We now turn to our second null hypothesis. Table 3.6 contains the results of regressions of the same five uses of cash that we have been studying onto contemporaneous and aggregate lagged uses of cash. As in the earlier tables, each use of cash is positively and significantly related to that same use of cash in the future. This leads us to reject the null hypothesis and accept H2a as one alternative. Models 3 and 8 show that prior acquisitions are negatively related to future capital expenditures and R&D, providing support for H2b. In model 1, prior spending on capital expenditures and R&D results in less spending on acquisitions in the future. This finding supports H2c. Table A-2 in the Appendix contains results using five individual lags of each of the uses of cash as explanatory variables. It shows that acquisitions, CAPX, and stock repurchases have predictive power for the same use of cash (autocorrelation) five years into the future. Table A-3 displays results of logit regressions; the inferences are the same as those from Table 3.6.

3.4.3 Sources of Cash Linked to Prior Sources

The final null hypothesis is that future sources of cash have no significant relation to the prior sources. Table 3.7 contains OLS regressions of sources of cash onto contemporaneous and aggregate lagged sources. Tobit models produce substantially similar results and are not reported. Again the null is rejected; all sources of cash have positive and statistically significant relations with their respective lagged sources. There is also evidence of intertemporal connections among some sources. For example, equity issuance in prior years can lead to debt issuance in the next year, but debt issuance has

Table 3.7
Regressions of Sources of Cash onto Aggregate Lagged Sources.

All regressions use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	2	3	4
Dependent Variable:	OpCF	Divest	DebtIssue	EqIssue
OpCF: contemporaneous		-0.017***	-0.119***	-0.226***
		(0.000)	(0.000)	(0.000)
OpCF: aggregate lags 1-2	0.289***	0.004***	0.077***	-0.058***
	(0.000)	(0.000)	(0.000)	(0.000)
Divest (+): contemp.	-0.184***		0.044	-0.084***
	(0.000)		(0.206)	(0.000)
Divest (+): aggregate lags 1-2	0.036***	0.098***	-0.007	-0.020**
	(0.003)	(0.000)	(0.689)	(0.047)
DebtIssue (+): contemp.	-0.041***	0.001		0.011**
	(0.000)	(0.197)		(0.025)
DebtIssue (+): aggregate lags 1-2	0.026***	0.006***	0.323***	0
	(0.000)	(0.000)	(0.000)	(0.893)
EqIssue (+): contemp.	-0.150***	-0.005***	0.022**	
	(0.000)	(0.000)	(0.043)	
EqIssue (+): aggregate lags 1-2	-0.080***	0	0.030***	0.083***
	(0.000)	(0.748)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.009***	-0.001***	0.002**	0.027***
	(0.000)	(0.000)	(0.013)	(0.000)
Intercept	0.031***	0.012***	0.038***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
N Obs	66,699	66,699	66,699	66,699
Adjusted R^2	0.498	0.052	0.216	0.236

no discernible relation with later equity issuance. Firms that divest tend to have higher operating cash flow in the future, implying that the remaining assets are more productive. The result that lagged equity issuance is negatively related to operating cash flow supports the idea that managers may issue stock when they perceive it to be overvalued. In contrast, lagged debt issuance is positively related to operating cash flow.

Table 3.8 contains results from OLS regressions with five lags of each source of cash. The findings are similar in nature to those in Table 3.7. All four sources of cash have significant and positive relations with all five years of lagged values of itself. This table allows us to estimate an implied discount rate that equates the present value of a stream of future cash flows with the "extra" value of cash today. Recall from Section 2 that $1.00 of net positive operating cash flow is valued by investors at $1.40 in the base specification (Table 2.6). Model 1 in Table 3.8 shows that one lag of operating cash flow has a coefficient of 0.468, and it decreases down to 0.012 at five lags. Consider a firm that generates $1.00 of operating cash flow in year *t*. The coefficients on the lagged cash flows imply that investors could expect the dollar realized in year *t* to result in 47 cents of operating cash flow in year *t*+1, 13 cents in year *t*+2, and so on. Ignoring all other effects of the year *t* operating cash flow, the implied rate of return that causes these uncertain future cash flows to be valued at $0.40 in year *t* ($1.40 - $1.00) is 47%, a high number. If taxes or agency costs were to make the $1.00 of operating cash flow to be worth less than $1.00 to investors as predicted in Table 2.2 (ignoring any other effects of

Table 3.8
OLS Regressions of Sources of Cash onto Five Lags of Sources.

All models use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

	1	**2**	**3**	**4**
Dependent Variable:	OpCF	Divest	DebtIssue	EqIssue
OpCF: contemporaneous		-0.018***	-0.118***	-0.149***
		(0.000)	(0.000)	(0.000)
OpCF: 1 lag(s)	0.468***	-0.004	0.133***	-0.058***
	(0.000)	(0.187)	(0.000)	(0.000)
OpCF: 2 lag(s)	0.129***	0.005**	0.040**	-0.006
	(0.000)	(0.045)	(0.012)	(0.591)
OpCF: 3 lag(s)	0.048***	0.006***	-0.007	-0.019**
	(0.000)	(0.003)	(0.516)	(0.021)
OpCF: 4 lag(s)	0.028**	0.001	-0.004	-0.01
	(0.011)	(0.559)	(0.539)	(0.166)
OpCF: 5 lag(s)	0.012**	0.002	-0.014*	0
	(0.032)	(0.228)	(0.072)	(0.999)
Divest (+): contemp.	-0.144***		0.07	-0.041**
	(0.000)		(0.144)	(0.025)
Divest (+): 1 lag(s)	0.051*	0.133***	-0.015	-0.02
	(0.080)	(0.000)	(0.698)	(0.242)
Divest (+): 2 lag(s)	0.02	0.060***	-0.037*	-0.031**
	(0.316)	(0.000)	(0.086)	(0.020)
Divest (+): 3 lag(s)	-0.006	0.024***	-0.040*	0.025
	(0.475)	(0.002)	(0.064)	(0.127)
Divest (+): 4 lag(s)	-0.008	0.016*	0.007	-0.009
	(0.500)	(0.050)	(0.693)	(0.425)
Divest (+): 5 lag(s)	-0.007	0.018**	0.041*	0.022*
	(0.551)	(0.023)	(0.080)	(0.075)

Table 3.8 Continued

	1	2	3	4
Dependent Variable:	OpCF	Divest	DebtIssue	EqIssue
DebtIssue (+): contemp.	-0.033***	0.002		0.019***
	(0.000)	(0.133)		(0.000)
DebtIssue (+): 1 lag(s)	0.040***	0.006***	0.467***	0.001
	(0.000)	(0.000)	(0.000)	(0.872)
DebtIssue (+): 2 lag(s)	0.009**	0.004***	0.151***	-0.005
	(0.027)	(0.007)	(0.000)	(0.349)
DebtIssue (+): 3 lag(s)	-0.003	0.003	0.066***	0.001
	(0.602)	(0.115)	(0.001)	(0.883)
DebtIssue (+): 4 lag(s)	-0.003	-0.003*	0.033***	0.001
	(0.489)	(0.070)	(0.005)	(0.641)
DebtIssue (+): 5 lag(s)	-0.015***	-0.003**	0.038***	-0.004
	(0.000)	(0.014)	(0.000)	(0.199)
EqIssue (+): contemp.	-0.119***	-0.004**	0.054***	
	(0.000)	(0.023)	(0.000)	
EqIssue (+): 1 lag(s)	-0.099***	-0.002	0.037**	0.158***
	(0.000)	(0.366)	(0.011)	(0.000)
EqIssue (+): 2 lag(s)	-0.026*	0.001	-0.001	0.051**
	(0.066)	(0.778)	(0.952)	(0.018)
EqIssue (+): 3 lag(s)	-0.015	-0.002	-0.016**	0.054***
	(0.150)	(0.250)	(0.038)	(0.000)
EqIssue (+): 4 lag(s)	0.005	0	-0.011	0.092***
	(0.631)	(0.995)	(0.147)	(0.000)
EqIssue (+): 5 lag(s)	0.004	0	-0.009	0.047***
	(0.685)	(0.885)	(0.338)	(0.002)
Lagged Mkt/Book Assets	0.011***	-0.001***	0.003*	0.020***
	(0.000)	(0.000)	(0.054)	(0.000)
Intercept	0.020***	0.012***	0.029***	0.002
	(0.000)	(0.000)	(0.000)	(0.175)
N Obs	41,247	41,247	41,247	41,247
Adjusted R^2	0.495	0.059	0.250	0.235

that dollar), then the implied rate of return would be lower.[21]

Table A-4 in the Appendix provides details of logit regressions. Some results do not carry through into the logit models: lagged divesting and lagged equity issues do not relate significantly to the indicator for top-quartile industry operating cash flow. Yet in all cases, sources of cash are positively and significantly autocorrelated. In sum, we reject the null hypothesis H3, and we accept the alternative hypothesis H3a. Prior sources of cash tell investors about likely future sources of cash and thereby provide another rationale for shareholders to value cash differently based on its source.

3.5 Discussion

Among other questions, the findings of Section 2 raise the question: Why do shareholders place such different values on cash from different sources? In this section we begin to answer the question by demonstrating that prior sources of cash provide shareholders with information about the likely uses of cash in the future. This information is impounded into stock prices, providing a link between sources of cash and the value of cash. As an example of this mechanism, we find that higher debt issuance in the past is associated with lower acquisition activity for the next few years. The fact that this connection holds most markedly for firms that appear to be overinvesting provides a reason for shareholders to value dollars stemming from debt issuance more highly than we might otherwise expect. Another example is the fact that

[21] For example, in a "Taxes Only" world with τ=.10, meaning that $1.00 of operating cash flow would be valued at $0.90 by investors (ignoring any other effects), the implied discount rate would then be 15.4% to equate the 50-cent disparity ($1.40-$0.90) with the five future operating cash flows.

lagged operating cash flows are positively associated with future acquisition activity for the firms that appear to benefit most from acquisitions (those in the first investing tercile). This connection can result in cash sourced from operating activities having even higher values than would be expected otherwise.

In the same way that past sources provide information about future uses, past *uses* of cash also provide information about future uses. This can result in a relatively larger present value effect, where uses of cash that may sometimes not add substantially to firm value (such as acquisitions or capital expenditures) may be projected several periods into the future, causing firm value to fall further because of the expectation of further cash outlays. Finally, past sources of cash also give investors information about the future sources and magnitudes of cash that firms may add to the balance sheet in future years. For example, for every $1.00 of cash holdings generated by operating cash flows, shareholders may look forward to the additional 69 cents that may be generated by operating cash flows in the next five years, discounting that value back to the present to assign a premium to the single dollar of cash generated today. Together, all three of these channels help explain why the value of cash is dependent upon its source.

4. CONCLUSION

In this dissertation, we investigate two related facets of the marginal value of cash in two essays. In the first essay, we study whether or not the value of cash depends on its source or on the direction of the cash (into or out of the firm). We also seek to understand if and how financial constraints and distress affect the value of cash across the different sources. Finally, we look into the nature of the frictions that may affect the values of cash. We find significant differences in the marginal value of cash, depending on the source of the cash. Also, increases in cash raise firm value more than corresponding decreases in cash lower firm value. Shareholders of firms facing financial constraints or distress tend to be more sensitive to any kind of changes in cash as opposed to shareholders of less constrained or stronger firms. Agency costs and information asymmetry are two frictions that appear to be most prevalent in causing deviations in the value of cash from the frictionless scenario. Financially constrained or distressed firms seem particularly prone to these frictions.

Among other questions raised by the first essay, one of the most pressing is why shareholders attribute such different values to marginal cash stemming from different sources. We address this question more fully in the second essay. Since the likely use of cash affects its value to shareholders, we study how the source of cash today might provide information about the likely use of cash in the future. We find statistically and economically meaningful relations between lagged sources and future uses of cash, providing a rationale for investors to place such different values on cash from different sources. Additionally, past uses of cash inform shareholders about likely future uses, and past sources of cash provide information about possible future sources. Some of the effects are significant two, three, or even five years into the future. In combination, all of the information embedded in cash flows helps explain why an incremental dollar in the firm can be worth much more or less than a dollar to shareholders depending on the source of that dollar.

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APPENDIX

TABLES

Table A-1
Variable Definitions.

All main variables (except $AbnRet_t$, and L_t) are first converted to real 2010 dollars. For Section 2, the variables are then deflated by the lagged market value of equity, and for Section 3, they are deflated by the lagged book value of assets. ΔX_t denotes the 1-year change of variable X from year t-1 to year t ($\Delta X_t = X_t - X_{t-1}$). Corresponding Compustat Xpressfeed codes used to calculate each variable are in capital letters after each definition.

Panel A: Main Variables

$AbnRet_t$ or Benchmark-adjusted returns	($r_{i,t} - R^B_{i,t}$), the raw annual return of stock *i* in its fiscal year *t* less the weighted average annual return of its Fama French-25 benchmark portfolio during the same year *t* (assigned based on the intersection of 5 size and 5 book-to-market quintiles)
Market Value of $Equity_t$	Common shares outstanding times share price at fiscal year-end (CSHO*PRCC_F)
$MktAssets_t$	Market Value of Assets: total assets plus market value of equity less book value of equity (AT+CSHO*PRCC_F-(CEQ+TXDITC))
Book Value of $Assets_t$	Total assets (AT)
$OpCF_t$	Net cash flow from operating activities (OANCF)
$InvCFNet_t$	Net cash flow from investing activities (excluding increases in, sales of, or changes in certain financial investments: IVNCF+IVCH–SIV–IVSTCH)
$Invest_t$	Gross investing cash flow (uses of cash) (CAPX + AQC – IVACO, where IVACO is set to zero if IVACO>0, and missing variables are each treated as zero)
$Divest_t$	Divesting cash flow (sources of cash) (SPPE + IVACO, where IVACO is set to zero if IVACO<0, and missing variables are each treated as zero)
$FinCFNet_t$	Net cash flow from financing activities (FINCF)

Table A-1 Continued

$DebtIssue_t$	Long-term debt issuance plus positive realizations of changes in current debt (DLTIS+DLCCH, where DLCCH is set to zero if DLCCH<0)
$DebtRetire_t$	Long-term debt reduction less negative realizations of changes in current debt (DLTR–DLCCH, where DLCCH is set to zero if DLCCH>0)
$EqIssue_t$	Sale of common and preferred stock (SSTK)
$EqPayout_t$	Purchase of common and preferred stock plus cash dividends (PRSTKC+DV, where missing variables are each treated as zero)
$FinOther_t$	Other financing cash flow plus excess tax benefit of stock options (FIAO+TXBCOF, where missing variables are each treated as zero)
Acquisitions	(AQC)
Capital expenditures	(CAPX)
C_t	Cash and short-term investments (CHE)
E_t	Earnings before extraordinary items plus interest expense, deferred taxes, and investment tax credits (IB+XINT+TXDI+ITCI)
NA_t	Net assets: total assets less cash (AT–CHE)
RD_t	Research and development expense (zero if missing, only in Section 2; missing observations are not in sample in Section 3) (XRD)
I_t	Interest expense (zero if missing) (XINT)
D_t	Common dividends (zero if missing) (DVC)
L_t	Market leverage ((DLTT+DLC)/(DLTT+DLC+CSHO*PRCC_F))
NF_t	Net financing: sales of stock, less purchases of stock, plus debt proceeds, less debt retirements (missing variables are each treated as zero) (SSTK–PRSTKC+DLTIS–DLTR)
$ATadj_t$	Total assets (AT)

Table A-1 Continued

Panel B: Financial Distress and Financial Constraint Variables:

2+ Yr Gain/2+ Yr Loss	Firms with positive net operating cash flow for the most recent two years are labeled "2+ Yr Gain" and are considered further from distress. Firm with negative net operating cash flow for the most recent two years are labeled "2+ Yr Loss" and are considered closer to distress. In the first two years of the sample, due to sparser population of the net operating cash flow variable we use Net Income + Depreciation as a proxy for net operating cash flow if *OpCF* is not available for 2 consecutive years.
Whited-Wu (2006) WW Index	Firms with observations in the top (bottom) tercile of the Whited and Wu (2006) structural index each year are considered financially constrained (unconstrained).
Hadlock-Pierce (2010) SA Index	Firms with observations in the top (bottom) tercile of the Hadlock and Pierce (2010) SA index each year are considered financially constrained (unconstrained).
Payout Ratio	The payout ratio is calculated as the sum of total dividends plus stock repurchases divided by operating income before depreciation ((DVC+DVP+PRSTKC)/OIBDP); observations in the top (bottom) tercile each year are considered financially unconstrained (constrained); firms with nonpositive OIBDP and positive payout are considered unconstrained, and firms with nonpositive OIBDP and zero payout are considered constrained.
Long-term Bond Rating	All firms with positive debt and a long-term credit rating (in Compustat) are considered financially unconstrained that year; firms with positive debt and no long-term credit rating are deemed to be financially constrained (SPLTICRM for credit rating; DLTT+DLC for debt).

Table A-2
OLS Regressions of Uses of Cash onto Five Lags of Uses.

All models use pooled OLS. All variables are defined in Table A-1 and are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * p<0.10, ** p<0.05, *** p<0.01.

	1	2	3	4	5
Dependent Variable:	Acqui-sitions	CAPX	Stk Repurch	Change in Divs	R&D
Acquisitions: contemp.		0.009**	-0.017***	0.001*	0.058***
		(0.016)	(0.000)	(0.059)	(0.000)
Acquisitions: 1 lag(s)	0.132***	0.01	-0.005	0	-0.051***
	(0.000)	(0.120)	(0.331)	(0.730)	(0.000)
Acquisitions: 2 lag(s)	0.088***	-0.009**	-0.002	0	-0.013***
	(0.000)	(0.016)	(0.638)	(1.000)	(0.000)
Acquisitions: 3 lag(s)	0.059***	-0.018***	0.003	-0.001	-0.004
	(0.000)	(0.000)	(0.621)	(0.127)	(0.360)
Acquisitions: 4 lag(s)	0.046***	-0.013***	-0.004	-0.001	-0.003
	(0.000)	(0.002)	(0.312)	(0.415)	(0.477)
Acquisitions: 5 lag(s)	0.036***	-0.016***	0.006*	0	-0.009
	(0.005)	(0.000)	(0.071)	(0.919)	(0.275)
CAPX: contemp.	0.031**		-0.002	0.006***	0.065***
	(0.022)		(0.813)	(0.000)	(0.000)
CAPX: 1 lag(s)	-0.040**	0.690***	-0.015	-0.003***	-0.040***
	(0.023)	(0.000)	(0.174)	(0.001)	(0.000)
CAPX: 2 lag(s)	-0.025	0.007	0	-0.002***	-0.031*
	(0.107)	(0.804)	(0.953)	(0.008)	(0.064)
CAPX: 3 lag(s)	-0.028**	0.061***	0.007	-0.001	0
	(0.035)	(0.004)	(0.477)	(0.288)	(0.971)
CAPX: 4 lag(s)	0.01	0.059***	-0.005	0	-0.058***
	(0.391)	(0.000)	(0.489)	(0.579)	(0.004)
CAPX: 5 lag(s)	-0.014*	0.026*	-0.006	0	-0.011
	(0.090)	(0.088)	(0.328)	(0.903)	(0.503)

Table A-2 Continued

	1	2	3	4	5
Dependent Variable:	Acqui-sitions	CAPX	Stk Repurch	Change in Divs	R&D
Stk Repurch: contemp.	-0.092***	-0.004		0.007***	-0.023***
	(0.001)	(0.814)		(0.000)	(0.005)
Stk Repurch: 1 lag(s)	0.127***	-0.01	0.397***	0	0.003
	(0.000)	(0.524)	(0.000)	(0.973)	(0.806)
Stk Repurch: 2 lag(s)	0.024	-0.003	0.103***	-0.003	0.003
	(0.502)	(0.796)	(0.000)	(0.111)	(0.649)
Stk Repurch: 3 lag(s)	0.02	-0.023**	0.047***	-0.001	-0.004
	(0.531)	(0.048)	(0.003)	(0.589)	(0.686)
Stk Repurch: 4 lag(s)	-0.009	-0.029***	0.030**	0.002***	0.013
	(0.549)	(0.000)	(0.011)	(0.008)	(0.220)
Stk Repurch: 5 lag(s)	-0.007	-0.021*	0.031**	0	-0.011
	(0.656)	(0.059)	(0.030)	(0.807)	(0.404)
Chg in Divs: contemp.	0.299*	0.551***	0.402***		-0.074
	(0.071)	(0.000)	(0.000)		(0.357)
Chg in Divs: 1 lag(s)	0.508***	0.218***	0.481***	0.108***	-0.165***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Chg in Divs: 2 lag(s)	0.149*	-0.012	0.064	0.007	-0.039
	(0.081)	(0.878)	(0.170)	(0.832)	(0.521)
Chg in Divs: 3 lag(s)	0.191*	-0.07	0.117**	-0.034**	-0.131**
	(0.063)	(0.244)	(0.041)	(0.046)	(0.015)
Chg in Divs: 4 lag(s)	0.197**	-0.116	0.119*	0.005	-0.094*
	(0.037)	(0.139)	(0.073)	(0.737)	(0.095)
Chg in Divs: 5 lag(s)	0.011	0.005	0.022	-0.022	-0.02
	(0.897)	(0.945)	(0.615)	(0.243)	(0.652)
R&D: contemp.	0.313***	0.101***	-0.022***	-0.001	
	(0.000)	(0.000)	(0.001)	(0.352)	
R&D: 1 lag(s)	-0.358***	-0.130***	-0.003	-0.002	0.975***
	(0.000)	(0.000)	(0.709)	(0.185)	(0.000)
R&D: 2 lag(s)	0.046*	-0.005	-0.01	0.002*	-0.127**
	(0.074)	(0.723)	(0.202)	(0.069)	(0.033)
R&D: 3 lag(s)	0.001	0.01	0.007	-0.001*	-0.005
	(0.981)	(0.465)	(0.295)	(0.089)	(0.865)
R&D: 4 lag(s)	0.004	-0.022*	0	0.001**	-0.026
	(0.831)	(0.065)	(0.968)	(0.019)	(0.352)
R&D: 5 lag(s)	-0.015	0	-0.006	-0.001**	0.060**
	(0.395)	(0.960)	(0.226)	(0.023)	(0.011)
Lagged Mkt/Book Assets	0.002***	0.005***	0.004***	0.000***	0.005***
	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.017***	0.004***	0.003***	0	0.003***
	(0.000)	(0.001)	(0.003)	(0.357)	(0.002)
N Obs	14,330	14,330	14,330	14,330	14,330
Adj. R^2	0.053	0.491	0.282	0.034	0.849

Table A-3
Logit Regressions of Cash Use Indicators onto Aggregate Lagged Uses.

The dependent variable equals one if the underlying variable is in the top quartile of all observations in the firm's 3-digit SIC code. All variables are defined in Table A-1, and all independent variables are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * *p*<0.10, ** *p*<0.05, *** *p*<0.01.

	1	2	3	4	5
Dependent Variable:	1[Acq in top industry quartile]	1[CAPX in top industry quartile]	1[Stk Repurch in top industry quartile]	1[ΔDivs in top industry quartile]	1[R&D in top industry quartile]
Acquisitions: contemp.		0.673**	0.001	1.719***	4.198***
		(0.018)	(0.999)	(0.000)	(0.000)
Acquisitions: aggregate lags 1-2	6.681***	-1.468***	0.855***	1.155***	-1.607***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.008)
CAPX: contemp.	1.707***		0.57	2.361***	7.986***
	(0.000)		(0.212)	(0.000)	(0.000)
CAPX: aggregate lags 1-2	-3.102***	15.387***	-0.795*	-0.848**	-3.861***
	(0.000)	(0.000)	(0.053)	(0.026)	(0.000)
Stk Repurch: contemp.	2.743***	1.016		4.117***	0.413
	(0.000)	(0.177)		(0.000)	(0.648)
Stk Repurch: aggregate lags 1-2	2.654***	-1.021**	17.700***	2.022***	-0.474
	(0.000)	(0.048)	(0.000)	(0.000)	(0.426)
Chg in Divs: contemp.	19.662***	29.037***	40.917***		-0.256
	(0.000)	(0.000)	(0.000)		(0.978)
Chg in Divs: aggregate lags 1-2	14.924***	16.801***	31.966***	132.890***	0.108
	(0.001)	(0.000)	(0.000)	(0.000)	(0.982)
R&D: contemp.	6.663***	8.784***	0.31	-2.222***	
	(0.000)	(0.000)	(0.566)	(0.003)	
R&D: aggregate lags 1-2	-5.346***	-6.510***	-2.129***	-5.284***	22.930***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.041***	0.244***	0.084***	0.089***	0.276***
	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	-1.158***	-3.746***	-1.311***	-1.386***	-6.341***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N Obs	27,354	27,354	27,354	27,354	27,354
Pseudo R^2	0.092	0.280	0.150	0.145	0.669

Table A-4
Logit Regressions of Cash Source Indicators onto Aggregate Lagged Sources.

The dependent variable equals one if the underlying variable is in the top quartile of all observations in the firm's 3-digit SIC code. All variables are defined in Table A-1, and all independent variables are scaled by lagged book assets. *p*-values based on standard errors clustered in two dimensions (firm and year) are in parentheses below the coefficient estimates. Statistical significance is denoted as follows: * *p*<0.10, ** *p*<0.05, *** *p*<0.01.

	1	2	3	4
Dependent Variable:	1[OpCF in top industry quartile]	1[Divest in top industry quartile]	1[Debt-Issue in top industry quartile]	1[EqIssue in top industry quartile]
OpCF: contemporaneous		-0.413***	-2.230***	-0.541*
		(0.006)	(0.000)	(0.067)
OpCF: aggregate lags 1-2	7.024***	0.302***	1.235***	-0.773***
	(0.000)	(0.001)	(0.000)	(0.000)
Divest (+): contemp.	-2.892***		0.131	-1.428***
	(0.000)		(0.755)	(0.004)
Divest (+): aggregate lags 1-2	-0.218	7.533***	0.249	-0.707***
	(0.373)	(0.000)	(0.243)	(0.000)
DebtIssue (+): contemp.	-0.011	0.198***		0.603***
	(0.897)	(0.005)		(0.000)
DebtIssue (+): aggregate lags 1-2	0.120**	0.334***	3.265***	-0.241***
	(0.034)	(0.000)	(0.000)	(0.002)
EqIssue (+): contemp.	0.272	-0.473***	-0.168	
	(0.115)	(0.000)	(0.204)	
EqIssue (+): aggregate lags 1-2	0.076	-0.225*	0.379***	1.606***
	(0.668)	(0.050)	(0.000)	(0.000)
Lagged Mkt/Book Assets	0.436***	-0.225***	-0.008	0.523***
	(0.000)	(0.000)	(0.575)	(0.000)
Intercept	-2.973***	-0.934***	-1.796***	-2.289***
	(0.000)	(0.000)	(0.000)	(0.000)
N Obs	66,699	66,699	66,699	66,699
Pseudo R^2	0.220	0.055	0.116	0.136

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