Allocating Marginal Cash Flow: Investment, Financing, and Distribution Decision Sensitivities

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ABSTRACT

Previous papers examine firms' abilities to raise external financing by studying investment/cashflow sensitivities in isolation. In this paper, we model the simultaneous effect that cashflows have on both investment and financing decisions, subject to the constraint that sources and uses of funds are equal. Our model produces efficient coefficient estimates that are free from omitted variable bias. Unlike prior studies that conclude that firms react to cashflow shocks by changing investments, we find that firms react by changing leverage. Furthermore, we find that financially constrained firms, even in declining cashflow environments, can access external capital markets.

1. Introduction

In their 1988 Brookings paper, Fazarri, Hubbard, and Petersen (hereafter FHP) document a positive relationship between internally generated cashflow and investment. They also find that this relationship is strongest for firms that are most likely to have difficulty accessing external capital markets. FHP interpret their findings as evidence of a difference between the internal and external costs of capital and conclude that capital market frictions may cause some firms to forego positive NPV projects.

Because this result, if true, has serious implications regarding the efficiency with which capital is allocated in the economy, it provoked a number of additional studies examining the relationship between cashflow and investment. Many of these studies support the original FHP findings (FHP (1996, 2000), Calomiris and Hubbard (1989, 1990, and 1995), Hoshi, Kashyap, and Scharfstein (1991), Oliner and Rudebusch (1992), Hubbard, Kashyap, and Whited (1992), Whited (1992), Schaller (1993), Bond and Meghir (1994), and Gilchrest and Himmelberg (1995)).[1, 2] Others find completely the opposite result. For example, Kaplan and Zingales (1997 and 2000) conclude that a monotonic relation between the degree of external market constraints and cash-flow sensitivity does not exist.[3] They find that firms with the easiest access to capital markets display the largest sensitivity of investment to cash flow. Firms that are financially

[1] In addition to cashflow/investment sensitivity, there is evidence that constraints in accessing external capital affect other corporate decisions. For example, Korajczyk and Levy (2002) examine the connection between firms' financial health and the timing of their financing decisions. They find that, unlike constrained firms, unconstrained firms are able to issue securities at economically favorable times.

[2] Minton and Schrand (1999) find that higher cashflow volatility increases the cost of external capital, and hence results in higher investment cashflow sensitivity. In particular they find that higher volatility is correlated with lower capital expenditures, R&D, and advertising expenses.

[3] Moyen (2002), finds support for both camps. Using generated data, she finds that the results obtained from her unconstrained model support Kaplan and Zingales. However, she also finds that cashflow sensitivity is higher for low dividend paying firms than it is for high dividend paying firms, supporting the results of FHP.

constrained have the next largest sensitivity, and firms that are partially constrained are least sensitive. Their findings imply that investment-cash flow sensitivities are uncorrelated with access to capital markets. Using a larger sample of firms, Cleary (1999) confirms Kaplan and Zingales' conclusion. In fact, Cleary finds that investment-cash flow sensitivities are actually inversely related to constraints--the most constrained firms have the lowest sensitivities and the least constrained firms have the highest sensitivities.

Econometric problems associated with model misspecification may be the cause of inconsistency in these results. The existing literature examines the cash flow sensitivity of investment in isolation, that is, without accounting for the simultaneous effect that cash flow shocks have on both investment and financing decisions. When investment and financing decisions are condensed into a single capital expenditure equation, the estimated cashflow sensitivity coefficient is likely to be biased. This bias is induced by omitted variables. Another econometric problem is that estimates produced by single equation models may be inefficient due to the fact that these models do not exploit fully the information contained in the sources/uses identity.[4]

Furthermore, separate from the bias and inefficiency issues, we argue that there is a potential problem of incorrect inference when a firm's ability to raise external funds is judged *only* on the basis of its investment-cashflow sensitivity. This problem exists even in systems of equation models that fully incorporate the sources/uses identity. Thus, even in models that do not have the sources/uses related omitted variables bias problem, the

[4] Inefficient estimates issue is the less serious of the two econometric problems discussed since the noisy estimates problem can be alleviated by using large samples. However, not all the studies in this literature employ large samples.

correct inferences should be made by examining investment-cashflow sensitivities *in conjunction with the other cashflow sensitivities of the system*.

In this paper, we propose a model in which firms make their investment and financing decisions jointly, subject to the constraint that sources and uses of funds be equal. The model follows James Tobin's suggestion, in his discussion of the original FHP article, that "… the firm jointly determines investment, dividend payments, and other ways of allocating its cash flow. Therefore,…the authors (should) model investment and dividends as depending on the same set of explanatory variables." Put differently, a firm's investment, financing, and distribution decisions are necessarily interrelated by the identity that sources of funds equal uses of funds.[5] A firm that experiences a $1 increase in its operating cash flow could increase its capital expenditures, say, by $1.[6] But it could also use the incremental cash flow to pay down debt, or increase shareholder distributions, or make any combination of investment and financing decisions that result in a net response of one dollar. *Ex-post*, this constraint holds precisely. *Ex-ante*, the constraint holds in expectation.

Specifically, our model contains nine equations describing the investment and financing decisions firms make: capital expenditures, acquisitions, and asset sales (negative investments); equity issues, dividends, and share repurchases; short-term debt issues, long-term debt issues, and changes in cash balances. We estimate this model

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[5] While there are no papers that estimate a system of cashflow sensitivity equations subject to the sources and uses of funds constraint, there are some papers that examine cashflow sensitivity of selected sources/uses variables. For example Gilchrist and Himmelberg (1998) use a structural model to find the marginal cost of funds and examine how it relates to debt, cash, and working capital. Also Fazzari and Petersen (1993), examine the cashflow sensitivity of working capital. Additionally, Almeida, Campello, and Weisbach (2002), develop a model of how cash holdings respond to cashflow changes (cashflow sensitivity of cash). Our results do not support their prediction that more of the cashflow increases will be used to build up the cash holdings in the case of the constrained firms compared with unconstrained firms.

using a sample that covers the 1950-2003 period to study the relationships between firms' internally generated cash flows and their investment, financing, and distribution decisions.

In this study, we extend the literature in several ways: First, we show that when the relationship between cashflows and capital expenditures, and cashflows and external financing are condensed into a single capital expenditures model, this leads to biased estimates for the cash flow sensitivity of capital expenditures coefficient. Second, we develop a system of equations model that acknowledges the joint nature of investment and financing decisions. Third, our model contains a much wider array of instruments both on the investment and financing side. For example, even on the investment side of the ledger, unlike previous studies, we don't just examine capital expenditures, but also acquisitions, as well as asset sales (negative investments). Fourth, by using examples, we also demonstrate that it may not necessarily be the case that there is a one-to-one correspondence between investment-cashflow sensitivities and firms' ability to access capital markets.

From an empirical perspective, our estimates yield three primary findings: First, cash flow sensitivity of investments is very small both for the full sample, and in the case of subsamples formed on the basis of perceived financial health of firms. In the full sample, a one dollar innovation in cash flow produces a net investment response of -\$0.007, and capital expenditure response of \$0.001 (statistically insignificant) when fixed effects are accounted for by first differencing the variables and including time dummies in the regression. This evidence, other things being equal, suggests that firms

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[6] In fact, the firm in question could even increase its capital expenditures even by more than a dollar, if the increase in the cashflow increases the firms' debt and/or external equity capacity by more than a dollar.

do not suffer from capital market frictions. In contrast, single equation models of previous studies yield estimates for this coefficient that is much larger. They base their conclusion on the question of capital market frictions by comparing the capital expenditure sensitivity coefficient differences across subsamples. But, for all the subsamples the estimates for the coefficient in question is much larger than our estimates. We later argue and show that this difference on the size of the sensitivity coefficient in question is due to the fact that the single equation models suffer from the omitted variables bias.

Second, firm behavior in both investment and financing platforms is similar across subsamples of firms with different degrees of financial health. Previous studies, because they model capital expenditures of firms in isolation. Thus, they are only able to compare investment-cashflow sensitivities. Our model, because it examines cashflow sensitivities in a framework that encompasses both investment financing decisions, enables us to make the cashflow sensitivity comparisons on both investment and financing platforms. Being able to compare firms' response across subsamples on two dimensions provides a stronger test than comparing only the investment response. Additionally, our approach enables us to compare investment sensitivities relative to financing cashflow sensitivities. In fact, this comparison of the relative sizes of the two sensitivities in question enables us to uncover new evidence regarding firms' ability to arrange external financing. In particular, unlike the investment cashflow sensitivities, we find that financing-cashflow sensitivities are very large and highly significant. Furthermore, the leverage dimension of the financing reaction dominates the financing-cashflow sensitivities. For example, for the full sample, a $1 shock in cashflow produces a reduction in short and long term debt by an amount of $0.777, and an increase in cash balances by a $0.226. Thus, our results show that leverage declines by almost $1 in reaction to $1 positive shock in cashflow. This implies that it could not have been the case that firms were suffering from an underinvestment problem prior to receiving an additional $1 increase in cashflow. If there was an underinvestment problem induced by capital market frictions, firms would have spent a significant portion (if not all) of the incremental cashflow to undertake new projects, rather than retiring capital. Needless to say, it is not possible to obtain this evidence from single equation investment models since these models imply, but do not explicitly specify, the response of firms on the financing front.

Third, when we partition the sample on the basis of positive and negative cashflow shocks, we observe that the response of both investment and financing variables are symmetric in the positive and negative cashflow subsamples. For example, for the full sample, a $1 negative cashflow shock causes firms to borrow an additional $0.15 of long term debt (total borrowings increase by $0.76). The reaction of debt variables appear to be symmetric with respect to the sign of the shocks since when the $1 innovation in cashlow changes is negative, our results show that firms pay down long term debt by $0.13 (total debt retirement is $0.78).

What is more remarkable is that the symmetry holds even for the subsample of firms that are classified as being "most constrained". The behavior displayed by firms that make up the constrained subsample constitutes a strong test of the capital markets access issue. It can be argued that examining firm behavior under the "worst case scenario" would provide the strongest test of firms' ability to raise external financing.

Observing the behavior of firms that are perceived to have the weakest financial health in an environment when they are experiencing negative cashflow shocks would represent such a scenario. If it turns out that these firms are able to raise funds under conditions of negative cashflow innovations, this evidence would provide strong evidence that capital market frictions do not create an underinvestment problem for firms in general. Our findings show this indeed is the case: firms in the financially constrained subsample pay off \$0.66 of short-term debt (total debt retirement is \$0.75) when they experience \$1 positive cashflow shock in cashflow changes. More importantly, these firms with poor financial health apparently, not only able to borrow funds when they face negative cash flow innovations, they actually are able to borrow *more* than the amount they pay off when the cashflow innovation is positive: Our findings show that these firms react to negative \$1 cashflow innovations by borrowing an additional \$0.76 of short-term debt (versus paying off \$0.66 when the innovations are positive), and by borrowing \$0.81 of total debt (versus total debt retirement of \$0.75 in response to a dollar's worth of positive cashflow innovations).

Taken together, these findings lead us to conclude that impediments to accessing capital markets have very little impact on firms' investment decisions.

The organization of the rest of the paper is as follows: Section 2 contrasts our system of equations model with the single equation models employed in the literature. In Section 3, we develop the system of equations model that we use in our estimations. In The discussion of the data we use is in Section 4. In section 5 we display and discuss the empirical results. Finally, Section 6 summarizes our conclusions.

2. Single Equation versus System of Equation Models

All existing studies reach their conclusions about the existence/absence of capital market access constraints, by conducting tests of cash flow sensitivity of capital expenditures across subsamples of firms that are formed on the basis of their perceived financial health. However, the estimates of cash flow sensitivities of capital expenditures represent at best an *indirect test* of the issue in question. The logic behind using cash flow sensitivity coefficients to make inferences regarding firms' ability to access external markets is as follows: Assume that the estimated coefficient in question is "small", presumably indicating that firms are relatively able to *immunize* their capital expenditures when they face negative cashflow innovations. The next step in the logic of the argument is that since capital expenditures are not cut by a significant amount, *it must be the case that firms are able to raise external capital to cover the cashflow shortage to finance their projects.* Similarly, a relatively "large" estimated cash flow sensitivity coefficient is interpreted as evidence that the significant cut in capital expenditures must be caused by firms' inability to offset the cashflow related financing shortage by raising external funds.

This conjecture that capital market access conditions can be inferred from cash flow sensitivity of capital expenditures is ironic. The *logic* of the conjecture in question *states* that not only there is an explicit correlation between cash flows and capital expenditures, but there is also an implicit connection between cash flows and firms' actions in the external markets. Yet, rather than explicitly specifying the two relationships in question as a system of equations, previous studies condense the two equations and estimate a single capital expenditure equation. However, this approach is problematic since capital expenditures equation is specified as being a function of cash flows plus the error term. In this specification, omitted variables (in this example, the external financing variables) are subsumed in the error term. In other words, the error term represents the true error term plus the omitted variables. The error term in such an equation therefore is correlated with the cash flow variable. The existence of the bias in the estimated investment-cashflow coefficient obtained from such a single equation model, as well as its sign, can be investigated. This can be done by comparing the single equation estimate of the coefficient in question with the estimate obtained from two equation system of equations contemplated by the single equation model. Previous studies estimate the following single equation model:

$$CAPX (t) = b'1*CF (t) + e' (t) \qquad (A1)$$

Where CAPX (t) is capital expenditures and CF (t) represents cash flows. The primes are used to indicate that the variables in question refer to the single equation models of the previous studies. Based on the interpretation of b'1 of the previous studies, (A1) contemplates the following system that consists of two equations:

$$CAPX (t) = b1*CF (t) + e (t) \qquad (A2)$$

$$DEBT (t) = b2*CF (t) + u (t) \qquad (A3)$$

We argue that this system should be estimated subject to the sources/uses constraint that b1 + b2 = 1. This of course means that b2 = b1 - 1. Assume that OLS, by minimizing the least squares associated with error terms e (t), produces an estimate of b1 = 0.2.

Similarly, OLS should produce an estimate for b2 = -0.8 by minimizing the least squares affiliated with the error terms u (t) subject to the constraint. Assume further that CF (t) goes down by a dollar. Based on (1) and (2), this means that CAPX will decline by $0.2 (estimate for b1), and Debt will increase by $0.8. Obviously, capital expenditures decline by only $0.2, when cashflow declines by $1, since the $1 decline in cashflow is partially offset by a $0.8 increase in debt. To see that single equation estimation of b'1 obtained from (1) suffers from an omitted variables bias, one can subtract (A3) from (A2) and rearrange,

$$CAPX (t) - Debt (t) = b1*CF (t) - (b1-1)*CF (t) + e (t) – u (t) \qquad (A4)$$

Where, b1 represents the "true" estimate. Moving Debt (t) to the right hand side of the equation yields,

$$CAPX (t) = (b1-b1+1)*CF (t) + e (t) – u (t) + Debt (t) \qquad (A5)$$

This satisfies the sources = uses constraint since the left hand side of the equation is the only use item in this model and the right hand side of the equation captures the two source items of the model (and also e(t) - u(t)). Thus, (A5) becomes:

$$CAPX (t) = (+1)*CF (t) + e (t) - u(t) + Debt (t) \qquad (A6)$$

Repeating the arithmetic of the example above means if CF=-1, CAPX = -1 + 0.8 + e – u which equals -\$0.2 under conditions where (e-u) = 0. However, since the single equation models' estimation of the CAPX equation is (A1), this results in

$$CAPX(t) = b'1 * CF(t) + e'(t) = (+1) * CF(t) + e(t) - u(t) + Debt(t) \quad \text{(A7)}$$

The correspondence between the single equation model and its implied two equation system is as follows:

$$b'1 = 1 \text{ and } e'(t) = (+1) * CF(t) + e(t) - u(t) + Debt(t) \quad \text{(A8)}$$

Thus the error term e' (t) is correlated with CF (t) since Debt (t) is in the error term, and Debt (t) is correlated with CF (t) via (A3). This proves the *presence* of the omitted variable induced bias in the estimate of b'1, but not the direction of the bias. To see the *sign* of the bias the size of b'1 needs to be compared with the magnitude of the "true" estimate (b1). This can be done by noting how OLS arrives at b'1 by minimizing the squared error terms represented by (e (t) – u (t) + Debt (t)).

$$\text{Since } CAPX = b'1 * CF(t) + e'(t) = (+1) * CF(t) + e(t) - u(t) + Debt(t) \quad \text{(A9)}$$

$$Cov(CAPX(t), CF(t)) = b'1 * Var(CF(t)) + Cov(e'(t), CF(t)) \quad \text{(A10)}$$

This means $b'1 = (Cov(CAPX(t), CF(t)) / Var(CF(t)) - Cov(e'(t), CF(t)) / Var(CF(t))$

Which amounts to $b'1 = b1 - Cov(e'(t), CF(t)) / Var(CF(t))$. (A12)

Thus, the sign of the bias hinges on the sign of the second term of (A12). The second term of (A12) can be rewritten as

$$Cov(e'(t), CF(t)) / Var(CF(t)) = Cov((e(t) - u(t) + Debt(t)), CF(t))/Var(CF(t)) \quad (A13)$$

Since $Cov(e(t) – u(t), CF(t))$ should be equal to zero, (A13) can be rewritten as:

$$b'1 = b1 - Cov(Debt(t), CF(t)) / Var(CF(t)) \quad (A14)$$

Since the expected sign of the correlation coefficient between CF (t) and Debt (t) is negative, this means

$b'1 > b1$ by the magnitude of $Cov(Debt(t), CF(t)) / Var(CF(t))$ (A15)

In other words, estimating the single equation model (A1) of previous studies, instead of the "true" model implied by (A1), which is the system of equations (A2) and (A3), results in an inconsistent estimates of b'1 which are too high compared with the true estimate of the capital expenditures cashflow sensitivity (b1) due to the fact that Debt (t) is an omitted variable in (A1).

This proves the presence and the sign of the omitted variables bias in the two equation world that is contemplated in (A1). Obviously, the omitted variables bias in

(A1) is potentially more severe, when the more realistic environment that firms operate in can be described by a model such as the 9 equation system of equations we specify in this study. However, while the presence of omitted variables bias is clear, *ex-ante,* it is not possible to predict the direction of the bias in question in a nine equation model. The sign of the bias is almost impossible to determine when reduced form (A1) is used rather than a model that fully incorporates the sources/uses identity. This is the case given the very complex nature of the covariances when the error term contains eight omitted variables. A more complete model rather than (A1) should be estimated to capture firm behavior without any bias problems. Such a model would display the environment that firms operate in a more complete and detailed manner. In fact, this is the very reason we think the capital markets access issue needs to be addressed by a model similar to ours. In other words, the issue can best be addressed by a model that acknowledges the joint nature of the investment and financing decisions, and also incorporates the constraint that sources of funds need to equal uses of funds.

In addition to the econometric problems of biased and inefficient estimates inherent in (A1), there are also potential problems of incorrect inference if firms are classified as capital markets access constrained or unconstrained based *only* on the investment-cashflow sensitivity coefficients. We will demonstrate these potential inference problems by using two examples below. These examples will assume that the environment firms operate in can be described by a system of equations that contains two equations (A2) and (A3) implied by (A1).

Example 1: Assume that a group of firms reduce their CAPX by $0.2 when their CF declines by a dollar, because they are able to access capital markets and borrow $0.8.

But, assume there is a second group of firms which also reduce their CAPX by $0.2 when they experience -$1 shock in their cashflows. Assume further that this second group of firms is able to reduce their CAPX not because they can borrow $0.8, but only because they resort to selling $0.8 worth of assets ***precisely*** because they are unable to access capital markets. On the basis of the estimated investment cashflow sensitivity coefficient b'1 (or b1 when the two equation model is estimated rather than the single CAPX equation), the inference will be that the two group of firms have equal access to capital markets. But, in reality, in this particular example, they do not. In fact, the first group can raise external funds while the second group cannot. Thus, the second group of firms in this example would be incorrectly classified as unconstrained from raising external funds, even though they face severe access constraints. This incorrect inference issue is caused by the fact that the two equation world does not account for asset sales. However, the main point here is not just that the environment that firms operate in should be modeled more realistically, say, by a model that contains nine equations which includes asset sales. It goes without saying that nine equations model is preferable. However, the main point is that even in such a model where there are no sources/uses related omitted variables bias, investment-cashflow sensitivities alone still cannot be used to assess the capital markets access status of firms. The reason why the issue of capital market access frictions can best be settled by a model with more exhaustive array of investment and financing variables is due to the fact that such a model will show a much more complete and detailed picture of how a particular group of firms is funding its investments. Additionally, such a detailed model is also likely to document differences firms may have regarding their investment strategies (e.g., pursuing growth opportunities Internally via capital expenditures versus externally, by acquisitions). For example, in the case discussed above, one would observe that the first group of firms' use of debt will show up in the estimation of the debt equation, while the second group of firms' inability will show up as an insignificant cashflow coefficient in the debt equation, and a significantly positive cashflow coefficient in the asset sales equation.

Example 2: The conjecture used in literature could also lead to incorrect inferences that firms suffer from capital market access constraints even when this may not be the case. Assume for example, that a group of firms are experiencing a negative cashflow shock. Assume further that the empirical estimate of the cashflow sensitivity of capital expenditures is relatively "large" indicating a significant curtailment of capital expenditures. However, the conjecture that "these firms must be unable to access external markets" is not necessarily accurate. For example, what if these firms' actions can be described by the following scenario? Some firms may curtail their capital expenditures because they may have concluded that their organic growth strategy is not working. As a result, they may have decided to grow by acquisitions. In fact, they may very well be financing their acquisitions by external financing. Under this particular scenario, this group of firms is clearly not capital market constrained. But, inference made on the basis of a high cashflow sensitivity of capital expenditures leads to the conclusion in this example that these firms are capital market constrained, when in reality, at least in this example, they are not. In this two equation world, this misinterpretation is caused by the fact that acquisition decisions are not modeled in a single equation capital expenditures framework. However, the comment given at the end of Example 1 applies here as well. In other words, even if the model incorporates all the sources/uses variables, and thus, not suffer from biased estimates, it will still not be possible to determine the capital market access status of firms by examining investment-cashflow sensitivities *in isolation*. Again, to arrive at the correct inference, cashflow coefficients of all investment and financing decisions need to be examined.

It is relatively easy to construct many other examples to show that inferences regarding capital markets issue should not be made *just* on the basis of cashflow sensitivities. In sum, the single equation models in the literature suffer from two econometric problems of noisy and biased estimates. Additionally, while the models that incorporate all sources/uses variables do not suffer from the two econometric problems discussed, they may still suffer from the same inference problem of the single equation models. As demonstrated in the examples above, the single equation models may lead to incorrect inferences since the conclusion regarding capital markets access is reached *on the basis of comparisons based only on investment cashflow sensitivities* across groups of firms. To address the issue of firms' access to capital markets, it is essential that models used incorporate all the important investment and financing variables Since estimates of such a model would display the complete array of cashflow sensitivities, it will enable one to correctly infer the ability of firms to raise external funds. In the next section we present one such model.

3. Model

The model we employ is based on Spindt and Tarhan (1980). They address the issue of how money center banks adjust their portfolios in response to deposits withdrawals, interest rate changes, and other exogenous events. The bank's objective in their model is to minimize the cost of adjusting its portfolio, where adjustment costs have two quadratic components. The first is the cost associated with being away from the target (desired) levels of decision variables. The second cost reflects the speed with which target variables are adjusted. Bank managers must choose endogenous variables at the beginning of the period, conditional on the forecasted end-of-period exogenous variables, and subject to the constraint that planned and forecasted variables satisfy the pro forma balance sheet constraint that total assets equal total liabilities.

In this study we use a similar approach to model the joint investment and financing decisions of firms. The manager's task is to select optimal values for investment and financing decision variables, given the expected values for exogenous and predetermined variables. Table 1 describes the variables that enter the optimization problem. In solving this problem, the manager faces the constraint that ex-post, sources of funds must equal uses of funds:

$$\Delta Cash_t + RP_t + DIV_t + CAPX_t + ACQUIS_t - \Delta LTD_t - \Delta STD_t - EQUISS_t - ASALES_t \equiv CF_t + OTHER_t \quad (1)$$

In equation (1), decision variables have been collected on the left-hand side of the identity for convenience. OTHER is the difference between the source and use variables used in the model, and captures miscellaneous source and use items that are not explicitly included in the model.

Our measure of cash flow (CF) is defined in equation (2):

$$CF_t = EBITDA_t - INTEXP_t - TAX_t - \Delta NWC_t \quad (2)$$

$EBITDA_t$ is earnings before interest, taxes, and depreciation. Because $EBITDA_t$ is jointly determined by the firm's past investments and by consumers' current behavior, it is assumed to be exogenous to the firm in the current period. $INTEXP_t$ is interest expense and TAX_t is cash taxes. Both of these variables are assumed to be determined by financing and investment decisions in prior years and are therefore taken as exogenous in the current period. Similarly, ΔNWC_t which equals change in net working capital from t-1 to t, is assumed to depend on past investment decisions and current sales projections. Thus, CF_t is assumed to be exogenous and represents internally generated funds that are available for undertaking investments or for making payments to shareholders and debtholders.

Because, as a simple matter of accounting, the sources/uses identity specified by equation (1) is always satisfied for *ex-post* quantities, it conveys little economic content. What is important from an economic standpoint is that the constraint also holds for *ex-ante* values, conditional on forecasts of end-of-period exogenous variables. This *ex-ante* budget constraint is expressed as:

$$\Delta Ca\tilde{s}h_t + \tilde{R}P_t + D\tilde{I}V_t + CA\tilde{P}X_t + AC\tilde{Q}UIS_t - \Delta L\tilde{T}D_t - \Delta S\tilde{T}D_t - EQ\tilde{U}ISS_t - ASA\tilde{L}ES_t = \hat{C}F_t + OTH\hat{E}R_t \quad (3)$$

Where tildes represent decision variables and hats represent exogenous variables that must be forecasted. Equation (3) states that at the beginning of period t, when firms make their investment and financing decisions, the planned values of decision variables are selected such that the expected end-of-period sources/uses constraint is satisfied. This implies that a firm cannot plan to allocate funds in excess or deficit of the amount it expects to generate, either through operations or financing, during the current period.

For choice variables, ex-ante quantities are planned values, determined based on beginning-of-period known quantities. While the firm has precise control over ex-ante (planned) levels, ex-post quantities depart stochastically from their ex-ante counterparts as follows:

$$\begin{bmatrix} -CAPX_t \\ -ACQUIS_t \\ \vdots \\ \Delta LTD_t \\ -\Delta CASH_t \end{bmatrix} = \begin{bmatrix} -CA\tilde{P}X_t \\ -AC\tilde{Q}UIS_t \\ \vdots \\ \Delta L\tilde{T}D_t \\ -\Delta C\tilde{A}SH_t \end{bmatrix} + \begin{bmatrix} e_{CAPX,t} \\ e_{ACQUIS,t} \\ \vdots \\ e_{\Delta LTD,t} \\ e_{\Delta CASH,t} \end{bmatrix} \tag{4}$$

In equation (4), a negative sign indicates that the variable in question represents a use of funds whereas a positive sign indicates a source of funds. $e_{CAPX,t}$,.... $e_{CASH,t}$ are error terms associated with the nine financing and investment decision variables, and represent deviations of actual quantities from planned quantities. Similarly, ex-post exogenous source variables (CF and OTHER) equal forecasts of these variables made at the beginning of the period plus forecast errors:

$$\begin{bmatrix} CF_t \\ OTHER_t \end{bmatrix} = \begin{bmatrix} \hat{C}Ft \\ OT\hat{H}ER_t \end{bmatrix} + \begin{bmatrix} e_{CF,t} \\ e_{OTHER,t} \end{bmatrix} \tag{5}$$

Taken together, equations (3), (4), and (5) imply that the error terms are related in the following manner:

$$e_{\Delta Cash_t} + e_{RP_t} + e_{DIV_t} + e_{CAPX_t} + e_{ACQUIS_t} - e_{\Delta LTD_t} - e_{\Delta STD_t} - e_{EQUISS_t} - e_{ASALES_t} = e_{CF_t} + e_{OTHER_t} \tag{6}$$

We assume that when making investment and financing decisions, firms attempt to achieve long-run optimal levels. Optimal levels depend on investment opportunities. The proxy variable used for investment opportunities is the ratio of market value of equity to book value of equity (MB), and firm size measured as book value of assets (SIZE):

$$\begin{bmatrix} -CAPX_t^* \\ -ACQUIS_t^* \\ \vdots \\ \Delta LTD_t^* \\ -\Delta CASH_t^* \end{bmatrix} = M \begin{bmatrix} \hat{MB}_t \\ SI\hat{Z}E_t \end{bmatrix} + L \begin{bmatrix} \hat{CF}_t \\ OT\hat{H}ER_t \end{bmatrix} \tag{7}$$

Our model assumes that firms attempt to minimize a penalty function that depends on deviations from optimal levels and on the speed of adjustment towards optimal levels. If the penalty function is quadratic in these two costs, then minimizing the penalty function subject to the constraint that sources of funds must equal uses of funds produces the linear equations that we estimate in the empirical section of the paper. If the true cost function has a more complicated form, the equations that we estimate should be interpreted as being reduced form.

By making investment and financing decisions to minimize the cost of being at suboptimal levels, subject to the constraint specified by equation (3), the following system of nine equations is obtained:

$$\begin{bmatrix} -C\widetilde{A}PX_t \\ -AC\widetilde{Q}UIS_t \\ \vdots \\ \Delta L\widetilde{T}D_t \\ -\Delta C\widetilde{A}SH_t \end{bmatrix} = K \begin{bmatrix} -CAPX_{t-1} \\ -ACQUIS_{t-1} \\ \vdots \\ \Delta LTD_{t-1} \\ -\Delta CASH_{t-1} \end{bmatrix} + M \begin{bmatrix} \hat{MB}_t \\ SI\hat{Z}E_t \end{bmatrix} + L \begin{bmatrix} \hat{CF}_t \\ OT\hat{H}ER_t \end{bmatrix} \tag{8}$$

Where, K, M, and L are matrices of response coefficients of size 9X9, 9X2, and 9X2 respectively.

Substituting equation (8) into equation (4) gives the system of equations to be estimated:

$$\begin{bmatrix} -CAPX_t \\ -ACQUIS_t \\ \vdots \\ \Delta LTD_t \\ -\Delta CASH_t \end{bmatrix} = K\begin{bmatrix} -CAPX_{t-1} \\ -ACQUIS_{t-1} \\ \vdots \\ \Delta LTD_{t-1} \\ -\Delta CASH_{t-1} \end{bmatrix} + M\begin{bmatrix} \hat{MB}_t \\ SI\hat{Z}E_t \end{bmatrix} + L\begin{bmatrix} \hat{CF}_t \\ OT\hat{H}ER_t \end{bmatrix} + \begin{bmatrix} e_{CAPX,t} \\ e_{ACQUIS,t} \\ \vdots \\ e_{\Delta LTD,t} \\ e_{\Delta CASH,t} \end{bmatrix} \tag{9}$$

The sources and uses constraint requires that the parameter matrices satisfy:

$$i'[K]=0'; \quad i'[M]=0'; \quad i'[L]=-i' \tag{10}$$

Where i' is a unit vector of appropriate order. The interpretation of equation (10) is that when there is a one dollar shock in a current period source or use variable, the total response of the investment and financing variables is opposite in sign to the shock and adds up to one dollar. For example, if the source variable, CF, increases by one dollar, other source variables must decline by a dollar, use variables must increase by one dollar, or some combination of the response of source and use variables must add up to one dollar. If, instead of cashflow, the shock originates from a variable that represents neither a source nor a use of funds in the current period, the total response across the system of equations must sum to zero. These non-source/non-use variables are the lagged dependent variables and the exogenous variables, MB and SIZE. For example, if SIZE increases by one, the reaction of the dependent sources/uses variables will be such that the estimated SIZE coefficients across the system will sum to zero. Consider the case where the estimated coefficient for the SIZE variable in the capital expenditures equation is 0.30, implying that capital expenditures go up by 30 cents when SIZE increases by one. Since capital expenditures is a use variable, and since sources of funds must equal uses of funds, either other use variables must decrease by 30 cents, or net source variables must increase by 30 cents, or some combination of these responses must sum to 30 cents. Similar constraints hold for shocks to MB and the lagged dependent variables.

3. Data

The annual data we use covers Compustat firms from 1950 to 2003, excluding financial institutions and utilities. Due to the presence of lagged variables in the model, the nine equation system specified in equation (9) is estimated with parameter restrictions (10) imposed for 52 years (1952-2003).

Table 1 describes the variables used in the model in terms of their sources/uses characteristics, and also in terms of whether they act as endogenous or exogenous variables in the model. Table 2 describes how the variables used in the model are constructed from Compustat definitions.[7] Means and standard deviations for each of the variables as a percentage of total assets (except for SIZE and MB) are presented in Table 3. In addition to the full sample, summary statistics are provided for three subsamples segmented based on degrees of financial constraints. The status of firms regarding their financial constraint status is judged on the basis of Shumway's default probability model. We calculate bankruptcy probabilities using Shumway's model for all firm-years in our sample. Firm years with predicted bankruptcy probabilities below the 25th percentile are considered to be unconstrained, and firm years with predicted bankruptcy probabilities above the 75th percentile are considered to be constrained. Firm years that fall between the above two percentiles constitute the partially constrained subsample.

[7] To avoid dropping observations with missing Compustat variables, we replace missing data with zero. We also estimated the model after dropping observations with missing data. Results are not significantly affected by how we treat missing data.

Based on the 25/75% cutoff, there are obviously about twice as many observations in the partially constrained subsample than the other two subsamples. It can be argued that classifying a larger number of firms as being partially constrained is desirable. Firms that are in this subsample are likely to fall into the gray area in terms of their financial health. Based on the number of observations in the subsamples, this increases the likelihood that firms that are in the two extreme financial health subsamples are truly financially constrained and financially constrained.

Table 3 shows that mean cashflow (as a percent of total assets) increases monotonically with the financial health of firms. The cashflow metric in question shows that firms in the financially unconstrained subsample have twice as much cashflow as the firms that makeup the partially constrained subsample. The mean cashflow actually is negative in the constrained subsample. Similarly, there is also a monotonic relationship between dividends and financial health status based subsamples. As expected the healthiest firms dividends (as a percent of total assets) is the largest, and the financially constrained firms' dividends are the smallest. Market-to-book ration is used in the regression as a proxy for investment opportunities. Based on this proxy, it appears that the healthiest firms have the most investment opportunities, while the financially constrained firms have the poorest investment opportunities. Finally, another monotonic relationship is displayed by the average firm size. The healthiest firms are also the largest firms, while the firms with poor financial health also are the smallest in terms of firm size. The general conclusion that emerges from the summary statistics displayed in Table 3 is that, based on the mean magnitudes of the variables discussed above, and also their monotonic nature across the subsamples suggest that the subsamples in question on average appear to be classify firms correctly.

5. Empirical Results

The system specified in equation (9) is estimated using two methods for forecasting the endogenous variables. The first forecast model, which we refer to as the perfect foresight model, assumes that planned values of the decision variables equal end-of-period (ex-post) realizations of these variables. The second forecast model uses I/B/E/S analysts' forecasts to construct estimates of internally generated cash flow (CF).[8]

Both approaches give similar estimates. In this paper, we report results obtained from the perfect foresight model. We first estimate the model for the full sample, in levels and without fixed effects, to give a general idea about the impact response, and the system dynamics matrix coefficients. These results are displayed in Tables 4A (impact response coefficients) and Table 4B (estimates of the system dynamics matrix). In the remainder of the paper our estimated equations include fixed effects.[9]

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$$\widetilde{\mathrm{CF}} = \mathrm{CF} + \left[(\mathrm{IBFIMD})(\mathrm{CSHO}) - \mathrm{NI}\right] - \mathrm{XIDO} \qquad (11)$$

Where IBFIMD is the median earnings per share estimate for the current fiscal year provided by I/B/E/S, CSHO is common shares outstanding, NI is net income, and XIDO is extraordinary items and discontinued operations (all Compustat Annual Mnemonics). The first term in equation (11) is the realized cashflow. The second term adjusts realized cashflow to reflect differences between expected and actual net income. Finally, extraordinary items are subtracted to reflect the fact that had they been expected, they would be unlikely to be extraordinary.

9 Similar to Cleary (1999), to capture fixed effects we transform the actual observations in two ways before running the regressions. In the first approach first differences and uses time dummy variables. The second approach involves subtracting firm and year means from actual observations. As displayed in Table 4, the two approaches give similar results. Based on this similarity, we only report the results performed using the first approach. Additionally, first difference estimations relate changes in cashflow to changes in investment within firms. The within-firm nature of the first difference estimation provides a more direct estimate of a firm's investment response to a change in cashflow. On the other hand, if levels are used, the

5.1. Estimates of Impact Response and System Dynamics Matrices

The estimates obtained from (9) subject to the restriction (10) of the impact response coefficients (Matrices M and L), and the system dynamics matrix K are reported in Tables 4A and 4B. The estimation uses the full sample, which consist 244,081 firm years. The regressions are estimated with robust standard errors. We account for clustering within firms and the number of clusters is 18,849.

Estimated responses of each of the endogenous financing and investment variables to changes in operating cash flow, the residual sources/uses variable (OTHER), market-to-book ratio, and firm size are reported in Table 4A. We will first examine column 1 which displays the response of the system to cashflow shocks. As expected, when firms experience a dollar of positive cashflow shock, the use variables tend to increase, while the source variables tend to decline. In the case of use variables, the coefficients in the first column of Table 4A imply that a one dollar increase in cashflow innovations causes a $0.03 increase in capital expenditures (statistically insignificant), a $0.01 increase each in dividends, and share repurchases, and a $0.24 increase in cash balances (all statistically significant).

Also as expected, the first column of Table 4A shows that positive cashflow innovations in cashflow causes other source variables to decline. The reaction of firms to a $1 cashflow shock is to retire $0.15 of long-term, and $058 of short-term debt. Both of the estimated debt coefficients are statistically different from zero at below the 1%

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coefficients resulting from the across-firm comparison are typically interpreted as responses to a one dollar shock to cashflow, even though the cashflow difference is across firms.

level. Asset sales and equity issues show no change. Additionally, acquisitions decline (significant at the 10 percent level). In all, excluding acquisitions, 7 of the remaining 8 coefficients in the estimated system have the expected sign, and the shareholder distribution and leverage variables are significant at the 1% level.

Because of the constraint specified in equation (10), a one dollar increase in cashflow must increase uses, or, decrease other sources (or some combination of the two) by one dollar. The coefficients reported in the first column of Table 4A show that this indeed is the case: use variables increase by \$0.27, while source variables decline by \$0.73. While the sign of both total uses and total sources are as expected, the real significant conclusion that emerges from these results is that financing sensitivities to cashflow dominate the investment-cashflow sensitivities. While leverage declines by \$0.97, and net distributions to shareholders increase by \$0.01, net investments increase by a meager \$0.02 (capital expenditures increase by \$0.03.)

The variable OTHER in Table 4A is defined to be the difference between miscellaneous source and use variables not explicitly accounted for in the model. For example, a decrease in "other assets" represents a source of funds as does an increase in "other liabilities." Neither one of these balance sheet accounts is explicitly modeled since they do not represent economically meaningful decisions. Thus, the effects of all miscellaneous sources and uses are subsumed in OTHER. Because of the way in which OTHER is defined, it has an interpretation that is similar to the cash flow variable. An increase of one dollar in OTHER must be offset by a one dollar increase in uses, a one dollar decrease in other sources, or some combination of the two. The results displayed in the second column of Table 4A shows that the constraint in question holds empirically.

The final variables in Table 4A are firm size (SIZE) and Market-to-Book ratio (MB). Since these variables represent neither sources nor uses of funds, the response of the system to changes in these variables should add up to zero. The last two columns in Table 4A show that the constraint in question holds.

In terms of significant coefficients, firm size (SIZE, which is measured as the log of book value of firm's total assets) appears to be positively correlated with all the variables except for asset sales, indicating that the larger is the firm, the larger is the magnitude of its reaction to cashflow changes in both investment and financing fronts. Finally, the estimated market-to-book ratio (MB) coefficients are statistically significant in 7 out of the 9 equations estimated. In terms of statistically significant coefficients, it appears that the higher is a firm's growth prospects, for its external financing needs, it relies less on debt markets, and more on equity markets. Given that high growth opportunities go hand in hand with risk, this strategy is as expected (for example, technology firms do not borrow much, in fact a good number of them have negative debt, i.e., excess cash). Also as expected, high growth opportunities are negatively correlated with dividends. The positive correlation between M/B and share repurchases may at firs appear to be counter intuitive, however, many high growth firms, signal their growth potential via share repurchases rather than dividends. For example, many technology firms pay no meaningful dividends, but are very active in repurchasing their shares.

Coefficients for the lagged endogenous variables (estimates for matrix K in equation (9)) are displayed in Table 4B. The estimated coefficients of the matrix describe how current investment and financing variables depend on lagged investment and financing variables. Diagonal elements of K may be loosely interpreted as own adjustment rates; the smaller in absolute value is the jth diagonal coefficient, the less inertia is displayed in the adjustment of the jth variable. Dividends, Capital expenditures, and asset sales display the most inertia, with lagged own coefficients of 0.92 and 0.87, and 0.84, respectively. Given the sticky nature of dividends, the large coefficient in question is not surprising. Apparently capital expenditures and asset sales (negative investments) also exhibit inertia. It is interesting that leverage variables (long and short-term debt issues, and change in cash balances) show very little inertia, indicating that these variables adjust to disequilibria in a very fast manner. It also appears that debt variables in question in the current period respond very strongly, both in terms of magnitude and statistical significance, to lagged capital expenditures. Furthermore, off-diagonal estimates for K provide some evidence that change in cash balances and both long and short-term debt issues act as "shock absorbers" in the system. In general, the largest off–diagonal elements (in absolute value) are found in the rows associated with these three leverage variables. This implies that in the current period cash holdings and issues respond strongly to previous period changes in other variables in the system. Conversely, columns associated leverage variables in question, have by far the smallest off diagonal coefficients compared with the other columns. The relative sizes of off diagonal rows and columns along with the small diagonal variables these three variables display, suggests that these three variables in question absorb shocks in the system but they do not transmit shocks to the rest of the system.

5.2. Fixed effects Estimates: Demeaned versus First Differences

Fixed effects are included in the regressions in order to estimate separate intercept for each firm and each year. These intercepts are designed to capture unobserved connections between the endogenous variables and independent variables, and also to account for factors such as the impact of business cycles, technological innovations, oil price shocks, etc. The two standard approaches to incorporate both involve transforming the actual observations prior to running regressions. The demeaning methodology involves subtracting from the actual observations both firm and year means. In the second methodology, the transformation of the actual observations is accomplished by taking first differences and running the regressions with first differenced variables and time dummies.

Our estimates of the full sample using both approaches are displayed in Table 5. As is evident from the estimated coefficients in this table, the two approaches in question appear to produce similar estimates both in terms of signs and magnitudes. In fact, of the 9 equations estimated, the signs of the estimated coefficients differ only in the cases of equity issues and asset sales equations (of these two, only the coefficient of the asset equation comes close to being statistically significant). The sizes of the coefficients are remarkably similar especially for the statistically significant coefficients. Examination of the first column of Table 4A, with the fourth column of Table 5, reveals that when fixed effects are accounted for (by first differencing and using time dummies), the estimates of the investment variables are even smaller compared with the case when fixed effects are ignored. Thus, when fixed effects are accounted for, the relative size of the financing response becomes even more dominant relative to the investment response. We argue below that the fact that financing response dominates investment response, when firms face innovations in cashflows, provides strong evidence that frictions regarding accessing capital markets have very little impact on firms' investment decisions.

In the rest of the paper, we will only report test results based on regressions that capture fixed effects by employing time dummies and first differencing the actual observations.

5.4. Determining the Degree of Access to Capital Markets

In this section we check the robustness of financial health based subsample formation. In particular, Z-score, and Shumway criterion will be compared by estimating (9) for the subsamples of firms formed on the basis of the two criteria in order to see if the estimates differ. Based on the two criteria, subsamples are formed by classifying firms in terms of the degree of their perceived abilities to access capital markets. Firms are classified as being "unconstrained", "partially constrained", and "constrained" using the 2 alternative methods. The first classification methods assign firms to the subsamples in question by using Altman's Z-scores. Based on Z-scores, the non-financially-constrained subsample consists of firm-years with Z-scores in excess of 3.00. Firm-years that have Z-Scores less than 1.81 are classified as "Financially Constrained." All other firm-years are classified as "Partially Financially Constrained." In the second method the classification is done using the Shumway (25^{th} percentile/75^{th} percentile procedure). Under both approaches capital market access status of firms are updated annually. Shumway's hazard model uses both accounting and market variables to calculate bankruptcy probabilities. It can be thought of as a reduced-form Merton-type default model. We calculate bankruptcy probabilities using Shumway's model for all firm-years in our sample. Firm years with predicted bankruptcy probabilities below the 25th percentile are considered to be unconstrained and firm years with predicted bankruptcy probabilities above the 75th percentile are considered to be constrained. Firm years that fall between the above two percentiles constitute the partially constrained subsample.

In Table 6, the results obtained from both procedures are reported only for the unconstrained subsample. We do not report the results obtained for the partially constrained and constrained subsamples because the conclusions of the unconstrained subsample also applies for these two unreported subsamples results. The results of Table 6 indicate that the estimates obtained from the two classification methods seem to be similar in terms of sign, and the degree of statistical significance. In fact, the sign of the estimates differ in only 2 out of 9 estimated equations (capital expenditures, and acquisitions. Both of these two coefficients in question are statistically insignificant. Furthermore, the size of the coefficients also appear to be similar accept for the leverage variables. However, while the composition of the leverage response is somewhat different for the two classification methods, these coefficients have the same sign and are highly significant. The basic conclusion that emerges from Table 6 is that the results appear to be robust with respect to the two subsample construction procedures. While empirical analysis was conducted using both subsample classification procedures, we only report test results that use the Shumway procedure in the rest of the paper. We have two reasons for preferring the Shumway methodology. First, it is more recent and represents an improvement over the Z-score technology. Second, the 25/75 percentile construction means that there are half as many firms in each of the constrained and unconstrained subsamples compared with the partially constrained subsample. If one interprets the partially constrained subsample as containing firms that are in the gray area in terms of financial health. Thus, it gives us a greater confidence that the firms in the constrained and unconstrained categories are less likely to be misclassified.

5.5. Effects of Capital Constraints

To determine if firms' investment/cashflow sensitivities depend on whether or not they are constrained from accessing external capital, we estimate the system specified by equation (9), subject to the constraint in (10), after segmenting firm-years by the degree of capital constraints. Equation (9) is estimated with fixed effects where the fixed effects are accounted for by first differencing the variables of the model and

Rather than presenting results for all the RHS variables, we focus on the sensitivity of each of the investment and financing variables to innovations in cashflow changes. Panel A of Table 7 presents results both for the full sample and the subsamples.

The results displayed in Panel A show that over the full sample and the three subsamples, 29 of the 36 coefficients have the expected sign (i.e. use variables increase and source variables decrease in response to positive shocks in cashflow changes). 19 of the 29 are statistically significant. 14 coefficients are significant at 1% or lower, 3 coefficients are significant at 5% or lower and 2 coefficients are significant at 10% or lower. Furthermore, only 1 of the significant coefficients has the wrong sign (the acquisitions coefficient in the partially constrained sample, which is significant only at the 10% level). Perhaps one of the most interesting results displayed in Panel A of Table 7 is that all the leverage variables have the correct sign, and they are all significant at or below the 1% level. Furthermore, it appears that, by far the biggest impact of positive innovations in internally generated funds is reduction of financial leverage, rather than increase in investments. When cash flow changes unexpectedly increase by a dollar, (a source variable), firms actually decrease their net investments (by and large, as a result of increasing their capital expenditures and acquisitions, but by increasing their asset sales) in a rage between less than \$0.01 and \$0.04. The investment related coefficients are statistically insignificant in both the full sample as well as in all the subsamples. statistically insignificant). Thus, for the full sample, as well as the subsamples, investments do not show any statistically or economically significant change. This insignificant response of investments to cashflow changes is in contrast with the results reported in the previous studies, which find significantly positive reaction in capital expenditures. However, as mentioned before, single equation models may biased estimates induced by omitting relevant sources/uses variables in their single equation estimation. Earlier in this paper, the sign of this bias was shown to be positive in a two equation world. Apparently, ex-post, this is still the case in a 9 equation system of equations model we use. Compared with the results of the model we employ, single equation models overestimate the cashflow sensitivity of capital expenditures.

Rather than increasing investments, it appears that firms react to \$1 positive shock in cashflow by reducing their net debt between \$0.99 and \$1.00, depending on the subsample. Short-term plus long-term debt is retired by a narrow range of \$0.71 to \$0.78. Overall, uses of funds increases by between \$0.23 and \$0.25. However, almost all of this increase is attributable to increases in cash holdings (a financial variable). Excluding increases in cash balances, uses of funds change not more than \$0.018. Panel A indicates that non-constrained firms "distribute" \$0.04 of funds to their shareholders (in the form of increased dividends and share repurchases and reduced equity issues), compared with essentially no distributions in the case of financially weaker firms. Thus, by far, the most striking action of the firms in all the subsamples is that when firms experience a $1 positive cashflow shock, they use essentially the whole amount in question to reduce their leverage. They do so by paying down between by increasing their cash balances.

While debt pay down is similar across subsamples, the composition of short-term versus long-term debt retirement changes monotonically across the subsamples. While, unconstrained firms pay down $0.38 of short term debt, partially constrained firms pay down $0.58 and $0.70 of short term debt. Since change in cash balances and changes in overall leverage is similar across the subsamples, the mirror image of short-term debt retirement holds true for long-term debt retirement. In fact, long-term debt retirement in response to a positive $1 innovation in cashflow changes is $0.35, $0.170, and $0.07, in the case of unconstrained, partially constrained, and constrained firms, respectively. This behavior may simply due to the fact that the more financially constrained firms are, the more it is that they rely on short-term debt rather than long-term debt. In the next section, we will provide evidence that the same monotonic relationship holds in the case of negative innovations in cashflow changes. In response to negative shocks unconstrained firms appear to be able to borrow relatively more long term debt compared with partially constrained firms, while the financially constrained firms appear to confine their borrowing more towards short-term debt. In fact, Diamond (1991), using a model where borrowers have private information about their future credit rating, finds that borrowers with lower credit rating can issue only short-term debt, in spite of the fact that they prefer long-term debt. The results of Table 7, and Table 8 (which will be discussed in the next section) are consistent with Diamond (1991) findings.

The composition of the leverage amount notwithstanding, it is clear that even the financially constrained subsample of firms appear to have access to external funds. The standard interpretation of the regression coefficients is Panel A is, of course, that that in a negative cashflow shock environment, firms, even those that are in the financially constrained category, are able to arrange external financing, typically in the form of borrowed funds. However, we will further test this interpretation by running the system of equations for the positive and negative cashflow shocks separately.

In section 2, we discussed that the relative magnitudes of investment and financing cashflow sensitivities, rather than just the investment cashflow sensitivities, should be used in judging whether or not capital market frictions prevent firms suffering from a potential underinvestment problem. On this account, the results in Panel A show that financing cashflow sensitivities dominate investment cashflow sensitivities for firms in all categories. We consider this to be very strong evidence that firms are not cut off from capital markets, and are not forced to forgo positive NPV projects as a result. After all, if firms were prevented from investing in valuable projects due to capital market frictions, we would expect a dramatic increase in investments and a much less dramatic decrease in financial leverage.

Perhaps this point can be further explored in the context of consumer behavior. Assume that one wants to test whether or not a consumer is forced to give up some desirable consumption opportunities (in the case of firms, valuable projects), due to being at his credit card limit. The following experiment can be conducted to answer the issue in question: the consumer could be given some money, and what he does with the funds can be observed. If the individual spends the funds on consumption, this would indicate that he was starved for funds to the extent of not being able to execute his consumption choices, because he was at his credit card limit (in the case of firms, constrained from accessing capital markets). However, if the consumer in question uses the funds to retire some of his credit card debt (as the firms seem to be doing when faced with positive cashflow shocks), it could not have been the case that prior to receiving the funds in question, he was being prevented from buying goods and services due to lack of available credit on his card. Thus, based on the very large size of financing (almost $1) relative to the size of investment cashflow sensitivities (essentially zero) displayed in Panel A of Table 7, we conclude that firms in our sample do not appear to be constrained from raising external financing. Long-term debt usage declines, and short-term debt usage increases as one moves from unconstrained to partially constrained and constrained subsamples. As expected, it is also the case that firms that makeup the financially unconstrained subsample distribute more funds to their shareholders both in the form of dividends and share repurchases, compared with firms that have less financial health status. In a way the statistically insignificant pair-wise differences also constitute "significant" evidence for the issue being addressed in this paper. First, firms of differing financial health do not show any different investment and financing cashflow sensitivities. Second, and more importantly, while neither financing nor the investment response is different across the subsamples, the relative size of financing response, by far, dominates the investment response in all the subsamples. As was argued in section 2, it is not the investment response in isolation, or the financing response in isolation, that can be used as evidence to judge whether or not firms face capital market frictions, but rather it is the relative magnitude of the investment/financing response that can settle the issue.

Panel B of Table 7 examines differences between coefficients for the subsamples of data presented in Panel A. The results in Panel B show remarkable similarity between firms in all subsamples. Of the 27 differences considered, only 9 are statistically different from zero. Furthermore, given the interpretation of Panel A results, most of the significant pair-wise differences are as expected. Thus, there is no evidence that sensitivity of capital expenditures or net investments to cashflow varies across subsamples. The significant pair-wise comparisons indicate that non-constrained firms engage in more share repurchases, accumulate more cash, retire less long-term debt, and execute more acquisitions.

5.6. Positive and Negative Cashflow Shocks

While the results presented so far show that investment cashlow sensitivity is essentially zero, financing cashflow sensitivity is negative and highly significant, it is possible that firm reaction is not symmetric with respect to the sign of cashflow shocks. This is especially important in the case of financing cashflow sensitivities. A stronger test on the capital markets access issue is more likely to be provided when the model is estimated in an environment when firms are operating in an environment characterized by negative cashflow shocks. Towards this end, we estimated (9) where the right hand side variables include the interaction variable of change in cashflow*DUMMY, where DUMMY takes on a value of 1 when change in cashflow variable is positive, and takes on a value of zero when change in cashflow variable is less than or equal to zero. Thus, when cashflow changes are negative, the negative of the estimated cashflow coefficient captures the reaction of the dependent variable. When the cashflow changes are positive, the response of the dependent variable is captured by the sum of the estimated coefficient for the cashflow variable and the estimated coefficient for the interaction term. For example, for the full sample, in the short-term debt equation the estimated coefficients for the cashflow changes and the interaction term are -0.666 and 0.059, respectively. This indicates when there is a negative one dollar innovation in change in cashflow firms borrow (as expected), an additional $0.666 of short-term debt. On the other hand, when the shock in question is a positive one dollar, firms pay down their short term debt (again, as expected), by -0.666 + (0.059)*(-1)*(-1), or -$0.607. Furthermore, apparently, the activities of firms in the short-term debt markets appear to be symmetric. The difference between the response to positive and negative cashflow innovations is $0.059 (they pay off more debt when faced with a positive one dollar cashflow shock then they borrow when faced with a negative shock by the same amount). Given that the 6 cents in question is not statistically different from zero, their reaction two the positive and negative shocks are symmetric. This, of course, also means that the firms that make up the full sample do not suffer from accessing short-term debt markets due to capital market frictions in this particular market. Panel A exhibits the estimates for the full sample, while Panels B, C, and D display the results for the financially unconstrained, partially constrained, and the constrained subsamples. The third column of each panel tests the symmetry of positive and negative cashflow shocks.

The results exhibited in Table 8 show that there is overwhelming evidence that that firms respond symmetrically to negative and positive cashflow shocks in the case of the full sample as well as the subsamples. In only 6 out of the 36 coefficients in column 3 indicate an asymmetric response of the nine equations system estimated. In fact, even 6 asymmetric response coefficients in the case of positive versus negative cashflow innovations overstate the case for the presence of asymmetry. What is being tested here is firm's access to external capital markets. These markets are represented by markets for equity issues, short-term, and long-term debt. Out of the 12 coefficients that represent firms' actions in these markets, none of them display asymmetry at the 5 percent statistical significance level or lower. The closest level of significance is obtained for the short-term borrowings of the financially constrained subsample. However, even this actually supports the hypothesis that firms are not handcuffed from accessing capital markets. On the contrary, the $0.096 difference, which is significant at the 10% level, indicates that firms that make up this subsample cut back their short-term borrowings by $0.659 when faced with a dollar of positive cashflow innovation. *But, more importantly, they actually appear to be able to borrow $0.755 of additional short term debt when the innovation in question is -$1.*

In fact, perhaps the strongest test of whether or not suffer from capital market access problems is likely to be provided by observing how firms that have the poorest financial health behave in an adverse internal funds environment characterized by negative cashflow innovations. While these firms do not appear to use the equity and long-term debt markets ($0.05 borrowing in the latter case is only 1.44), they are able to borrow $0.76 of short term. In fact, combined with the decline of $0.21 in cash balances, these firms increase their leverage by $1.02 when they face a negative cashflow innovation of $1. In all, in an adverse cashflow shock environment firms that make up the full sample and the subsamples in question, are able to access short and long-term markets at a significance level of less than 1% in 7 out of the possible 8 cases (the 8th one is significant at the 10%level). While equity issues are statistically significant in only one out of the 4 possible cases (it is significant at the 5% level for the partially constrained subsample), it has the right sign in all the 4 cases (i.e., equity issues increase in response to negative cashflow shocks). In all, we consider the evidence provided by all firms, but especially the firms that make up the financially constrained subsample, to be very strong evidence against the hypotheses that firms suffer from capital market frictions in raising external funds. The fact that apparently even firms with poor financial health can borrow in a declining cashflow environment, leads to the conclusion that firms in general do not encounter any difficulties in funding the projects that they perceive to have positive NPVs.

Another interesting conclusion that emerges from Tables 7 and 8 is that while leverage changes significantly and by a similar amount across the subsamples, the debt composition of leverage appear to vary in a monotonic way. While the response of changes in cash balances is similar across the subsamples, it appears to be the case that the reliance of firms to short term debt increases as firms' financial health deteriorates. In particular, for the estimated short-term coefficients are \$0.38, \$0.58, and, \$0.70 for firms in the financially unconstrained, partially constrained and financially constrained subsamples, respectively. Firms' reliance on long-term debt, on the other hand, increases with financial health. The coefficients for the long-term equation are \$0.352, \$0.170, and \$0.07 for the same ordering of the subsamples. It should be noted that all the coefficients in question are have high degrees of statistical significance, indicating that they are not cut off from accessing the long-term debt markets. Nevertheless, based on the relative sizes of short and long-term borrowing, it can be argued that while none of the subsample of firms have difficulty in both short and long-term debt, firms with poorer financial health have to rely on debt with a short-term maturity. It is not surprising that, given the default risk involved, apparently, firms with poorer financial health find it easier toaccess short-term debt markets more than the long-term debt markets.

6. Conclusion

In this study we examine whether or not firms suffer from underinvestment problems due to potential frictions in accessing capital markets. Previous studies examine this issue in a single equation framework, and empirically reach contrasting conclusions regarding the ability of firms in raising funds in the external markets. We extend this literature both conceptually and empirically.

First, we argue that these studies may produce inefficient estimates since they reach their conclusion on the basis of a single capital expenditure equation, and thus, do not fully incorporate the information contained in the sources/uses identity. This econometric problem is unlikely to be very severe when regressions use large samples. However, some studies rely on relatively small number of observations. Our second extension addresses a more severe econometric problem associated with earlier studies. These studies produce inconsistent estimates as a result of having omitted variables. We provide proof that the bias in question is positive for the single equation based estimates of cashflow sensitivity of investments. In other words, the estimates obtained from single equation models are higher than the "true" investment-cashflow sensitivity estimates obtained from two equations system that is implicit in the single equation models. The system of equations model we employ actually goes beyond the two equation models. The nine equation system we use covers all the major investment and financing variables. We estimate this model subject to the sources/uses constraint. Our final conceptual contribution is that by using examples, we show that even in a nine equation system, investment cashflow sensitivities in isolation cannot be used to reach conclusions regarding the presence or absence of capital market access constraints.

We also make contributions to the issue in question by our empirical findings. We show that cashflow innovations trigger response in the financing variables, especially leverage variables, rather than investment variables. First, based on the domination of financing response over investment response, supports the conclusion that firms do not appear to suffer from under investment problems. The fact that, firms appear to use positive cashflow innovations in reducing their leverage, rather than taking additional projects, leads us to conclude that it is unlikely that these firms were under investing prior to experiencing positive innovations in internally generated funds. Third, the firm behavior with respect to both investment and financing platforms appear to be uniform across firms that make up the different subsamples. Thus, large financing response relative to investment response across subsamples, indicate that firms, irrespective of their perceived financial health, do not appear to face frictions in accessing capital markets. Finally, further evidence that supports the same conclusion is provided by the symmetry/asymmetry of firms' actions in capital markets when they face positive versus negative shocks in cashflow changes. We find that firms' response, especially in the financing arena, is symmetric. Furthermore, it can be argued that observing the behavior of financially weak firms under adverse conditions of negative innovations in cashflow changes, is likely to provide a very strong test of whether or not firms in general can arrange external financing. Apparently, the fact that under such "worst case scenario" conditions of unexpected cashflow shortages, even the weaker firms are able to raise funds makes us believe that capital market impediments do not affect the investment decisions of firms in general

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Table 1
Sources and Uses of Investment and Financing Variables

This table describes the variables used to estimate the system described by equation (9) subject to the constraints described by equation (10). Compustat definitions used to construct the variables are described in the appendix.

Variable Name		Description	Type of Variable
Sources	Cash Flow (CF)	Internally available cash flow for investment and financing	Exogenous/financing
	OTHER	The difference between source and use variables that captures miscellaneous sources and uses of funds not explicitly included in the model	Exogenous
	ΔLong-term Debt (ΔLTD)	Change in long -term debt	Endogenous/financing
	ΔShort-term Debt (ΔSTD)	Change in short-term debt	Endogenous/financing

	Equity Issues (EQUISS)	Dollar value of equity issues	Endogenous/financing
	Asset Sales (ASALES)	Dollar value of assets sold	Endogenous/investment
Uses	Share Repurchases (RP)	Dollar value of shares repurchased	Endogenous/financing
	Dividends (DIV)	Dollar value of dividends paid	Endogenous/financing
	Capital Expenditures (CAPX)	Dollar value of capital expenditures	Endogenous/investment
	Acquisitions (ACQUIS)	Dollar value of acquisitions	Endogenous/investment
	ΔCASH	Change in cash balance	Endogenous/financing
Other variables	Market-to Book Ratio (MB)	Ratio of market value of equity to book value of equity	Exogenous
	Size (SIZE)	Logarithm of total book assets	Exogenous

Table 2
Variable Definitions

Variable	Description	Compustat Pneumonic
CASH	Cash and equivalents	CHE
LTD	Long term debt	Long term debt (DLTT)
STD	Short term debt	Debt in current liabilities (DLC)
EQUISS	Sale of common and preferred stock	SSTK
ASALES	Sale of assets and investments	SPPE
CAPX	Net capital expenditures	Capital expenditures (CAPX)
ACQUIS	Acquisitions	ACQ

RP	Purchase of common and preferred stock	PRSTKC
DIV	Cash dividends	DV
SIZE	Log of total assets	Log of AT
MB	Market-to-book value of assets	(Market value of equity – book value of equity + book value of total assets)/book value of total assets (MKVALF – CEQ + AT)/AT
NWC	Net working capital	(Total current assets (ACT) – cash and equivalents (CHE)) – (Total current liabilities (LCT) – Debt in current liabilities (DLC))
Cash Flow	Internal cash flow net of net interest expense, cash taxes and change in net working capital	EBITDA (OIBDP) – Net interest expense (XINT –IINT) – Cash taxes (TXT – TXDC) – Change in net working capital (ΔNWC)
OTHER	Sources of funds minus uses of funds variables used in the model	(ΔSTD + ΔLTD + Cash Flow + ASALES + EQUISS +) – (CAPX + ACQUIS + RP + DIV + ΔCASH)

Table 3
Data Summary

This table presents a summary of the Compustat data used in the empirical analyses. All numbers, except for Market/Book and Firm Size, is measured in millions of dollars. Firm Size is measured as the natural logarithm of book assets measured in millions of dollars. The Subsamples are formed based on Shumway's hazard model. Shumway's hazard model uses market and accounting variables to predict bankruptcy probabilities. We consider firm years below the 25th percentile to be unconstrained, and firm years above the 75th percentile to be constrained.

	Full Sample			Unconstrained Sample			Partially Constrained Sample			Constrained Sample	
	Number of Firm Years = 244,081			Number of Firm Years = 60,876			Number of Firm Years = 121,752			Number of Firm Years = 61,453	
	Mean	**Std. Dev.**		**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**		**Mean**	**Std. Dev.**
Cashflow	0.043	0.18		0.085	0.11		0.042	0.14		-0.015	0.29
OTHER	-0.004	0.25		-0.001	0.18		0.002	0.18		-0.022	0.42
ΔLTD	0.012	0.19		0.011	0.13		0.019	0.15		-0.005	0.33
ΔSTD	0.003	0.18		0.001	0.08		0.003	0.10		0.008	0.35
Equity Issues	0.041	0.14		0.031	0.11		0.041	0.14		0.055	0.19
Asset Sales	0.006	0.04		0.004	0.02		0.006	0.04		0.009	0.06
Share Repurchases	0.007	0.05		0.008	0.03		0.008	0.05		0.006	0.07
Dividends	0.010	0.04		0.018	0.05		0.008	0.04		0.004	0.04
Capital Expenditures	0.067	0.08		0.073	0.07		0.064	0.08		0.064	0.09
Acquisitions	0.014	0.06		0.012	0.05		0.015	0.06		0.016	0.07
ΔCash Balances	0.010	0.16		0.022	0.10		0.014	0.15		-0.016	0.24
Market/Book	1.537	1.28		1.844	1.55		1.465	1.17		1.284	1.02
Firm Size	5.106	1.88		5.896	1.96		5.063	1.77		4.082	1.50

TABLE 4A

Full Sample Estimates of the Impact Response Coefficients to a One Dollar Change in Cash flows

This table presents results from estimating the system of equations specified by equation (9) subject to constraints specified by equation (10). The constraints require that sources of funds are offset by uses of funds. Results presented in this table suggest that a $1 increase in cash flow (source of funds) is offset by a $0.28 decrease in other sources (decreases of $0.005 in Asset Sales, no change in Equity Issues, $0.40 in Long-Term Debt, and an increase of $0.12 in Short-Term Debt) and a $0.72 increase in uses of funds (an increase of $0.074 in Capital Expenditures, an increase of $0.012 in Acquisitions, an increase of $0.016 in Share Repurchases, an increase of $0.013 in Dividends, and an increase of $0.606 in Cash Balance). A similar constraint holds for a $1 increase in OTHER, the other source/use independent variable. A $1 increase in other independent variables create changes in sources and uses such that these changes are equal but opposite in sign. Thus, the constraint for non sources/uses variables such as market to book ratio, and firm size, have the net effect across sources and uses that adds up to zero. T-statistics are in parentheses. Variables are in levels. Regressions are estimated with robust standard errors. Number of observations is 244,081 firm years. Number of clusters is 18,849. Annual COMPUSTAT data is used for the sample period 1950-2003.

Dependent Variable	Cash Flow	Other	Size	M/B	R 2
Capital Expenditures$_t$	0.031 (1.39)	-0.033 (-0.82)	2.608 (1.60)	-0.714 (-1.35)	0.83
Acquisitions $_t$	-0.014 (-1.84)	-0.012 (-1.20)	1.858 (3.63)	-0.567 (-2.65)	0.17
Asset Sales $_t$	-0.001 (-0.50)	0.002 (0.72)	-0.454 (-1.55)	0.203 (1.69)	0.86
Equity Issues$_t$	0.005 (1.19)	-0.003 (-0.26)	1.672 (6.75)	0.606 (5.22)	0.12
Share Repurchases$_t$	0.011 (2.48)	-0.008 (-3.00)	0.249 (2.20)	0.183 (2.55)	0.44
Dividends $_t$	0.007 (2.92)	0.000 (0.04)	0.400 (3.74)	-0.185 (-3.94)	0.83
Δ Long-term Debt $_t$	-0.151 (-4.86)	0.579 (10.19)	2.107 (3.49)	-0.962 (-3.43)	0.60
Δ Short-term Debt $_t$	-0.579 (-10.35)	0.357 (6.74)	2.371 (3.04)	-0.888 (-2.62)	0.46
Δ Cash Balances $_t$	0.239 (5.52)	-0.012 (-0.45)	0.581 (1.25)	0.240 (1.06)	0.18

Table 4B

The coefficient estimates for the system dynamics matrix

This table presents results from estimates of the system dynamics matrix, K obtained from estimating the equations specified by equation (9) subject to constraints specified by equation (10). The estimates describe the internal dynamics of the sources and uses variables by specifying how the current state of the sources/uses portfolio depends on its lagged state in the absence of external pressure. In particular, the *jth* row of K indicates how the current *jth* sources/uses item is affected by changes in the sources/uses structure last period and the *jth* column of K describes the rearrangement of the current sources/uses portfolio induced by a partial change in the *jth* item last period. The diagonal elements of K can be loosely interpreted as own adjustment rates. The smaller in absolute value the *jth* diagonal element, the less inertia is exhibited in the adjustment of the *jth* sources/uses variable in question. Since the lagged dependent variables are neither or sources or uses in the current period, the constraints require that reaction of sources and uses variables are equal and opposite in sign, such that the net effect of lagged dependent variables across the current dependent variables are zero. T-statistics are in parentheses. Variables are in levels. Regressions are estimated with robust standard errors. Number of clusters is 18,849. Number of observations is 244,081. Annual COMPUSTAT data is used for the sample period 1950-2003.

Dependent Variable	Capital Expenditure $_{t-1}$	Acquisitions $_{t-1}$	Asales $_{t-1}$	Equity Issues $_{t-1}$	Share Repurchases $_{t-1}$	Dividends $_{t-1}$	Δ Long-term Debt $_{t-1}$	Δ Short-term Debt $_{t-1}$	Δ Cash Balances $_{t-1}$
Capital Expenditures	0.873 (6.22)	0.049 (1.72)	0.157 (0.54)	-0.422 (-1.32)	0.137 (2.06)	0.202 (1.15)	0.003 (0.23)	0.013 (1.81)	0.023 (1.65)
Acquisitions$_t$	0.013 (0.78)	0.213 (3.20)	0.090 (1.38)	-0.046 (-1.38)	0.204 (4.03)	0.341 (2.50)	-0.010 (-1.11)	0.006 (1.04)	0.005 (0.95)
Asset Sales $_t$	0.074 (2.49)	0.012 (0.96)	0.840 (11.88)	-0.055 (-1.34)	0.045 (0.89)	-0.106 (-1.90)	0.001 (0.17)	0.008 (1.42)	-0.007 (-1.63)
Equity Issues $_t$	0.019 (1.16)	0.049 (1.95)	-0.013 (-0.46)	0.136 (3.49)	0.085 (3.19)	0.020 (0.75)	0.004 (1.20)	-0.002 (-0.83)	0.001 (0.26)
Share Repurchases$_t$	0.003 (0.33)	-0.018 (-1.51)	0.009 (0.58)	0.063 (1.69)	0.583 (9.64)	0.118 (3.17)	-0.002 (-0.64)	0.002 (0.51)	0.011 (2.26)
Dividends $_t$	0.014 (2.50)	0.007 (0.78)	-0.031 (-2.73)	-0.003 (-0.28)	0.030 (2.32)	0.915 (26.31)	0.004 (1.63)	0.004 (1.02)	0.011 (3.46)
Δ Long-term Debt $_t$	0.249 (5.60)	0.128 (1.23)	-0.055 (-0.33)	-0.281 (-2.61)	0.282 (3.99)	0.399 (2.07)	-0.033 (-1.36)	0.051 (3.68)	-0.043 (-1.31)
Δ Short-term Debt $_t$	0.383 (4.61)	-0.001 (-0.02)	-0.182 (-1.56)	-0.108 (-0.60)	0.539 (5.18)	1.106 (7.59)	0.077 (2.35)	-0.026 (-0.85)	-0.004 (-0.06)
Δ Cash Balances $_t$	-0.179 (-4.45)	-0.062 (-1.20)	0.364 (5.66)	0.100 (1.05)	-0.002 (-0.02)	-0.157 (-1.24)	0.053 (2.06)	0.007 (0.22)	-0.101 (-2.41)

Table 5
Full Sample Estimates to a $1 Shock in Cash Flow: When Variables Are Demeaned versus When They Are In First Differences

This table presents results from estimating the system of equations specified by equation (9) subject to constraints specified by equation (10). Regression estimates are obtained using fixed firm and year effects. Fixed effects reflect separate intercepts for each firm and for each year. The fixed effects are used in order to capture both unobserved correlations between investment/financing variables and the exogenous variables, and to capture business-cycle related effects. The fixed effects are obtained by using two approaches. Both approaches used transform the actual observations prior to running regressions that use the transformed variables. The results reported in column two are obtained when the transformation is accomplished by subtracting the firm and year means from the actual observations. The results in Column four display the coefficients obtained from estimating regressions where the transformation of the actual observations is accomplished by using time dummy variables and by using first differences. The t-statistics are in parentheses. Regressions are estimated with robust standard errors. Number of observations are 268,208 in the demeaned regressions. In the first differences regressions, the number of observations is 237,440. Annual COMPUSTAT data is used for the sample period 1950-2003. Comparison of columns 2 and 5 indicate that the estimated coefficients are similar in terms of magnitude and patterns.

Dependent Variable	Demeaned Estimates Cash Flow	R_2	First Difference Estimates Cash Flow	R2
Capital Expenditures $_t$	0.032 (1.39)	0.81	0.001 (0.20)	0.38
Acquisitions $_t$	-0.010 (-1.78)	0.17	-0.007 (-1.55)	0.25
Asset Sales $_t$	-0.003 (-1.60)	0.83	0.004 (1.93)	0.03
Equity Issues $_t$	0.003 (0.68)	0.10	-0.001 (-0.30)	0.37
Share Repurchases $_t$	0.008 (2.67)	0.46	0.006 (2.52)	0.15
Dividends $_t$	0.006 (3.48)	0.81	0.001 (0.62)	0.12
Δ Long-term Debit $_t$	-0.177 (-5.34)	0.47	-0.143 (-4.07)	0.67
Δ Short-term Debit $_t$	-0.536 (-10.38)	0.39	-0.634 (-11.08)	0.59
Δ Cash Balances $_t$	0.251 (4.99)	0.13	0.226 (4.90)	0.45

Table 6
Effects of Financial Constraints on Reactions to Cash Flow Changes: Z-Score versus Shumway based Unconstrained Subsample

This table presents the coefficients for the Cash Flow variable for each of the equations in the system specified by equation (9) subject to constraints specified by equation (10). The estimation assumes perfect foresight; ex-ante cash flow forecasts are assumed to equal ex-post realizations. To account for fixed firm and year effects the regressions are estimated using first differencing the variables and by using time dummies. Results are presented for the full subsample (see column 5 in Table 3) and for subsamples of data segmented according to financial constraints. Firm-years with Altman Z-scores below 1.96 are considered to be financially constrained; firm-years with Altman Z-scores above 3.00 are considered to be unconstrained. Firm years in the Z-scores based unconstrained reported below is 113,351. Shumway's hazard model uses market and accounting variables to predict bankruptcy probabilities. We consider firm years below the 25th percentile to be unconstrained, and firm years above the 75th percentile to be constrained. Firm years in the Shumway based unconstrained sample reported below are 58,709. T-statistics are in parentheses

Unconstrained Subsample

	Z-Score Based Subsample Results		Shumway (25th Percentile / 75th Percentile) Based Subsamples	
Dependent Variables	**Cash Flow**	**R2**	**Cash Flow**	**R2**
Capital Expenditures $_t$	0. 010 (0.61)	0. 04	-0.007 (-0.70)	0.31
Acquisitions $_t$	0. 043 (1.41)	0. 28	-0.031 (-1.28)	0.26
Asset Sales $_t$	0. 002 (1.85)	0. 15	0.002 (0.73)	0.22
Equity Issues $_t$	-0. 007 (-1.12)	0. 22	-0.008 (-0.83)	0.32
Share Repurchases $_t$	0. 077 (4.15)	0. 17	0.032 (3.49)	0.16
Dividends $_t$	0. 033 (4.16)	0. 11	0.010 (3.24)	0.07
Δ Long-term Debit $_t$	-0. 175 (-4.06)	0. 39	-0.340 (-6.02)	0.53
Δ Short-term Debit $_t$	-0. 222 (-4.94)	0. 46	-0.352 (-9.58)	0.53
Δ Cash Balances $_t$	0. 435 (6.62)	0. 48	0.297 (4.08)	0.44

Table 7
Reactions to Cash Flow Changes and the Effects of Financial Constraints

This table presents the coefficients for the Cash Flow variable specified by equation (9) and subject to the constraint (10). For the full sample, and subsamples constructed on the basis of Shumway's hazard model. Shumway's hazard model uses market and accounting variables to predict bankruptcy probabilities. We consider firm years below the 25th percentile to be unconstrained, and firm years above the 75th percentile to be constrained. Firms in between these two benchmarks are considered to be partially constrained. Shumway based subsamples have 58,709, 115,128, and 51,395 observations in firm years. The full sample consists of 225,232 firm years. To account for fixed effects, the regressions are estimated using first differences and time dummies. Panel A presents coefficient estimates. Panel B presents differences in coefficients across subsamples. Panel B represent the estimates obtained from running the following equation: Dep. Var. = b1*CF + b2*PFCDUMMY*CF + b3*FUCDUMMY*CF Where CF is cashflow, PFC, and FUC Dummies take on values of 1 if the firm belongs to the appropriate constrained class, and zero otherwise. In the above equation, financially constrained firms (FC) are used as the baseline. The above equation is repeated with the partially financially constrained firms are used as the baseline. Using the estimates obtained from the two systems of equations, we construct the estimates for (FUC – FC), (PUC - PFC), and, (PFC -FC) paired differences. Number of firm years in the above two regressions is 225,232

PANEL A				
Dependent Variable	**Full Sample**	**Financially Unconstrained**	**Partially Financially Constrained**	**Financially Constrained**
Capital Expenditures	0.001 (0.20)	-0.004 (-0.70)	-0.005 (-1.54)	0.003 (0.89)
Acquisitions	-0.007 (-1.55)	-0.029 (-1.28)	-0.018 (-1.90)	-0.003 (-0.70)
Asset Sales	0.004 (1.93)	-0.001 (0.73)	0.001 (0.32))	0.006 (1.79)
Net Change in Investments	-0.007	-0.032	-0.033	-0.006
Equity Issues	-0.001 (0.37)	-0.006 (-1.14)	-0.009 (-2.37)	-0.001 (-0.50)
Share Repurchases	0.006 (2.52)	0.034 (3.49)	0.004 (1.38)	0.002 (0.85)
Dividends	0.001 (0.62)	0.011 (1.90)	0.001 (0.41)	-0.000 (-0.05)
Net Distribution to Shareholders	0.008	0.040	0.014	0.003
Δ Long-Term Debt	-0.143 (-4.07)	-0.352 (-6.02)	-0.170 (-3.57)	-0.073 (-2.14)
Δ Short-Term Debt	-0.634 (-11.08)	-0.380 (-9.58)	-0.580 (-5.66)	-0.703 (-9.60)
Δ Cash Balance	0.226 (4.90)	0.247 (4.08)	0.260 (3.09)	0.228 (3.72)
Change in Leverage	1.00	0.979	1.00	1.00
Changes in Uses of Funds	0.227	0.248	0.242	0.230
Change in Uses-Change in Cash Balances	0.001	0.001	-0.018	0.002

PANEL B				
Dependent Variable		**Financially Unconstrained-Financially Constrained**	**Financially Unconstrained-Partially Constrained**	**Partially Constrained-Constrained**
Capital Expenditures		-0.002 (-0.16)	0.001 (0.12)	0.008 (1.79)
Acquisitions		-0.031 (-1.31)	-0.011 (-0.51)	0.014 (1.48)
Asset Sales		-0.006 (-2.00)	-0.002 (-0.63)	0.005 (1.07)
Net Change in Investments		-0.027	-0.012	0.017
Equity Issues		-0.006 (-0.66)	0.002 (0.25)	0.008 (1.98)
Share Repurchases		0.034 (4.36)	0.030 (3.58)	-0.002 (-0.64)
Dividends		0.013 (2.86)	0.010 (3.62)	-.001 (-0.17)
Net Distribution to Shareholders		0.053	0.060	-0.011
Δ Long-Term Debt		-0.276 (-5.01)	-0.181 (-3.35)	0.098 (1.77)
Δ Short-Term Debt		0.310 (3.74)	0.199 (1.75)	-0.123 (-0.96)
Δ Cash Balance		0.007 (0.09)	-0.012 (-0.13)	-0.033 (-0.30)
Change in Leverage		0.041	0.030	-0.058
Changes in Uses of Funds		0.021	0.039	0.020
Change in Uses-Change in Cash Balances		0.015	0.027	-0.013

Table 8
Testing for Symmetry of Positive and Negative Cash Flow Shocks

This table presents the coefficients for the Cash Flow variable for each of the equations in the system specified by equation (9) subject to constraints specified by equation (10). To account for fixed firm and year effects the regressions are estimated using first differencing the variables and by using time dummies. The system (9) is estimated where the RHS includes the interaction variable of change in cashflow*DUMMY, where DUMMY takes on a value of 1 when change in cashflow variable is positive, and takes on a value of zero when change in cashflow variable is less than or equal to zero. Thus, when cashflow changes are negative, the negative of the estimated cashflow coefficient captures the reaction of the dependent variable. When the cashflow changes are positive, the reaction of the dependent variable is captured by the sum of the estimated coefficient for the cashflow variable and the estimated coefficient for the interaction term. For example, for the full sample, in the short-term debt equation the estimated coefficient for the cashflow variable and the interactive term are -0.666, and 0.059 respectively. This indicates that when the change in cashflow declines by a dollar, short-term borrowings increase by $0.666. On the other hand, when cashflow changes increase by a dollar, firms pay down short-term debt by in the amount of -0.666 + (0.059)*(-1)*(-1) or -$0.607. Apparently, the amount of paying down of short-term debt (-$0.607) when faced with positive $1 of change in cashflow innovations versus additional borrowing of ($0.666) when the innovations are in the form of -$1 change in casflow innovations, is ($0.059) is not statistically different. In other words, the response to cashflow innovations, in the case of short-term debt is symmetric. Panel A displays the results for the full sample. Panels B, C, and D display the results for the financially unconstrained, partially constrained, and the constrained subsamples. The third column of each panel tests the symmetry of positive and negative cashflow shocks.

PANEL A
FULL SAMPLE RESULTS
N = 225,532

Dependent Variable	Positive Cashflow Shocks $_t$	Negative Cashflow Shocks $_t$	Positive-Negative Cashflow Shocks	R^2
Capital Expenditures $_t$	0.008	0.007 (1.92)	0.015 (2.22)	0.38
Acquisitions $_t$	-0.010	0.005 (1.15)	-0.004 (-0.65)	0.25
Asset Sales $_t$	0.007	-0.001 (-0.57)	0.006 (1.93)	0.03
Equity Issues $_t$	-0.000	0.001 (0.41)	0.001 (0.27)	0.37
Share Repurchases $_t$	0.009	-0.003 (-1.95)	0.006 (1.83)	0.15
Dividends $_t$	0.009	0.007 (2.07)	0.016 (5.24)	0.11
Δ Long-term Debt$_t$	-0.152	0.131 (3.63)	-0.021 (-1.17)	0.67
Δ Short-term Debt $_t$	-0.607	0.666 (10.95)	0.059 (1.53)	0.59
Δ Cash Balances$_t$	0.231	-0.220 (-4.58)	0.012 (0.36)	0.45

PANEL B
FINANCIALLY UNCONSTRAINED SUBSAMPLE RESULTS
N = 58,709

Dependent Variable	Positive Cashflow Shocks $_t$	Negative Cashflow Shocks $_t$	Positive-Negative Cashflow Shocks	R^2
Capital Expenditures $_t$	0.010	0.023 (2.13)	0.033 (2.92)	0.04
Acquisitions $_t$	-0.028	0.023 (1.04)	-0.004 (-0.25)	0.26
Asset Sales $_t$	0.001	-0.002 (-0.51)	-0.001 (-0.16)	0.22
Equity Issues $_t$	-0.004	0.011 (1.41)	0.006 (0.53)	0.31
Share Repurchases $_t$	0.043	-0.015 (-2.30)	0.027 (2.25)	0.17
Dividends $_t$	0.019	0.003 (1.12)	0.021 (4.13)	0.11
Δ Long-term Debt$_t$	-0.324	0.323 (5.47)	-0.001 (-0.03)	0.54
Δ Short-term Debt$_t$	-0.353	0.360 (6.65)	0.007 (0.11)	0.49
Δ Cash Balances$_t$	0.277	-0.343 (-4.02)	-0.066 (-1.08)	0.44

PANEL C
FINANCIALLY PARTIALLY CONSTRAINED SUBSAMPLE RESULTS
N = 115,128

Dependent Variable	Positive Cashflow Shocks $_t$	Negative Cashflow Shocks $_t$	Positive-Negative Cashflow Shocks	R^2
Capital Expenditures$_t$	-0.000	0.007 (1.60)	-9.75e-06 (-0.00)	0.01
Acquisitions$_t$	-0.022	0.013 (1.57)	-0.009 (-0.80)	0.30
Asset Sales$_t$	-0.001	0.004 (1.21)	0.003 (1.07)	0.11
Equity Issues$_t$	-0.003	0.011 (2.13)	0.007 (1.46)	0.25
Share Repurchases $_t$	0.000	-0.008 (-2.39)	-0.008 (-2.53)	0.19
Dividends $_t$	0.002	0.003 (1.99)	0.005 (2.08)	0.29
Δ Long-term Debt$_t$	-0.185	0.211 (2.96)	0.026 (0.45)	0.64
Δ Short-term Debt$_t$	-0.618	0.592 (5.30)	-0.026 (-0.50)	0.61
Δ Cash Balances$_t$	0.220	-0.197 (-2.52)	0.023 (-0.49)	0.46

PANEL D
FINANCIALLY CONSTRAINED SUBSAMPLE RESULTS
N = 51,382

Dependent Variable	Positive Cashflow Shocks $_t$	Negative Cashflow Shocks $_t$	Positive-Negative Cashflow Shocks	R^2
Capital Expenditures $_t$	0.006	0.001 (0.10)	0.007 (0.84)	0.65
Acquisitions $_t$	-0.003	0.003 (0.74)	-0.000 (-0.07)	0.19
Asset Sales $_t$	0.007	-0.003 (-1.40)	0.004 (1.39)	0.04
Equity Issues $_t$	-0.002	0.001 (0.49)	-0.002 (-0.67)	0.63
Share Repurchases $_t$	0.003	-0.001 (-0.41)	0.002 (0.45)	0.16
Dividends $_t$	0.007	0.009 (1.63)	0.017 (3.09)	0.12
Δ Long-term $Debt_t$	-0.089	0.053 (1.44)	-0.036 (-1.66)	0.77
Δ Short-term $Debt_t$	-0.659	0.755 (9.81)	0.096 (1.82)	0.62
Δ Cash $Balances_t$	0.245	-0.208 (-3.18)	0.037 (0.79)	0.46