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Charlotte Ostergaard, Amir Sasson and Bent E. Sørensen

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Real and Financial Tradeoffs in Non-Listed Firms: Cash Flow Sensitivities and How They Change With Shocks to Firms' Main-Bank

Charlotte Ostergaard, Amir Sasson, and Bent E. Sørensen*

Abstract

We study how non-listed firms trade off financial, real, and distributive uses of cash. We show that firms' marginal value of cash (MVC) affects the mix of external and internal finance used to absorb fluctuations in cash flows; in particular, high-MVC firms employ substantially more external finance on the margin. Linking firms to their main bank, we find that shocks to bank finance affect corporate trade-offs and have real effects in high-MVC firms, making investment more sensitive to firm cash flows. Our analysis suggests that external finance constraints affect the real economy via firms' marginal value of cash.

Keywords: Cash Management, Cash Holdings, Cost of External Finance, Non-Listed Firms, Bank Lending Channel

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1 Introduction

How do external financing costs affect the cash-flow trade-offs corporations make? Corporate decision-making involves a series of real and financial tradeoffs of intertemporal nature. For example, a firm that experiences a cash flow shortfall and wants to shield investments will have to increase external borrowing, draw on previously saved cash balances, lower dividend payments, or a combination of all three. Increasing borrowing may raise its future borrowing costs, with repercussions for future investment. Alternatively, if external finance is prohibitively costly, a draw-down of cash reserves today will lower the amount of internal finance available for future investments. Recent papers that study such cash-management trade-offs include Almeida, Campello, and Weisbach (2004), Almeida and Campello (2007), Bakke and Whited (2008), Riddick and Whited (2009), and Campello, Giambona, Graham, and Harvey (2010).

Because a firm's financing, investment and distribution decisions are interlinked, examining individual decisions in isolation may fail to provide a complete picture of the trade-offs it makes. This has also been pointed out by Gatchev, Pulvino, and Tarhan (2010). A firm operates subject to uncertain cash flows and must trade off its sources and uses of funds, subject to the constraint that cash inflow must equal the total uses of cash as given by the cash flow accounting identity.[1] To understand how external financing costs affect corporate tradeoffs, we therefore need to consider the impact on all components of the cash flow identity.

In this paper, we study external financing costs and corporate trade-offs in nonlisted firms, using data that link a sample of privately-held Norwegian firms to their banks. Our objective is two-fold: First, we want to understand how nonfinancial firms trade off

[1] A fall in cash inflows must necessarily be financed by a reduction in one or more outflows. Disregarding minor sources (empirically unimportant for our sample) a decrease in cash flows must be reflected in lower dividend payments, larger draws on cash balances, increased net borrowing, or a drop in investment. A similar reasoning applies to an *increase* in cash flows. Simply put, an increase in cash flows must be used by adding it to cash balances, paying it out, or investing it.

financial, real, and distributive decisions. Little is known about corporate decision-making in closely-held firms that do not have access to public equity and debt markets. Second, we study how shocks to the cost of external finance affect firms' decisions—to what extent do firms substitute between different types of finance and to what extent do distributive and real policies give? The firms in our sample are heavily dependent on bank finance and our identification strategy employs exogenous shocks to the balance sheet of firms' main bank that carry over to the cost of lending.

The main contribution of our paper is a comprehensive study of how substitution between internal and external finance interacts with distributive and investment decisions, but our findings also add to our understanding of how the bank lending channel works. By studying how corporate trade-offs react to bank lending shocks, we will have something to say about the mechanism through which credit shocks affect the real economy.

The trade-off between a firm's sources and uses of cash is studied empirically by estimating the sensitivity of each component of the cash identity to its cash flows. As we explain below, these cash flow sensitivities reveal how costly it is for a firm to draw on its different sources of funds in the face of a cash flow shortfall. Essentially, the sensitivities are estimates of how quickly the marginal (shadow) cost of each source changes when the firm draws on it.[2] The extent to which the firm substitutes between different sources of funds depends on how quickly the costs of using them change. Therefore, it is interesting to consider cash flow sensitivities, and not just levels of deposits, loans, and capital, because the cash flow sensitivities reveal firms' marginal financing choices and contain information about the relative cost of firms' finance alternatives on the margin.

Our results show that, on average, firms save cash and repay bank loans in good times, and borrow and dis-save in bad times. On the margin, however, they draw almost twice as much on deposit balances than bank loans in the face of a cash flow shortfall; that is, firms'

[2]Because firms draw on a source up to the point where the marginal cost equals the marginal benefit, the cash flow sensitivities equivalently reveal how much the marginal benefit of each use of cash increases in the face of a rise in cash inflow.

cash accumulation is more sensitive to cash flows than is their use of bank finance. The average firm in our sample, therefore, habitually uses both internal and external finance, but relies more on internal funding on the margin. This reflects that, for the average firm, the marginal cost of internal funds changes less rapidly than the cost of bank finance. Firms' investment and dividend payments also fluctuate pro-cyclically, but less than cash accumulation. Although trade credit is an important source of finance for our firms, the use of trade credit is quite insensitive to cash flows. The marginal cost of trade credit obviously changes rapidly as firms draw on it so they tend to repay it on time. Importantly, we include the lagged levels of loans, deposits, and capital stock in the regressions and find very strong mean-reversion in the levels, that is, firms appear to revert to an "optimal" (firm-specific) capital structure. For instance, if a firm enters the period with a high level of bank debt, it repays part of that debt in the current period as opposed to borrowing more. Some of the lagged level terms are very large with t-statistics near triple digits and ignoring these terms, as has been common in the literature, potentially leads to left-out variable bias.

Internal funds is an important source of finance for many firms and perhaps especially for nonlisted firms. A priori, therefore, one would expect that the cost of drawing on internal funds is related to the level of cash balances accumulated in the firm; i.e., low for firms with plenty of cash and high for firms with little cash. We sort firms into groups according to their marginal value of cash and find striking differences between firms. Firms that operate with a high marginal value of cash ("high-MVC firms") employ a financing mix that depends almost five-fold more on bank finance on the margin. Low-MVC firms employ a marginal fixing mix that depends eight-fold more on internal finance. That is, in cash rich firms, cash balances fluctuate sharply because it is relatively costless to absorb fluctuations in cash flow through variations in deposit holdings. The opposite occurs in cash poor firms who absorb fluctuations by borrowing and repaying bank credit. The higher cost of adjusting cash reserves for cash poor firms has real implications—investment is relatively more sensitive to cash flow in high-MVC firms.

We then consider how cash flow sensitivities are affected by exogenous shocks to a firm's main bank. We identify shocks to the bank as deviations-from-average in the bank's loan loss provisions. Following bank shocks, high-MVC firms' use of bank funding falls. They repay bank debt and cash flow fluctuations are now absorbed less by bank loans, reflecting an upward shift in the marginal cost of bank loans. As a consequence, investment becomes more sensitive to fluctuations in cash flows. Importantly, we do not observe that high-MVC firms increase their use of internal cash balances after bank shocks, suggesting that the marginal cost of drawing on cash is so high that firms will not substitute internal for external finance.

In conclusion, our results show that low-MVC firms which operate with high cash balances and hence a low marginal cost of cash use are able to substitute internal for external finance, and do so to a large extent. Therefore, they appear to be relatively insulated from external finance supply shocks. Firms with a high marginal value of cash find it costly to draw on cash balances and prefer instead to use bank finance. They are less able to substitute between internal and external finance and this is the reason credit constraints affect their investment. Our analysis therefore suggest that the mechanism through which external finance constraints are transferred to the real economy operates via firms' marginal value of cash.

In alternative sample splits, we take high-MVC firms to be firms that do not pay dividends in a given year. This yield results that are similar to those obtained from splitting on cash balances. It is common in the literature on external financing costs to split on measures such as dividend-payments that, a priori, are believed to capture the severity of financial constraints and our approach is quite similar, expect there is an important difference in interpretation.[3] As Riddick and Whited (2009) point out, a firm that accumulates little

[3]Estimating differential cross-sectional impacts of credit supply shocks, Kashyap, Lamont, and Stein (1994) split their sample on whether firms issue public bonds or not, Gertler and Gilchrist (1994) split on firm size, and Fazzari, Hubbard, and Petersen (1988) split on firms' dividend-payout ratios.

cash may be drawing extensively on its savings because its capital is so productive that it is optimal for firms to dis-save today in order to invest and increase cash flows tomorrow. Similarly, firms may abstain from paying dividends today because it is more productive to invest. The high-MVC firms in our sample, therefore, are not necessarily more financially constrained than low-MVC firms in the sense that they save little because they cannot get bank loans—in fact we find that high-MVC firms borrow more. *Per se*, estimated cash flow sensitivities reveal firms' relative marginal financing costs, but not whether their choices occur due to poor access to external finance or due to good investment opportunities. However, we can gauge the impact of credit constraints from the change in cash flow sensitivities following shock to firms' main banks. We argue that to understand cross-sectional differences in the trade-offs firms make, it is more informative to focus on the (marginal) value firms place on cash, rather then on the proxies for financial constraints that have been the focus of much of the literature.[4]

Almeida et al. (2004) directed attention towards the information contained in firms' accumulation of cash balances. Cash may provide liquidity for investment when there is uncertainty about how much external finance may be raised in the future. They analyze firms' cash accumulation out of cash flow, which they coin the "cash flow-sensitivity of cash," and this is one of the cash flow sensitivities that we estimate. In their model, credit constrained firms should compensation by retaining more cash and have a larger cash flow sensitivity than unconstrained firms. Although their focus and the type of firms they consider are somewhat different from ours, we estimate a *smaller* sensitivity for firms that would be characterized as constrained with the definitions they use. That is, our findings suggest that firms that value cash higher are more reluctant to draw extensively on their savings and prefer to absorb fluctuations in cash flows by drawing on sources whose marginal cost is less sensitive to the extent of their use. Our results are therefore consistent

[4]Because firms operate where the marginal (shadow) cost of each source are equalized and, in turn, equal to the marginal (shadow) values, a high-MVC firm is more precisely a firm that operates with high marginal values of *all* sources of funds (not just cash).

with the arguments presented in Riddick and Whited (2009) and Bakke and Whited (2008).

Other papers focus on the *level* of cash balances and find that firms with relatively poorer access to external finance tend to hold larger buffer-stocks of cash.[5] Many of these papers tend to address the question from the point of view of large widely-held corporations, partly due to availability of data and we believe ours is the first paper to analyze how small firms trade off the accumulation of cash against other uses of cash flow.[6]

Financial flexibility may also be provided by lines of credit. Sufi (2009) shows that firms with access to a line of credit display a higher cash flow sensitivity of cash and Campello et al. (2010) study firms' use of lines of credit during the 2008 financial crisis. As we do, they focus on how companies substitute between internal and external liquidity and real investment in the face of a shock to external finance. Although they do not consider the marginal value of cash in their analysis they find, consistent with our results, that cash-plenty firms uses lines of credit less extensively.

External financing costs may have real effects on investment. Initiated by Fazzari et al. (1988), a large literature finds a larger sensitivity of investment to cash flow for firm that are more likely to be credit constrained.[7] The investment-cash flow sensitivity is, of course, another of the sensitivities from the cash flow identity that we consider in this paper. The investment-cash flow sensitivity idea builds on the notion that financial frictions cause a wedge between the cost of external and internal finance but does not explicitly include a motive for accumulating cash balances.[8] In contrast, our analysis incorporates the decision

[5]See, for example, Opler, Pinkowitz, Stulz, and Williamson (1999), Acharya, Almeida, and Campello (2007), Bates, Kahle, and Stulz (2006), and Mao and Tserlukevic (2009).

[6]Faulkender (2002) examines determinants of the *level* of cash holdings of small firms in the National Survey of Small Business Finance and documents, as found for listed firms, that firms facing greater uncertainty regarding their ability to raise finance in the future tend to hold larger buffer stocks of cash. Brav (2009) examines capital structure determinants in U.K. privately-held firms and finds, among others, that leverage is relatively more sensitive to operating performance (cash flow) compared to listed firms that have easier access to external finance. Although the firms in his sample are much larger than ours (about 10 times), this result is consistent with ours.

[7]Later contributions include Gilchrist and Himmelberg (1995) and Kaplan and Zingales (1997) who questions the interpretation of the sensitivities estimated in Fazzari et al. (1988).

[8]A closely related literature is the business cycle models of the so-called financial accelerator; e.g., Bernanke and Gertler (1989) and Bernanke, Gertler, and Gilchrist (1996).

to accumulate cash and firms' cash holdings are assumed to be optimal in the sense that they are the outcome of a dynamic optimization problem that trades off all current and future uses and sources of funds.

Finally, our paper is related to the literature arguing that shifts in bank lending policies have real effects because some borrowers are bank dependent and cannot substitute other finance for bank loans (*the bank lending channel*).[9] We add to that literature by studying how bank shocks affect corporate trade-offs, thereby identifying a mechanism for how bank shocks are transmitted to the real economy.

The rest of the paper is organized as follows. Section 2 presents a simple model of firms' decision problem demonstrating that cash flow sensitivities have information about changes in the marginal costs of components of the cash flow identity. Section 3 presents our empirical methodology. Sections 4 and 5 present data and results, and Section 6 concludes.

2 A simple model of cash management trade-offs

In this section, we present a model that captures the intertemporal nature of firm's cash management policies and the trade-offs between different uses and sources of cash. We present a simple deterministic infinite horizon model and we believe that the logic will carry over to more complex setups with uncertainty, as outlined at the end of the section. The model has two main results: First, we show that in optimum firms operate where the marginal shadow value of cash equals the marginal shadow costs of each item in the cash identity; i.e., at the point where all marginal costs and benefits are equalized. Second, the model provides expressions for the cash flow sensitivities of each items in the cash identity and illustrates how they are inversely related to the slope of their marginal cost/benefit curve. That is, the model illustrates mathematically how our estimated cash flow sensitivi-

[9] A non-exhaustive list of contributions include Bernanke and Blinder (1988), Bernanke and Lown (1991), Kashyap, Stein, and Wilcox (1993), Peek and Rosengren (2000), Ashcraft (2005), and Jiménez, Ongena, Peydró-Alcalde, and Saurina (2010).

ties uncover how quickly the marginal cost of a source of finance changes as the firm draws on it.

Consider a firm whose owner maximizes the discounted sum of future dividends. We denote the maximized value by V_t:

$$V_t = \max \Sigma_{t=0}^{\infty} \beta^t U(\text{DIV}_t) ,$$

where the maximum is taken with respect to decision variables and constraints to be spelled out, β a discount factor, and U a concave utility function.

We assume that cash flow (EBITDA) is determined from an increasing concave production function which delivers output $f(\text{K}_{t-1})$ where K_t is physical capital at the end of period t. The production function f is increasing, concave, and differentiable with a law of motion $\text{K}_t = \text{K}_{t-1} + \text{I}_t$ (depreciation is ignored for simpler notation). Dividends (DIV_t) equal cash flows minus interest paid plus increases in outstanding loans minus increases in deposits minus gross investments. We denote the stock of loans and deposits at the end of period t by L_t and DEP_t, respectively, and investment during period t by I_t.

We assume the borrowing interest rate $r^b(\text{L}_t)$, paid at the beginning of period $t+1$, is a positive convex increasing function of the amount of loans outstanding. The return on deposits is comprised of a constant deposit rate of interest, r^d, plus a "shadow interest rate," captured by a differentiable, convex function $s(\text{DEP}_t)$. The shadow value of cash is a simple way of capturing that firms hold cash to insure against future states with low cash flows where external finance is limited or costly. The positive effect on firm value from accumulated cash stems, among others, from the positive net present value of investment projects that would otherwise not have been undertaken—the mechanism modeled by Almeida, Campello, and Weisbach (2004) (ACW).[10] Alternatively, as in the

[10]In their three-period model, firms may hoard cash in period one to invest in a "short-term" project in the interim period, and the marginal value of cash is the marginal return to that investment, realized in the final period.

model of Riddick and Whited (2009), the shadow value of cash stems from a fixed cost of raising outside finance. For our purposes it is convenient to capture these features by assuming that cash delivers a direct valuable service. The overall monetary return to holding cash is $r^d + s(\text{DEP}_t)$.

All variables are chosen simultaneously, but in an accounting sense we can write dividends as a residual from the simplified cash flow identity:

$$\text{DIV}_t = f(K_{t-1}) - \Delta\text{DEP}_t + \text{DEP}_{t-1} r^d + s(\text{DEP}_{t-1}) + \Delta L_t - L_{t-1} r^b(L_{t-1}) - I_t \ ,$$

We derive Euler equations for deposits, loans, and real capital—see Cochrane (2005), p. 5, for a similar derivation of the general Euler equation. Starting from values that are optimally chosen, the Euler equations are derived from the permutations of the optimal choice variables. The firm's owner can decide to lower current dividends by a fraction ("one dollar"), which decreases current utility by $U'(\text{DIV})$, deposit the cash and in the next period take out the one dollar plus the interest to be used for dividends next period. This would increase next period's utility by $U'(\text{DIV}_{t+1})(1+r^d+s')$. At the optimum the owner will be indifferent to this permutation and therefore the marginal utility of receiving dividends today will equal the discounted marginal utility times the gross return from postponing dividends one period, which provides the Euler equation:

$$U'(\text{DIV}_t) = \beta U'(\text{DIV}_{t+1})(1 + r^d + s'(\text{DEP}_t)) \ .$$

Alternatively, the owner may decrease dividends, repay loans, and increase dividends the following period by the same amount plus saved interest, leading to the Euler equation for loans:

$$U'(\text{DIV}_t) = \beta U'(\text{DIV}_{t+1})(1 + r^b_t + L_t \frac{dr^b}{dL}) \ .$$

Similarly, we can derive the standard Euler equation for investment:

$$U'(\text{DIV}_t) = \beta\, U'(\text{DIV}_{t+1})(1 + f'(K_t)) \ .$$

Equating the right-hand side of those Euler equations and denoting the marginal value of cash, $\beta U'(\text{DIV}_{t+1})(1 + r^d + s'(\text{DEP}_t))$, by MVC_t, we have in optimum that the marginal value of cash equals the marginal value or cost of other uses of funds in the cash flow identity

$$\begin{aligned} \text{MVC}_t &\equiv \beta U'(\text{DIV}_{t+1})(1 + r^d + s'_t) = \beta U'(\text{DIV}_{t+1})(1 + r^b + L_t \frac{dr^b}{dL}) \\ &= \beta U'(\text{DIV}_{t+1})(1 + f'(K_t)) = U'(\text{DIV}_t) \ . \end{aligned} \tag{1}$$

In words, the marginal value of cash equals the marginal cost of borrowing equals the marginal value of physical capital equals the marginal value of dividend pay-outs.

We can derive cash flow sensitivities from this identity. Rewrite (1) as

$$r^d + s'(\text{DEP}_t) = r^b_t + L_t \frac{dr^b}{dL} = f'(K_t) = \frac{U'(\text{DIV}_t)}{\beta U'(\text{DIV}_{t+1})} - 1 \tag{2}$$

and linearize using a simple first order Taylor series expansion. This provides expressions for the cash flow sensitivities as detailed in Appendix B. The solutions are (with all functions except utility evaluated at period t values):

$$\begin{aligned} \Delta\text{DIV}_t &= \frac{1}{1 + U''_t/(\beta U'_{t+1} s'') + U''_t/(\beta U'_{t+1} 2r^{b'}) + U''_t/(\beta U'_{t+1} f'')} \text{CF}_t \ , \\ \Delta\text{DEP}_t &= \frac{1}{\beta U'_{t+1}\, s''/U''_t + 1 + s''/2r^{b'} + s''/f''} \text{CF}_t \ , \\ \Delta L_t &= \frac{1}{\beta U'_{t+1}\, 2r^{b'}/U''_t + 2r^{b'}/s'' + 1 + 2r^{b'}/f''} \text{CF}_t \ , \\ I_t &= \frac{1}{\beta U'_{t+1}\, f''/U''_t + f''/s'' + f''/2r^{b'} + 1} \text{CF}_t \ . \end{aligned}$$

The intuition of the cash flow sensitivity of cash is the same as formula (5) of ACW. In their model cash is hoarded in period t for the purpose of investing in period in a short-term production function in period $t+1$ and their cash flow sensitivity of cash depends on the second derivative of a short-term production function relative to the second derivative of a long-term production function.

In our sample, several firms do not pay dividend and the derivations above ignore the non-negativity constraints on dividends—we outline the first order conditions for this case in Appendix B. It is clear that dividends will be zero in period t if $U'(0) < \text{MVC}_t$.

In Figure 1, we illustrate the optimal allocation for deposits, loans, and physical investment for a cash-rich, low-MVC firm and a cash-poor, high-MVC firm, with identical utility, cost, and production functions. At the outset, time t, the marginal values are equalized. A negative cash flow shock at date $t+1$ causes re-optimization to a higher MVC level. The figure illustrates the interpretation of the cash flow sensitivities; in particular, it shows how the steepness of the MVC-curve affects the magnitude of the adjustments in deposits, loans, and investment to the new equilibrium. The cash-rich firm operates where the shadow value of cash changes slowly (s'' is small in absolute value) and therefore a large fraction of the firm's cash flow fluctuations will be absorbed by an adjustment in deposits. The curves are drawn such that the same holds for investments, while loans react less.[11] The cash-poor firm, in contrast, operates on a relatively steep segment of the MVC-curve and absorbs relatively less of its cash flow fluctuations through deposits, such that loans may react relative more.

While we do not intend to parameterize and solve the model under our simplifying assumptions, one might solve the model by iterating over the Bellman equation

$$\begin{aligned} V(\text{DEP}_{t-1}, \text{L}_{t-1}, \text{K}_{t-1}) \quad &= \quad max_{\text{I}_t, \Delta\text{DEP}_t, \Delta\text{L}_t} U(f(\text{K}_{t-1}) - \Delta\text{DEP}_t + \text{DEP}_{t-1}\text{r}^{\text{d}} + \Delta\text{L}_t - \text{L}_{t-1}\text{r}^{\text{b}}(\text{L}_{t-1}) - \text{I}_t) \\ &+\beta V(\text{DEP}_t, \text{L}_t, \text{K}_t) \end{aligned}$$

[11] The figure may have a slope that is too steep for low amounts of loans but the same result would hold if a fraction of firms adjusted loans significantly while another fraction of firms didn't adjust loans at all because they were at the zero lower limit.

subject to the law of motions of our model.

A more extensive model, see for example Riddick and Whited (2009), would have cash flows subject to stochastic shocks $f(\text{K}_{t-1}, \epsilon_t^p)$ where ϵ^p is a stochastic shock to productivity (potentially correlated over time), costs of adjusting capital, and non-negativity constraints on dividends and deposits, as well as potential constraints on future borrowing—capturing the intuition of ACW. Under suitable concavity and compactness assumptions, the value of the firm, V, will be a concave differentiable (away from corners) function which satisfies the Bellman equation

$$V(\text{DEP}_{t-1}, \text{L}_{t-1}, \text{K}_{t-1}) \quad = \quad max_{\text{I}_t, \Delta\text{DEP}_t, \Delta\text{L}_t} U(\text{DIV}_t) + \beta \text{E}_0 \text{V}(\text{Dep}_t, \text{L}_t, \text{K}_t)$$

where DIV_t is $f(\text{K}_{t-1}, \epsilon_t^p) - \Delta\text{DEP}_t + \text{DEP}_{t-1}\text{r}^d + \Delta\text{L}_t - \text{L}_{t-1}\text{r}^b(\text{L}_{t-1}) - \text{I}_t$ (DIV_t may be zero) and E_0 is the expectation conditional on period zero information. In such a more general framework, the marginal trade-offs still hold and in the case of non-binding constraints, we would have (among other first order conditions):

$$\text{MVC}_t = \beta \text{E}_0 \{ \frac{\partial \text{V}(\text{DEP}_t, \text{L}_t, \text{K}_t)}{\partial \text{DEP}} (1 + \text{r}^d) \} \ ,$$

where the value function captures the future expected benefits of holding cash. Riddick and Whited (2009) display such first order conditions for the shadow value of cash balances but in their model V can only be solved by simulation.

3 Empirical methodology

Consider the accounting identity for cash flows. We start by defining symbols for the elements of the cash identity and we choose the sign such that all variables refer to *uses* of cash, such as depositing cash in a bank account, investing in equipment, or repaying loans. Define cash flows CF (EBITDA) as earnings before taxes, depreciation, and amortization, DIV as dividends paid to owners, DEP as net increase in deposits in financial institutions, LOANS as net repayment on loans (net of new borrowing), TRADECRED as net repayment of trade credit, TRADEDEB as net granting of credit to customers, SECBOUGHT as securities purchased, EQUITY as equity retired, INTPAID as net payments of interest, INV as gross investment in fixed capital and inventories and TAXPAID as taxes paid. Given a dollar of cash inflow, firms can pay out dividends or invest in capital, firms typically are obligated to pay (or receive) interest and pay taxes, and they normally grant trade credit to costumers as part of routine business transactions. For our firms, purchases of securities and changes in firms' equity are small and we include these terms here for completeness but ignore them in the empirical work. Finally, firms can add to cash holdings, repay (bank) loans, or postpone payments for goods delivered; i.e., borrow from suppliers.

In symbols, the (approximate) cash identity is:

$$\begin{aligned} \text{CF} &= \text{DIV} + \text{DEP} + \text{LOANS} + \text{TRADECRED} + \text{INV} + \\ &\quad \text{TRADEDEB} + \text{TAXPAID} + \text{INTPAID} + \text{SECBOUGHT} + \text{EQUITY} \end{aligned} \tag{3}$$

Equation (3) is the starting point for our empirical analysis. As discussed, the sensitivity of investments to cash flows has generated a large literature while the the sensitivity of cash (deposits) to cash flows is a more recent active literature. We consider the cash flow sensitivities of all significant components of the cash identity simultaneously.

Empirically, we estimate how an extra dollar of cash flows (EBITDA) is allocated to each of the terms in the cash identity. We estimate panel Ordinary Least Squares (OLS) regressions

$$(\text{Y}_{it} - \overline{\text{Y}}_{i.}) \;=\; \nu_t \;+\; \beta\,(\text{EBITDA}_{it} - \overline{\text{EBITDA}}_{i.}) \;+\; \text{lags} \;+\; \epsilon_{it}\,, \tag{4}$$

where the index i refers to firm i and index t refers to year t. ν_t is a dummy variable for each time period. The variable Y is generic and represents an element of the cash flow identity, such as deposits or net loans repayments.

"Lags" refers to lagged variables. Gatchev et al. (2010) show that including lagged variables have important effects on the estimated parameters which likely display left-out variable bias in a static specification. In the literature on optimal capital structure the change in loans to assets are typically regressed on explanatory variables and the lagged level in order to allow for mean reversion.[12] Similarly, Opler et al. (1999) find that the majority of firms display mean reversion in cash to asset ratios. We, therefore, do not follow Gatchev et al. (2010), who include the lagged flows (the Ys) in the regression—a specification which imply that firms have a target level for cash flows rather than for the levels of deposits, loans, capital, etc.[13] We include the lagged stock of deposits, loans, trade credit, accounts payable, and physical capital and, as shown below, find strong mean reversion in the stock levels.

We further include lagged EBITDA based on initial explorations: Physical investments take time to implement and we find that, indeed, investment reacts to cash flows with a lag. The notation $\overline{\text{EBITDA}}_{i.}$ refers to the average over time of the values of EBITDA for firm i. By subtracting the average of the variables for each firm, the regression measures how Y reacts to deviations in EBITDA from the firm average and not the correlation between the levels of Y and EBITDA. In other words, we control for firm fixed effects because we wish to study how; e.g., the accumulation of cash reacts to cash inflows relative to the firm average, and not cross-sectional differences between firms. The variables are all measured in millions of Norwegian kroner and a coefficient β of, say, 0.25, implies that out of a cash flow of a one hundred kroner in firm i at time t, 25 kroner are paid out on cash flow component Y on

[12]See, among others, Shyam-Sunder and Myers (1999), Baker and Wurgler (2002), and Fama and French (2002). Relatedly, Graham and Harvey (2001) find, using questionnaires, that most CEOs aim for a target level of debt to equity.

[13]The specification of Gatchev et al. (2010) is suitable if the level variables are non-stationary. In our specification, non-stationarity of the level variables is a special case where a coefficient to the lagged level near unity indicates non-stationarity.

average. More precisely, these numbers are deviations from firm- and year-averages.

We estimate equation (4) with each component of the cash identity taking the place of the generic Y variable and if the cash identity holds in the data, the β-coefficients will sum to unity.[14] We present the β-coefficients multiplied by 100 and each coefficient then has the interpretation as the percent of EBITDA allocated to the relevant component. In other words, we provide at decomposition of the EBITDA-shock to the typical firm into its components of use. In most of our work we focus on dividends, deposits, net loan repayment, net trade credit repayment, and gross investment. The other components are negligible for the firms in our sample (except for accounts payable).

In order to examine the effect of bank shocks on the decomposition of cash flows, we allow the coefficient β to change with shocks to loans-loss provisions in the main bank of firm i. We specify the coefficient β_{it} as

$$\beta_{it} = \beta_0 + \beta_1 \, \mathrm{X}_{it} \qquad (5)$$

where $\mathrm{X}_{it} \equiv (\mathrm{PROV}_{jt} - \overline{\mathrm{PROV}}_{j.} - \overline{\mathrm{PROV}}_{.t})_{it}$ is a measure of the shock to firm i's main bank j at date t. The intuition is that firm i's main bank may tighten lending and/or increase costs if it experiences larger-than-average loan loss provisions in a given year.

We estimate regressions with interactions between EBITDA_{it} and X_{it} of the following basic form,

$$(\mathrm{Y}_{it} - \overline{\mathrm{Y}}_{i.}) \;=\; \nu_t \;+\; \beta_{it}\,(\mathrm{EBITDA}_{it} - \overline{\mathrm{EBITDA}}_{i.}) \;+\; \gamma(\mathrm{X}_{it} - \overline{\mathrm{X}}_{i.}) \;+\; \mathrm{lags} \;+\; \epsilon_{it}\,. \qquad (6)$$

We allow for interactions between $\mathrm{EBITDA}_{i,t-1}$ and $\mathrm{X}_{i,t-1}$ as well, because firms may adjust to bank shocks over more than over period.

[14] The equations all have the same right-hand side regressors and form a so-called Seemingly Unrelated Regression (SURE). It is well known that system estimation provides estimates identical to equation-by-equation OLS estimates for SURE systems.

The coefficient β_1 is the interaction effect and an estimated value larger than aero implies that a larger share of cash flows are allocated to Y on average when X is large (relative to firm- and overall means). In other words, the cash flow sensitivity of Y increases when firm i's main bank makes above-average loan loss provisions.

We do not include a measure of Tobin's q in our regressions, as is customary in the investment-cash flow sensitivity literature. Several papers; e.g., Riddick and Whited (2009), have pointed out the difficulties of measuring Tobin's q and measurement error is likely to be an even larger problem in our sample of non-listed firms. The estimated cash flow sensitivities depend on a variety of factors, such as external financing constraints and investment productivity, that are extremely difficult to control adequately for in a regression. Our identification strategy is therefore a different one: The effect of external financing constraints are revealed through the interaction effect which captures the *changes* in estimated sensitivities when firms' main bank receives an exogenous shock and tightens lending.

3.1 Instrumental variables

One may question the causality of the interaction effect in equation (6). That is, it is possible that the interacted cash flow sensitivities are caused by financial difficulties of firms in our sample—such firms may trade off sources of funds differently *and* their financial difficulties might show up as delinquencies and subsequent loan loss provisions at the banks they borrow from. Hence, it is possible that a significant interaction term does not reflect an exogenous change in banks' loan supply, but rather that distraught firms behave differently.

It is unlikely that such reverse causality is a problem in our regressions because the outstanding loans of the average firm in our sample constitute only 0.043 percent of their main bank's outstanding loans and leases (loan portfolio) in a given year. The median fraction is a low 0.0024 percent. The banks' loan loss provisions are therefore unlikely to be caused by delinquencies of the firms in our sample, as the banks have many other, larger, loan engagements with corporations that are not included in the sample.[15]

Nevertheless, we perform instrumental variables (IV) regressions to validate our interpretation. We construct instruments from three variables related to banks' loan loss provisions: (1) specified provisions against loan losses in the household sector in percent of firm i's main bank j's loan portfolio; (2) the fraction of delinquent loans in the household and foreign sector, in percent of firm i's main bank j's loan portfolio; and (3) commercial and industrial loan loss reserves held by firm i's main bank j against firms in industries *other* than firm i's industry. Norwegian banks do not report loan loss provisions (flow) by industry but they report loan loss reserves (stock) by industry. We may therefore proxy provisions in industry k in year t by the change in loan loss reserves from year $t-1$ to year t. Such changes will be correlated with the bank's overall loss provisions, but not with *idiosyncratic* shocks to firm i's cash flow.[16] By similar reasoning, we compute the change in the stock of delinquent loans in the household and foreign sector as a proxy for provisions in those sectors. We retain the (scaled) level of reserves and delinquent loans as instruments, although most power comes from the changes in these variables.

4 Data

Our sample consists of Norwegian limited liability firms operating in Norway between 1995 and 2005. All Norwegian limited liabilities firms must annually report audited balance sheet and income and loss statements to the official Company Registrar, the *Brønnøysund Register*.[17] Norwegian law requires that accounts be audited, irrespective of company size

[15]As we explain in Section 4, we exclude firms that belong to a business group from the sample.

[16]We set negative changes in loan loss reserves to zero. The change in reserves may be negative in years where banks write off large amounts of loans from their balance sheet. Such write-offs are related to provisions made in the past and are unlikely to affect the current loan policy of the banks. Therefore, we prefer to set negative values to zero.

[17]This data is made available to us through the Center for Corporate Governance Research (CCGR) at the Norwegian School of Management.

which ensures high quality data even for small and medium size firms.[18]

From the population of all limited liabilities firms we exclude firms which are subsidiaries of larger corporations such that our sample is comprised of independent firms that are not members of business groups. Because business groups may transfer resources between member firms, thus counteracting credit constraints imposed on individual members, we prefer to focus on independent firms in order to aid identification of the *mechanism* with which bank loan supply shocks are transmitted to the real economy. Also, subsidiaries do not have full autonomy with regards to financial management decisions. We also exclude public (listed) firms and firms whose main owner is the Norwegian state or a foreign firm. Finally, we exclude firms from the following industries: Finance and insurance; professional, scientific, and technical services; public administration, educational services; health care and social assistance; other services; and ocean transportation.

The data is cleaned of missing and mis-recorded information in the following way: Firms with negative assets and sales are excluded from the sample. Firms of average size less than 1 million Norwegian kroner (approx. 167,000 USD) and firms where the difference between reported total assets and liabilities exceeds 1 million kroner are excluded. We are interested in studying the reaction of variation in the time series of firms' cash flow, hence we exclude firms whose organization number is missing from the sample in one or more years in between the first and the last year they appear in the sample. Finally, we exclude firms for which we observe less than three consecutive years of data leaving us with 119,682 firm-year observations and 23,057 individual firms. Sixty percent of the firms appear in all eleven years of the sample so we have a relatively long time-series of data available for more than half of the firms of the sample.

Some firms-years have missing information on location, industry, and/or establishment year. Missing values are filled where possible, by checking consistency with industry and

[18]The failure to submit audited accounts within a specified deadline automatically results in the initiation of a process that may end with the enforced liquidation of the firm.

establishment years before and after the missing entry.

We match the sample of independent firms with annual data on their outstanding loans and deposits in financial institutions as well as interest paid and received. The data is made available to us by the Norwegian Tax Administration. It specifies each deposit and loan relationship that a given firm has with any loan-giving institution in Norway. This allows us to match up individual firms and loan-giving institutions. In those cases where such institutions are banks, we can merge the sample further with data on Norwegian banks' financial accounts (Norwegian *call reports*) made available to us by the Central Bank of Norway and Statistics Norway.

4.1 Construction and data source of main variables

The construction of the variables in the cash flow identity is as follows: From the tax data we construct a firm's accumulation of cash as the increase in its outstanding deposits aggregated over all deposit-giving institutions with which it has a deposit account. The repayment of loans (net of new borrowing) is the decrease in outstanding loans aggregated over all loan-giving institutions. Net interest paid is the difference between annual interest paid and received, summed over all institutions.[19]

The remaining variables in the cash flow identity are from firms' annual accounts. EBITDA is earnings before interest, taxes, depreciation and amortization. The repayment of trade credit (net of new borrowing) is the decrease in accounts payable between two consecutive years. Extension of trade credit (net of repayments) is the increase in accounts receivable between years. Capital stock is the value of fixed assets and inventories and gross investment is the change in the capital stock plus depreciation. Accrued taxes is reported accounting taxes and reduction in paid-in equity is the net reduction in share capital; i.e., the cash outflow due to write-downs. All firm-level variables are scaled by the average firm

[19] Although firms in our data set may borrow from non-financial institutions and non-banks, almost all borrowing is from savings or commercial banks. If we substitute loan from all lenders with bank loans in our regressions, it makes little difference to the results.

size computed over the sample, are deflated to 1998-values, and are winsorized at the 1st and 99th percentile.

Bank-level variables are constructed from Norwegian call reports. Loan loss provisions comprise gross provisions made on loans, leases, and guarantees.[20] Provisions comprise so-called "specified" and "unspecified" provisions where the former is provisions against delinquent engagements of three months or longer. Norwegian law requires that banks compute loss assessments and set aside reserves for such loans. The latter type of provisions may not be tied to individual engagements but are of a general nature and likely to contain forward-looking information about expected, but not yet realized, delinquencies. The instruments for loan loss provisions are constructed as follows: Specified provisions against loans/leases/guarantees to households is a subset of specified provisions as described above. Delinquent loans in the household and foreign sector is the value of all loans and leases extended to customers that are in delinquency on one or more engagements. We define delinquent loans as those where payments are at least 30 days behind schedule. Loan loss reserves is the stock of reserves held on the balance sheet against loan/leases/guarantees. Annual changes in loan loss reserves include realized losses on engagements for which provisions were previously made. All bank level variables are scaled by the value of the bank's loans and leases at the end of the previous period (the size of its loan portfolio), are deflated to 1998-values, and are winsorized at the 1st and 99th percentile. Furthermore, we measure loan loss provisions in percent of the bank's loan portfolio to ease the interpretation of the estimated coefficients.

We construct a bank shock-measure from banks' loan loss provisions, by demeaning gross provisions in year t with the bank's average level of provisions during the sample. Higher-than-average provisions thus constitutes a negative shock to a bank. A firm's main bank is defined as the bank with which it has the largest outstanding amount of loans in

[20]Gross provisions are new provisions on engagements for which provisions have not previously been made, plus increased provisions on engagements for which provisions have been made previously, minus reductions in previously made provisions. The measure does not include realized losses on engagements.

a given year. Only a very small fraction of firms change main bank during the sample. In each year, the firm is paired up with it's main banks and the credit shock to a firm in a given year, is the demeaned level of loan loss provisions at its main bank in that year.

4.2 Descriptive statistics

Table 1 reports key ratios from the firms' balance sheet and income statements. The firms are on average 11 years of age and the main owner holds a controlling stake of 65 percent. The distribution of assets, and most other variables, is clearly right-skewed. Average turnover is about twice the size of total assets. Fixed assets make up 37 percent of assets and cash holdings, in the form of deposits, 14 percent. Accounts receivable make up 20 percent. On the capital side, equity constitutes 16 percent of assets and the liability-to-asset ratio is high at 84 percent. Part of the explanation for this ratio is the Norwegian value-added tax of 25 percent which accumulates as a liability on firm's balance sheets and constitutes 14 percent of short term liabilities on average (not reported in Table 1). In addition, the item "other debt," which collects a variety of liabilities including loans from shareholders and other private lenders, unpaid salaries, and unpaid reserves for vacation pay (12 percent of annual salary), account for 22 and 54 percent of short and long-term liabilities, respectively (not reported in Table 1). Bank debt is the largest financial debt item at 28 percent followed by trade credit at 21 percent. Return on assets is 6 percent and the firms pay out 39 percent of net income as dividends, suggesting that dividends is an important source of income for the owners of these firms.

The industry distribution of the firms is a follows: The largest group is wholesale and retail firms which constitutes 45 percent of the firms in the sample followed by 21 percent of firms in construction and 16 percent in manufacturing. Approximately 6 percent of the firms operate in each of the following sectors: Accommodation and Food Services, Transportation and Warehousing, and Agriculture. Firms operating in the Mining, Utilities, and Information (telecommunication) sectors constitute approximately one percent of the firms in our sample.

Table 2 compares our sample to the 2003 U.S. Survey of Small Business Finance (SSBF)—both a sample of S-corporations and the larger C-corporations.[21] As we have eliminated firms that belong to a business group from our sample, our firms are, not surprisingly, small compared to the SSBF-firms with median assets at approximately 0.7 million USD compared to assets of 2.5 and 3.7 million USD for S and C-corporations, respectively. Further, the Norwegian firms operate with substantially lower equity ratios. A large part of this difference in capital-structure can presumably be explained by structural (esp. tax) differences between the two countries, as described above. Focusing on the medians and comparing chiefly to the smaller S-corporations, we see that the Norwegian firms tend to have more debt, in particular bank debt, but also substantially more trade credit. The median age is 7 years, substantially less than median age of the U.S. samples which may be due to firms in business groups being eliminated. The median share held by the largest owner is 62 for our sample and 70 percent for U.S. S-corporations. In general, we notice that the higher standard deviations in the U.S. samples indicate more heterogeneity in the SSBF.

5 Regression results

5.1 Cash flow decomposition

We start by estimating the cash flow sensitivities of each component of the cash flow identity. The first line of Table 3 gives the coefficient on contemporary EBITDA and shows how a one-hundred dollar increase in cash flow (EBITDA) is allocated to different uses—alternatively, how a one-dollar shortfall may be funded from different sources. Standard errors are estimated robustly with clustering at the firm level. In general, the t-statistics are

[21] S-Corporations must have no more than 100 shareholders and are taxed as partnerships, that is, at the level of the shareholders. C-corporations are limited liability firms.

so large—for instance, about 100 for dividends—that we do not comment on significance for this table.[22]

Firms cover a cash flow shortfall by lowering dividends, drawing on accumulated deposits or bank loans, giving less trade credit, and, to a lesser extent, decreasing investment. The sum of these five items indicate that they finance 84 percent of the shortfall. Dividends and deposits react strongly to cash flows with 20 percent of (above average) cash flows being paid out as dividends and 24 percent deposited and similar declines when cash flows fall short of average. Repayment of bank loans (net of new borrowing) in good times, and borrowing in bad times, amounts to about 13 percent of cash flows while repayment of trade credit does not depend on whether firms have high or low cash flows. This likely reflects that trade credit is an expensive source of finance on the margin, with high penalty rates when payments are not made within the standard deadlines. In contrast, firms extend trade credit when their cash flows are high, but they tighten up when cash flows are low.[23] Hence, the average firm does not use trade credit to cover a shortfalls—the estimated cash flow sensitivity is less than 1 percent. This insensitivity, however, hides cross-sectional differences as our subsequent analysis will show.

An additional 19.62 percent of cash flow variations is covered by accrued taxes. The remaining items, interest paid, increased securities holdings, and paid-in equity are of negligible importance and we disregard these in further analysis. Clearly, small firms accumulate cash but not securities and, as expected, equity is not issued much by this type of firms. We also disregard accrued taxes in our analysis because we cannot observe actually paid taxes. Accrued taxes reflect accounting taxes and this variable has little information about firms' ability to delay tax payment as a source of finance. The estimated coefficients sum up to 104.22 despite the fact that we do not constrain the estimated cash flow sensitivities

[22]The estimated coefficients have all been multiplied by 100 to allow interpretation in percentage terms.

[23]Notice, that because we estimate sensitivity to firm's *idiosyncratic* cash flow, the cyclical extension of trade credit is not necessarily mirrored the use of trade credit, even if our sample contained the entire population of firms.

to add to one. In the data, the cash flow identity is far from satisfied when we consider the levels of the items, but the estimated cash sensitivity coefficients are close to add up to unity and we therefore do not display results that impose the adding-up constraint on the parameters.

It is obvious from our results that, on the margin, the average firm's financing mix is biased towards internal funds in that it draws mainly on internal funds (including dividends) to absorb cash flow fluctuations. As discussed in Section 2, the sensitivity to cash flow reflects how quickly the marginal cost of each source of funds changes as the firm draws on it. Our results therefore reveal that the average firm operates with a steeper marginal cost-curve for external than for internal funds.

Dividends may be an important source of income to the owners of the firms in our sample as the firms are closely held and owners' wealth not necessarily very diversified. If owners were highly diversified, one would expect the marginal utility of dividends to be roughly constant. Our results suggest that the shadow marginal values of dividends changes at a somewhat higher rate than the marginal value of cash but still at a considerably lower rate than that of external finance. Our results therefore are consistent with dividends being an important, but not the sole, source of income for owners.

We include lagged cash flows as a regressor to account for potential dynamic effects. Table 3 shows that the investment sensitivity to lagged cash flows is actually *larger* than the contemporaneous one, implying that investment reacts to cash flows with a lag. This likely reflects that investment takes time and if one focuses only on the current investment-cash flow sensitivity, a large part of investment is missed and the relation between cash flows and real investment may be severely underestimated. The lagged sensitivities of the remaining coefficients are small compared to the the contemporaneous estimates, except for loan repayments, where net borrowing increases in response to last year's EBITDA. Hence, higher cash flow today leads firms to repay loans faster but the subsequent year they repay less, likely in order to finance the increase in investment.

Table 3 has interesting predictions for the capital structure of firms. Firms with high levels of deposits drastically decrease cash savings. The point estimate implies that 100 dollars more in deposits is associated with 70 dollars less deposits in the following period. A 100 dollars of lagged deposits is also associated with significantly higher dividends (6 dollars), higher granting of trade credit (10 dollars), and more investment (14 dollars). Of course, these numbers should not be given a causal interpretation; in particular, firms will accumulate cash for the purpose of financing planned investment. Firm with high levels of outstanding bank loans (100 dollars higher) repay loans (50 dollars) and lower dividends (5 dollars), deposits (4 dollars), trade credit (4 dollars), and investments (3 dollars). Outstanding trade credit is paid off as soon as possible as indicated by the coefficient to the lagged level of 73 and leads to lower dividends, deposits, loan repayments, and investments in the 5-10 dollars range per 100 dollars outstanding. Accounts receivable is almost as strongly mean reverting as accounts payable and a high level of accounts receivable predicts higher investments, deposits, loans (marginally), and investments, but a lower extension of further trade credit.[24] An high capital stock level also affects the allocation of cash the following period with a 100 dollars more of physical capital predicting 26 dollars less of investment and around 5 dollars more of dividends, deposits, and extension trade credit, while associated with 5 dollars lower repayment of trade credit and 13 dollars less repayment of loans. The latter negative numbers may reflect that physical investment is associated with a larger scale of operations. Whatever the reason may be is not the focus here, but it is clear that the coefficients of the lagged stocks are large, albeit numerically less than one consistent with mean reversion, implying a large potential for left-out variable bias in the coefficients of interest if the lagged levels are not included.

[24] One might conjecture that a high level of accounts payable partly is associated with a temporarily high level of goods turnover, in which case accounts receivable might also be temporarily high.

5.2 Firms with high vs. low marginal costs of cash

We split the sample into firms with high versus low marginal value of cash using two measures that a priori would seem to proxy that value well: The level of deposit holdings and firms' dividend payments (both scaled by average firm size).

We first compute various descriptive statistics for these subgroups of firms, displayed in Table 4. Considering the splits by dividends and cash holdings, the difference between the high- and low-MVC groups are quite similar in the two splits. Firms with high cash holdings pay higher dividends and firms that pay higher dividends hold more cash. High-MVC firms also operate with higher levels of external finance, both in terms of bank loans and trade credit and high-MVC firms have more physical capital. They tend to grow less rapidly, although investment levels are about the same as low-MVC firms (higher in the split by cash holdings, lower in the split by dividends). Clearly high-MVC firms have been able to borrow and they may therefore face a high marginal cost of lending as sketched in Figure 1. However, it does not necessarily follow that, for a given level of lending, these firms face higher borrowing costs and we, therefore, avoid referring to those firms as "financially constrained."

Next, we run the cash flow sensitivity regressions for high- and low-MVC firms separately and we display the estimated coefficients to current and lagged cash flows in Table 5. (Lagged levels are included in the regressions but the estimated coefficients not displayed.) The results reveal strong differences in financing choices between high- and low-MVC firms. Splitting by average cash holdings, the estimated cash flow sensitivities in Table 5 show that high-MVC firms pay out (about) 12 dollars in dividends (for average current cash flows 100 dollars above average) while low-MVC firm pay out 28 dollars in dividends consistent with the argument that cash has lower value within the firm. Investments are more cash-flow sensitive for high-MVC firms with significance at the 5 percent level. High-MVC firms draw almost 6 times as much on external (loans and trade-credit) than internal finance, whereas low-MVC firms draw 35-times more on internal finance.[25] Considering the ratio of bank finance to deposits saved, the ratio is five in the case of high-MVC banks, and 0.12 in the case of low-MVC firm; i.e., the latter uses internal funds about 8 times more. Splitting by dividend-payments, the picture is very similar although high-MVC firms tend to draw more on deposits and less on bank finance compared to the cash holdings-split and investment now is more cash-flow sensitive for the low-MVC firms.[26]

Generally, we find that firms with low-MVC operate with a financing mix that relies heavily on internal funds on the margin. High-MVC firms, in contrast, operate with a marginal financing mix that relies more on external funding (esp. bank loans but also trade credit). This difference reveals differences in the marginal cost curves of each financing source for the firms. Accumulated cash is more valuable for a high-MVC firm on the margin, therefore, it uses only little cash to make up for a cash flow shortfall—if the firms buffer-stock of cash is low, it is associated with large costs to draw it down considerably: It may affect future investment adversely, or the risk of financial distress may increase. The marginal cost curve for bank loans is relatively flatter for high-MVC firms, therefore it makes up for a cash flow shortfall by borrowing more. For low-MVC firms, the intuition is the reverse: They may draw down their cash reserves aggressively without affecting the value of the firm much; i.e., the marginal value of cash does not change much even with relatively large movements in cash holdings. The firm is situated on the flat segment of the marginal value of cash-curve.

This difference between firms is illustrated in Figure 1. The figure shows a high-MVC firm with marginal costs and marginal value of all sources and uses of money equalized at the level $\text{MVC}^{t}_{\text{H}}$. If the firm experiences a cash flow shortfall, it reacts by drawing a little on

[25] For high-MVC firms: (18.19+5.48)/4.03=5.87. For low-MVC firms: 44.24/(5.63-4.39)=35.68.

[26] Notice that the estimated cash flow sensitivity of dividend payments is not zero for the high-MVC group (with 0 dividends for the given year) in the dividend-split because we are estimating the covariation between *firm demeaned* EBITDA and dividends. A firm that pays zero dividends in one year will pay below its average level in that year and if this occurs in years where EBITDA is also below average, the cash flow sensitivity of dividends will be positive.

its deposits and increasing its borrowing by a larger amount until the marginal value of cash in the firm's new equilibrium occurs at the level MVC_H^{t+1}. For a a low-MVC firm operating at the level MVC_L^{t}, in the face of a cash flow shortfall, it draws down its cash reserves a lot and borrows only a little. The figure also shows the corresponding adjustments in investment. In general, the investment schedule may have a variety of shapes, we have drawn it as a smooth downward-shaping curve where the adjustments in investment are about of similar size for the low and the high-MVC firms in order to agree with our empirical results. As should be obvious from the figure, the differences between firms arise between the high-MVC firm operates on the steep segment of the MVC-curve, whereas the low-MVC firm operates on the flat segment.

Our finding that the cash flow sensitivity of cash is considerably larger for firms with large cash holdings and, therefore, a lower marginal value of cash, is extremely robust. It appears in all the regression specifications we use. A similar difference holds for the payment of dividends. Comparing to papers that study the cash flow sensitivity of cash, this regularity is in line with Riddick and Whited (2009) who argue that firms whose optimal level of cash balances is high, have more slack and can vary their balances more aggressively to counteract the effect of cash flow shocks. Our findings, however, are somewhat contrary to the intuition of the model of Almeida et al. (2004) in which the firms that value cash the most, which in their model is those with the tightest credit constraints, exhibit a higher cash flow sensitivity of cash. Our respective analyses differ in that they compare constrained and unconstrained firms, where unconstrained firms have an undetermined cash flow sensitivity of cash and they do not focus their analysis on the marginal value of cash. Although it is not discussed explicitly, one might be inclined to deduce from in Almeida et al. (2004) that a larger cash flow sensitivity of cash is associated with a higher valuation of cash (tighter constraints). Our results, however, suggest that the opposite is true. The different in results may be due to their sample of large firms with access to equity and corporate bonds market which our closely held firms can not access.

5.3 Transmission of bank shocks

So far, the estimated cash flow sensitivities tell us little about potential credit constraints that firms face. Credit constraints affect cash-flow sensitivities but the sentivities are also correlated with firms' investment opportunities, the stochastic process governing firms' cash flows, etc., and expectations of these. In other words, firms ease of access to credit is not an exogenous variable. We may, however, deduce the effect of credit constraints by examining how the cash flow sensitivities *change* with exogenous shocks to the supply of external finance. Because we have information about the banks from which each firm borrows we can examine how shocks to a firm's main bank affect the financing trade-offs made by the firm. In particular, we look at the reaction of firm's cash flow sensitivities in years where its main bank makes loan loss provisions that deviate from its average level of provisions. Specifically, our measure of the shock to bank j in year t is the difference between provisions made in year j and the bank's average provisions over the sample. Loan loss provisions increase banks' capital requirements making it harder for banks to expand their balance sheet by lending and they are therefore likely to respond to high provisions by reducing lending and/or increasing the costs of borrowing.[27]

We include in our previous regression specification terms where EBITDA is interacted with the measure of bank shocks, allowing for the shock to provisions to work over two years; that is, we include both a measure of provisions in year t and year $t-1$ which we interact in all combinations with EBITDA_t and EBITDA_{t-1}. We include these lags because investment, as shown, reacts to cash flows with a lag.

In Table 6, we show four sets of results: For high- and low-MVC firms, using the cash-holding split, and OLS-estimates in the top panel and IV-estimates in the bottom panel. In order to limit the number of regressors, we average some regressors, such that $\text{EBITDA}_{t/t-1} \equiv (\text{EBITDA}_t + \text{EBITDA}_{t-1})/2$, and (for provisions) $\text{Prov}_{t/t-1} \equiv (\text{Prov}_t + \text{Prov}_{t-1})/2$. The

[27]The costs of borrowing should be understood to include all terms of the loan, not just the interest rate. For example, costs will increase if the bank tightens covenants or collateral requirements.

averaging is done based on preliminary regressions and averaging is done for variables that exert an effect over two periods. The previously discussed results already revealed that, especially, investment adjusts to cash flow over two periods, for example, EBITDA_t and EBITDA_{t-1}. Preliminary regressions revealed that the cash flow sensitivity of loan repayments adjusts to loan loss provisions over two periods, which is the reason for focusing on the interaction variable $\text{EBITDA}_t \times \text{Prov}_{t/t-1}$. (Regressions with no averaging are displayed in Appendix A).

High bank loan-loss provisions leads to less net lending the following period: The coefficient to lagged provisions is 0.71 (OLS) and 1.26 (IV) for the high-MVC group—both significant at the 5 percent level while loan-loss provisions have no effect on the low-MVC group. The coefficient is significant in economic terms—the interpretation of the coefficient of 0.71 is as follows: A one percentage point increase in loan loss provisions (that is, a shock of size one), causes the average firm to increase its repayment of loans by 0.71 percent, that is, its outstanding volume of loans falls by almost one percentage point relative to total assets. The average high- firm's bank loans constitute 43 percent of its assets (Table 4), that is, a one percentage point bank shock prompts a reduction in the use of bank loans from the average level by 2 percent (from 43 percent to 42 percent). The average bank shock is 6 percent of bank's loan portfolio. Hence, the average bank shock directly reduces firm's use of bank loans by approximately 10 percentage points.

We also estimate a, more surprising, positive relation between current net lending and provisions—this holds also for the IV-estimations wherefore this is not due to reverse causality. Possibly this occurs because firms draw on lines of credit but we cannot verify this; however, such cash hoarding has been documented during the 2008 financial crisis by Ivashina and Scharfstein (2009). Firms do limit dividend pay-out at the same period as higher loan-loss provisions are observed at their respective main banks. Our regressions include time fixed effects which makes the result unaffected by nationwide credit contraction.

Turning to cash-flow sensitivities, Table 6 reveals that bank shocks affect the cash flow sensitivity of loan repayments and investment for high-MVC firms, whereas there is no effect for the low-MVC group of firms. It is possible that banks tighten standards relatively more for lenders with higher outstanding loans, on the other hand such firms may automatically be more affected by across-the-board tightenings. For high-MVC firms, the cash flow sensitivity of loans falls whereas the cash flow sensitivity of investment increases in response to bank shocks.

The coefficient on cash flows interacted with loan-loss provisions averaged over two years (EBITDA$_t$ $\times$ Prov$_{t/t-1}$) is –8.77 for the high-MVC group but –1.62 (and clearly insignificant) for the low-MVC firms. The economic interpretation of the coefficient of –8.77 i that if a bank makes loan loss provisions in the order of 1 percent of loans (averaged over the current and previous period) then the sensitivity of net repayments falls by 8.77 percentage points. That is, firms will draw 8.77 dollars less on loans out of a 100 dollar cash flow shortfall. This estimate is economically significant: Without the shock the firms' marginal financing mix (over period t-1 and t) is four, that is the firm employs four times more bank finance. After a shock of size one, that ratio falls to 1.6, that is, the use of bank finance is more than halved.[28] For an average size bank shock of six percentage points, the cash flow sensitivity of loan repayments actually turn negative, that is, firms repay loans in bad times (and borrow in good times).

The changes in cash flow sensitivities are significant at the five percent level and they are significantly different from the corresponding estimates in the low-MVC group at the one and five percent level in the IV regressions (although the difference is not quite significant at conventional levels in the OLS regressions). These results imply that following bank shocks, the cost of drawing on bank finance increases for high-MVC firms and, therefore, the cash flow sensitivity of loan repayments fall. That is, a cash flow shortfall is now financed less with bank loans than before. It is natural to expect that firms facing an increase in the cost of bank finance switches to other sources of finance, for example, internal funds. This,

[28] Approximately; with no shock, the ratio is 15.10/3.91 = 3.9. With a shock of size one, it changes to (15.10-8.77)/3.91 = 1.6, ignoring the small sensitivity changes estimated with respect to EBITDA$_{t-1}$.

however, is not what we observe in our sample—there is no effect of bank shocks on the cash flow sensitivity of cash. Rather, it is the firms' investment that gives. The correlation of investment with firms' (idiosyncratic) cash flow goes up and in this sense investment becomes more procyclical, in economic terms the sensitivity of investment to cash flows increases by 33 percent: With no shock, a cash flow shortfall of 100 dollars cuts investment by 20 dollars. With a shock of size one, investment is cut by 30 dollars, an increase of 33 percent.

The point estimate is around 10 for OLS with a similar interpretation as that for loans, except now investment contract more with cash flow shortfalls, and about 27 for IV—the IV-estimate is significant but less precisely estimated. Our interpretation is that loan shocks affect investment through firms' valuation of cash: The firms for which it is costly to use cash, have to adjust in real terms because it is too costly to draw down cash reserves further.[29]

Using the IV-specification of Table 6, we find that the marginal cost of trade credit, and to a lesser extent the marginal utility of dividends, increases in response to bank shocks (the estimated cash flow sensitivities fall) making firms more reluctant to draw on especially trade credit in bad times. One interpretation could be that in the face of uncertainty over future access to bank finance, firms prefer not to borrow from expensive non-bank sources fearing difficulties with repayment, alternatively trade credit may become more cyclical because the firms scale of operation have to follow cash flows more closely. These cash flow sensitivities are not significant in the OLS-estimation so we hesitate to stress those findings.

The second part of Table 6 presents OLS- and IV-regressions with the sample split according to whether the firm pays dividends in a given year. The results are in line with the cash holdings-split, albeit the differences between the high and low-MVC groups are less

[29]We present the "full" regression specification, without averaging, in the appendix, Table A-1. Those results clearly show that the effect of loan provisions on the cash flow sensitivity of loan repayments is spread out over two periods, as the coefficient on both $\text{EBITDA}_t \times \text{Prov}_t$ and $\text{EBITDA}_t \times \text{Prov}_{t-1}$ are negative. The two coefficients are jointly significant. For that reason, we prefer to average the effects and use the regressor $\text{EBITDA}_t \times \text{Prov}_{t/t-1}$ in the main tables.

significant. The results, however, clearly indicate that bank shocks affect both the cash flow sensitivity and the level of loan repayments/borrow and investment: Bank finance becomes more expensive so firms use it less, and as a result, investment gives. Overall, the results are very robust to the type of different sample split used.

5.4 Robustness

Last, we check that our results are robust to dynamic panel effects. The lagged levels of the main variables are included in our regressions and they are correlated with the error terms through the estimated firm fixed effects when the time dimension is small.

We therefore re-estimate the specifications in Table 6 using the Arellano-Bond Generalized Method of Moments (GMM) dynamic panel estimator.[30] The results (for our variables of interest) are presented in Table 7. They are quantitatively and qualitatively similar to those in Table 6—hence, our results do not appear to be significantly biased by the presence of dynamic panel effects.

6 Conclusion

We study the financial, real, and distributive trade-offs made by non-listed, closely-held, firms using Norwegian data. Our aim is to understand what determines the degree to which firms rely on internal or external finance, and to what extent firms are willing to trade off financial and real decisions. Our firms are heavily bank dependent, and by using data that link individual firms to their main bank lender, we examine how these trade-offs are affected by external bank loan shocks.

Firms' marginal value of cash (MVC) is a key determinant of firms' marginal financing choices and we show that the sensitivity of the components of the cash flow identity to firms' (idiosyncratic) cash flow contains information about how quickly the marginal cost of the

[30] The procedure is available for Stata as xtabond2, written by Roodman (2006).

different sources of finance changes as the firm draws on them. By comparing estimated cash flow sensitivities for firms with a high MVC to those of firms with a low MVC, we find substantial differences. High-MVC firms relies six-fold more on external (mostly bank) finance to absorb fluctuations in cash flow whereas low-MVC firms relies eight-fold more on internal finance (cash) than bank finance.

Low-MVC firms are not affected by shocks to their main bank but high-MVC firms switch away from bank finance, reflecting that bank finance becomes more expensive. High-MVC firms, however, do not substitute internal funding for bank loans in the face of bank loan shocks; rather, investment becomes more dependent on the firm's cash flows.

Our results point to the importance of the marginal value of cash for understanding firm decision-making and suggest that the mechanism through which external finance constraints are transferred to the real economy operates via firms' marginal value of cash.

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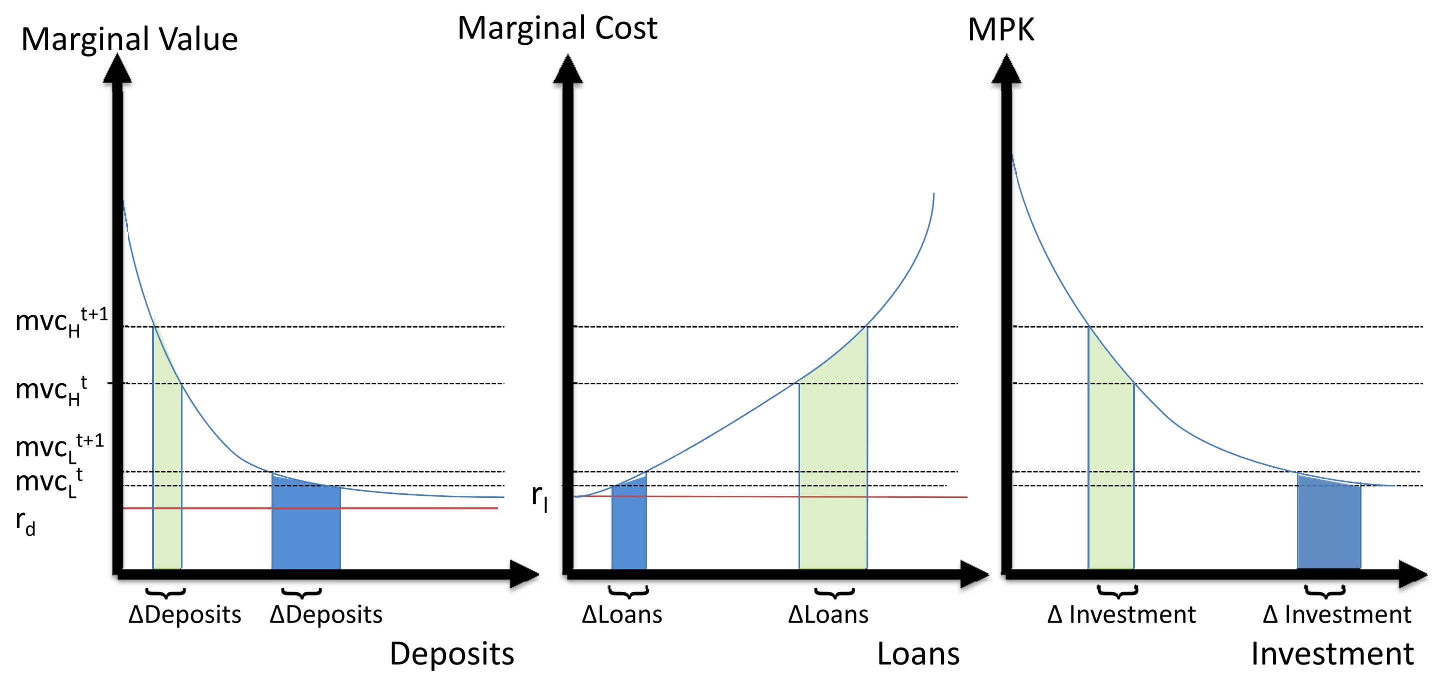
Figure 1: Effect of a Cash Flow Shortfall on High-MVC vs. Low-MVC Firms



The figure illustrates the effect of a cash flow shortfall on the firm's demand for cash balances (deposits), bank loans, and investment as estimated in Table 5. The initial marginal shadow value of cash for high-MVC firms resp. low-MVC firms is mvc_H^t resp. mvc_L^t. A cash shortfall causes the marginal value to increase to mvc_H^{t+1} resp. mvc_L^{t+1}, as firms adjust their deposit holdings, bank borrowing and investment accordingly. High-MVC firms that operate on the steep segment of the MV-curve adjust deposits only a little (light/green shaded area), whereas low-MVC firm, operating on a flatter segment, draw down their cash balances to a larger extent (dark/blue shaded area). Similarly, the adjustment in bank loans is larger for high-MVC firms and smaller for low-MVC firms.

Table 1:
Descriptive Statistics: Firm Characteristics

	Regression sample		
Firm-year obs.		119,682	
Firm obs.		21,206	
Percent	Mean	Median	Std
Firm age (years)	11	7	2
Largest Owner Share	65	62	6
Turnover (Sales) (thousand kr.)	11,406	6,226	2,616
Total Assets (thousand kr.)	5,520	3,002	1,381
Fixed Assets	37	31	13
Investment in Fixed Assets	7	4	10
Gross Investment	9	7	16
Deposits	14	9	8
Accounts Receivable	20	16	9
Equity	16	17	11
Liabilities	84	84	10
Bank Debt	28	22	12
Accounts Payable	21	16	9
EBITDA	5	4	11
ROA	6	6	10
Dividend	4	2	5
Dividend-Payout	39	24	48
Dividend/EBITDA	27	10	59

The table shows descriptive statistics of the firms in the regression sample. All values, unless indicated otherwise, are standardized by average firm size over the period 1995-2005, reported in percent, and winsorized at the 1 and 99 percent level. Total assets and turnover are reported in thousands of Norwegian Kroner (NOK). Firm age is the number of years since the firm's incorporation. Largest owner is the ownership percent of the largest owner. Total Assets is book value of assets. Turnover (Sales) is total sales. Deposits is the balance outstanding on accounts in deposit-giving institutions. Equity is book value of equity. Liabilities is the sum of nonfinancial and financial debt. Bank Debt is loans from commercial and saving banks. Accounts Payable is short-term debt to creditors (trade credit received). Accounts Receivable is short-term credit given to customers (trade credit extended). EBITDA is earnings before interest, taxes, depreciation, and amortization. ROA is the return of total assets. Fixed Assets is the book value of fixed assets. Investment in Fixed Assets the change in fixed assets. Gross Investment is the change in fixed assets and inventories plus depreciation. Dividend is the value of dividends to be paid to shareholders. Dividend Payout is dividend-payments scaled by net income. Dividend/EBITDA is dividend-payments scaled by EBITDA.

Table 2:

Descriptive Statistics: Norwegian Sample Compared to the 2003 Survey of Small Business Finance

	Regression sample			SSBF S-corporations			SSBF C-corporations		
Firm-year obs.		119,682			1,472			896	
Firm obs.		21,206			1,472			896	
	Mean	Median	Std	Mean	Median	Std	Mean	Median	Std
Total Assets	737	401	184	2,510	340	5,800	3,700	1,060	8,070
Turnover (Sales)	1,522	831	349	5,850	1,070	12,500	8,440	2,870	14,200
Deposits	97	39	56	220	30	640	350	70	770
Equity	144	62	67	1,050	100	2,790	1,450	330	3,310
Liabilities-to-Assets Ratio	84	84	10	40	39	28	40	36	30
Total Debt	576	334	163	1,160	140	2,920	1,640	360	3,630
Bank Debt	224	85	101	480	10	1,520	560	30	1,360
Account Payable	164	63	74	280	10	750	500	70	1,150
Firm Age	11	7	2	16	13	11	21	20	13
Largest Owner Share	65	62	6	72	70	27	65	53	28

The table compares key descriptive statistics from the regression sample to the sample of S-corporations and C-corporations from the 2003 Survey of Small Business Finances (SSBF) conducted by the Federal Reserve. All values are reported in thousands US dollars unless indicated otherwise and winsorized at the 1 and 99 percent level. Conversion of Norwegian kroner to USD is performed using the average NOK/USD-exchange rate over the period 1995-2005. Total Assets is book value of assets. Turnover (Sales) is total sales. Deposits is the balance outstanding on accounts in deposit-giving institutions. Equity is firm book value of equity. Liabilities is the sum of nonfinancial and financial debt. Bank Debt is loans from commercial and saving banks. Accounts Payable is short-term debt to creditors (trade credit received). Firm age is the number of years since the firm's incorporation. Largest owner is the ownership percent of the largest owner.

Table 3:
Decomposition of Cash Flow Identity: Sensitivity to Cash Flow and Effect of Stock Levels

	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Extension of Trade Credit (net)	Invest-ments (gross)	Accrued Taxes	Interest Paid (net)	Increase in stock of Securi-ties	Reduction in Paid-in Equity
EBITDA_t	19.92	24.09	12.69	0.39	21.30	6.18	19.62	-0.83	0.24	0.62
	(0.26)	(0.35)	(0.43)	(0.37)	(0.43)	(0.60)	(0.14)	(0.03)	(0.04)	(0.11)
EBITDA_{t-1}	0.82	-0.22	-4.17	-0.90	-0.77	10.67	0.75	-0.29	-0.13	0.45
	(0.21)	(0.31)	(0.46)	(0.38)	(0.40)	(0.58)	(0.10)	(0.03)	(0.04)	(0.13)
Outstanding Deposits_{t-1}	5.93	-69.84	0.39	-0.35	10.31	14.37	2.32	-1.58	0.57	-0.49
	(0.31)	(0.62)	(0.57)	(0.48)	(0.55)	(0.78)	(0.11)	(0.05)	(0.07)	(0.17)
Outstanding Loans_{t-1}	-4.86	-3.72	51.53	1.06	-3.56	-2.92	-1.78	4.54	-0.27	-0.76
	(0.17)	(0.29)	(0.56)	(0.36)	(0.37)	(0.64)	(0.09)	(0.05)	(0.05)	(0.13)
Accounts Payable_{t-1}	-3.65	-7.18	-7.47	72.60	-0.20	-8.12	-1.05	0.98	-0.25	-1.10
	(0.23)	(0.39)	(0.60)	(0.71)	(0.57)	(0.76)	(0.11)	(0.05)	(0.05)	(0.17)
Accounts Receivable_{t-1}	4.46	11.16	1.08	-6.16	-64.64	14.81	1.80	-0.15	0.22	-0.37
	(0.23)	(0.37)	(0.55)	(0.53)	(0.67)	(0.67)	(0.10)	(0.05)	(0.04)	(0.15)
Capital Stock_{t-1}	4.76	4.45	-12.61	-4.41	6.75	-26.35	2.12	0.93	0.20	0.62
	(0.15)	(0.25)	(0.45)	(0.32)	(0.32)	(0.57)	(0.08)	(0.04)	(0.04)	(0.12)
R-squared	0.26	0.39	0.22	0.32	0.34	0.12	0.57	0.49	0.00	0.02
No. Firms	23,057	23,057	23,057	23,057	23,057	23,057	23,057	23,057	23,057	23,057
No. Obs.	119,682	119,682	119,682	119,682	119,682	119,682	119,682	119,682	119,682	119,682

The table shows the coefficients from a panel OLS regression of the variable indicated in the column heading on the variables in column one. The regressions are performed on the same sample of firms in each row. EBITDA is earnings before interest, taxes, depreciation and amortization. Loans and deposit holdings by firms are outstanding balances on accounts held in deposit-taking (loan-giving) financial institutions. Repayment of Loans (net) is the net reduction in outstanding (bank and non-bank) loans, i.e. the net cash outflow due to repayment of loans. Repayment of Trade Credit (net) is the decrease in accounts payable. Extension of Trade Credit (net) is the increase in accounts receivable. Gross Investment is net (after depreciation) investment in fixed assets and inventory plus depreciation. Accrued Taxes is accounting taxes in a given year. Interest Paid (net) is interest expenses minus interest income, i.e. the net cash outflow due to debt service. Reduction in Paid-in Equity is the net reduction in share capital, i.e. the cash outflow due to write-downs. Capital Stock is the stock of fixed assets and inventory. Regressions include firms from all industries except financial and real estate-related services. All regressions are run with firm and time fixed effects. No. Firms is the number of unique firms in the regression and No. Obs. denotes the number of firm-year observations. All variables are annual, measured in millions Norwegian kroner, standardized by firm average size, and winsorized at the 1st and 99th percentiles. Firm clustered standard errors are reported in parentheses. Sample: 1995–2005.

Table 4:

Descriptive Statistics by Subgroup of Firms: Split by High-MVC vs. Low-MVC Firms

percent	Firm-Year Obs. in Group	Total Assets (mill.)	Dividend Ratio	Deposit Ratio	Loan Ratio	Trade Credit Ratio	Capital Stock Ratio	Invest-ment Ratio	Sales Growth Ratio
AVERAGE CASH HOLDINGS									
High-MVC	32,522	6.27***	2.03***	2.78***	43.1***	21.4***	75.6***	8.42*	2.16***
Low-MVC	25,896	4.83	7.59	28.6	24.1	17.3	53.3	8.14	3.64
DIVIDENDS									
High-MVC	39,983	5.31***	0.00***	8.62***	41.6***	21.5***	69.7***	8.48***	2.50***
Low-MVC	63,504	5.77	13.1	18.7	25.0	16.8	63.0	8.83	3.35

The table shows the average value of key variables by subgroup according to two sample splits performed on the regression sample in Table 3. In the split by average cash holdings, firms are split into the High-MVC (Low-MVC) group according to their average of cash holdings, scaled by average firm size, over the sample. In the split by dividends, firm-year observations are split into the High-MVC (Low-MVC) group according to dividends scaled by average firm size. The High-MVC (Low-MVC) group is defined as the upper (lower) 30% percentile of the distribution. Firm-Year Observations in Group indicates the number of firm-year observations in each subgroup. Total Assets is measured in million Norwegian 1998-kroner. Dividend Ratio is the value of dividends paid out scaled by average firm size. Deposit Ratio is the outstanding amount of deposits scaled by average firm size. Loan Ratio is the outstanding amount of loans scaled by average firm size. Trade Credit Ratio is accounts payable scaled by average firm size. Capital Stock Ratio is the value of fixed assets and inventory scaled by average firm size. Investment Ratio is the change in fixed assets and inventory scaled by average firm size. Sales Growth Ratio is change in the log of sales scaled by average firm size. Sample: 1995–2005. ***, **, and * indicate significant difference at the 1, 5, and 10 percent level respectively in a two-sided t-test with unequal variances of difference between the group means.

Table 5:

Sensitivity to Current and Lagged Cash Flow:
Split by High-MVC vs. Low-MVC Firms

	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)
	High-MVC Firms					Low-MVC Firms				
AVERAGE CASH HOLDINGS										
$EBITDA_t$	11.74	4.03***	18.19***	5.48***	8.75**	28.48	44.24***	5.63***	-4.39***	4.71***
	(0.43)	(0.20)	(0.97)	(0.77)	(1.36)	(0.51)	(0.72)	(0.63)	(0.62)	(0.95)
$EBITDA_{t-1}$	1.75***	-0.30	-6.12***	-1.19	12.59***	-0.22***	-1.15	-2.16***	-1.75	6.22***
	(0.27)	(0.20)	(0.94)	(0.77)	(1.16)	(0.48)	(0.80)	(0.75)	(0.64)	(0.97)
DIVIDENDS										
$EBITDA_t$	4.36***	17.20***	13.68***	3.29***	4.85***	34.32***	36.19***	5.48***	-6.24***	11.25***
	(0.12)	(0.38)	(0.57)	(0.48)	(0.77)	(0.47)	(0.67)	(0.63)	(0.56)	(0.97)
$EBITDA_{t-1}$	0.27**	0.57***	-4.20	-1.28**	10.77	-0.98**	-2.88***	-3.85	0.40**	10.12
	(0.11)	(0.33)	(0.56)	(0.48)	(0.71)	(0.51)	(0.70)	(0.72)	(0.61)	(1.00)

The table shows the coefficients from panel OLS regressions of the column headings variables on the variables reported in Table 3 according to two sample splits. For brevity, the estimated coefficients on lagged stock levels are omitted from the table. In the split by average cash holdings, firms are split into the High-MVC (Low-MVC) group according to their average cash holdings over the sample. In the split by dividends, firm-year observations are split into the High-MVC (Low-MVC) group according to dividends scaled by average firm size. The High-MVC (Low-MVC) group is defined as the upper (lower) 30% percentile of the distribution. Sample period is 1995-2005. The number of observations in each regression is displayed in Table 4. Firm clustered standard errors are reported in parentheses. ***, **, and * indicate significant difference between High-MVC and Low-MVC group coefficients at the 1, 5, and 10 percent level in a two-sided Wald test.

Table 6:
Effect of Bank Shocks on Cash Flow Sensitivities for Firms with High vs. Low Marginal Value of Cash

	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)
	High-MVC Firms					Low-MVC Firms				
AVERAGE CASH HOLDINGS (OLS)										
$EBITDA_{t/t-1}$	**14.48*****	**3.91*****	**15.10*****	**5.62*****	**20.97*****	**33.19*****	**51.58*****	**7.13*****	**−6.51*****	**10.02*****
	(0.30)	(0.22)	(1.00)	(0.75)	(1.22)	(0.55)	(0.91)	(0.85)	(0.70)	(1.10)
$EBITDA_t \cdot Prov_{t/t-1}$	-0.92	0.24	**−8.77***	-1.97	**10.75**	0.80	-3.46	-1.62*	0.73	2.91
	(0.72)	(0.54)	(2.39)	(1.80)	(2.93)	(1.23)	(2.04)	(1.91)	(1.58)	(2.47)
$Prov_t$	**−0.12**	0.01	**−0.55***	-0.06	**0.54**	-0.19	-0.23	0.05*	0.02	0.08
	(0.06)	(0.05)	(0.22)	(0.16)	(0.26)	(0.13)	(0.22)	(0.20)	(0.17)	(0.26)
$Prov_{t-1}$	0.09	-0.02	**0.71****	0.13	**−0.61**	0.13	0.06	0.12**	0.01	-0.16
	(0.06)	(0.05)	(0.21)	(0.16)	(0.26)	(0.13)	(0.21)	(0.20)	(0.16)	(0.26)
$EBITDA_{t-1} \cdot Prov_{t-1}$	-0.49	-0.33	0.67	-1.41	-0.69†	1.01	-0.66	-2.48	-0.35	**5.98**†
	(0.64)	(0.48)	(2.15)	(1.62)	(2.64)	(1.14)	(1.89)	(1.77)	(1.46)	(2.28)
AVERAGE CASH HOLDINGS (IV)										
$EBITDA_{t/t-1}$	**13.13*****	**3.94*****	**16.21*****	**6.72*****	**18.45*****	**31.71*****	**51.17*****	**8.17*****	**−7.11*****	**9.43*****
	(0.63)	(0.35)	(1.81)	(1.44)	(2.32)	(1.01)	(1.56)	(1.46)	(1.23)	(2.04)
$EBITDA_t \cdot Prov_{t/t-1}$	**−6.58**	1.84*	**−21.76*****	**−13.31****	**27.16****	-3.58	-7.53*	-2.48***	-2.01**	5.25**
	(2.69)	(1.13)	(6.54)	(4.39)	(8.25)	(2.96)	(4.86)	(3.50)	(3.76)	(5.25)
$Prov_t$	**−0.24***	-0.01	**−1.26**	0.21	0.42	0.22*	-0.36	-0.56	0.08	0.67
	(0.11)	(0.09)	(0.44)	(0.31)	(0.52)	(0.25)	(0.42)	(0.37)	(0.32)	(0.51)
$Prov_{t-1}$	0.08	0.05	**1.26****	0.15	-0.71	-0.06	0.27	-0.08**	0.01	-0.03
	(0.15)	(0.10)	(0.46)	(0.35)	(0.52)	(0.25)	(0.40)	(0.33)	(0.31)	(0.43)
$EBITDA_{t-1} \cdot Prov_{t-1}$	-2.26**	1.14	-1.53	-2.41	5.80	4.70**	4.36	-0.81	-2.00	3.05
	(1.53)	(1.05)	(5.63)	(3.71)	(6.67)	(2.99)	(4.23)	(3.06)	(3.07)	(4.35)

The table shows the coefficients from regressions of the column headings variables on the variables reported in Equation (6) according to a sample split by average cash holdings. For brevity, the estimated coefficients on lagged stock levels are omitted from the table. The table reports results from a panel OLS and an instrumental variables panel OLS regression, respectively, where firms are split into the High-MVC (Low-MVC) group according to their average cash holdings over the sample. The High-MVC (Low-MVC) group is defined as the upper (lower) 30% percentile of the distribution. Sample period is 1995-2005. The number of firm-year observations in the High-MVC group OLS, resp. IV are 32,522 and 21,023. The number of firm-year observations in the Low-MVC group OLS, resp. IV are 25,896 and 16,765. Estimated coefficients in bold script indicates significance at the 5 percent level. Firm clustered standard errors are reported in parentheses. ***, **, and * indicate significant difference between High-MVC and Low-MVC group coefficients at the 1, 5, and 10 percent level in a two-sided Wald test.

Table 6—*continued*

	High-MVC Firms					Low-MVC Firms				
	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)
DIVIDENDS (OLS)										
$EBITDA_{t/t-1}$	**4.98** ***	**18.41*****	**12.57*****	**2.80*****	**15.30*****	**38.42*****	**38.11*****	**5.11*****	**−6.52*****	**0.90*****
	(0.17)	(0.53)	(0.87)	(0.73)	(1.13)	(0.77)	(1.07)	(1.03)	(0.84)	(1.50)
$EBITDA_t \cdot Prov_{t/t-1}$	**−0.77**	-2.48	**−3.97**†	-2.03	**8.68****	-0.81	-0.99	0.14†	0.53	-0.21**
	(0.35)	(1.25)	(1.97)	(1.54)	(2.59)	(1.95)	(2.70)	(2.20)	(1.91)	(3.48)
$Prov_t$	0.00	-0.04	**−0.39**	-0.21**	**0.60**	0.00	0.01	-0.17	0.16**	0.25
	(0.03)	(0.08)	(0.17)	(0.12)	(0.21)	(0.13)	(0.17)	(0.19)	(0.14)	(0.26)
$Prov_{t-1}$	**0.06**	**−0.28**	**0.61****	0.21	**−0.45**	0.13	-0.04	0.13**	0.00	-0.20
	(0.03)	(0.09)	(0.17)	(0.12)	(0.20)	(0.13)	(0.15)	(0.18)	(0.14)	(0.24)
$EBITDA_{t-1} \cdot Prov_{t-1}$	0.33	-0.96	1.79	0.18	0.88	-0.71	-1.14	1.59	0.14	-2.08
	(0.28)	(0.97)	(1.76)	(1.26)	(2.12)	(1.49)	(1.94)	(1.91)	(1.57)	(2.80)
DIVIDENDS (IV)										
$EBITDA_{t/t-1}$	**4.21*****	**18.71*****	**12.83*****	**2.96*****	**14.83****	**38.62*****	**39.47*****	**5.46*****	**−7.13*****	**19.33****
	(0.20)	(0.65)	(1.07)	(0.89)	(1.38)	(0.96)	(1.32)	(1.34)	(1.02)	(1.88)
$EBITDA_t \cdot Prov_{t/t-1}$	**−1.69**	-1.56	**−6.00**	-5.55	**12.39**†	-5.77	-3.50	-2.93	-4.51	1.13†
	(0.61)	(2.17)	(3.45)	(2.69)	(4.57)	(3.46)	(4.68)	(4.06)	(3.31)	(6.15)
$Prov_t$	-0.03	0.08	**−0.84**	-0.22	0.74	0.12	-0.22	-0.64	0.24	0.48
	(0.05)	(0.16)	(0.32)	(0.24)	(0.39)	(0.24)	(0.31)	(0.36)	(0.25)	(0.46)
$Prov_{t-1}$	0.03	-0.17	**1.05**	0.23	-0.64	0.17	0.23	0.49	-0.13	-0.28
	(0.06)	(0.17)	(0.31)	(0.25)	(0.37)	(0.23)	(0.30)	(0.33)	(0.25)	(0.43)
$EBITDA_{t-1} \cdot Prov_{t-1}$	0.08*	-0.95**	0.71	2.79	2.79	4.53*	**7.02****	-0.71	2.08	-7.15
	(0.54)	(1.85)	(3.14)	(2.50)	(3.99)	(2.65)	(3.47)	(3.60)	(2.83)	(5.04)

The table shows the coefficients from regressions of the column headings variables on the variables reported in Equation (6) according to a sample split by dividend-payments. For brevity, the estimated coefficients on lagged stock levels are omitted from the table. The table reports results from a panel OLS and an instrumental variables-panel OLS regression, respectively, where firm-year observations are split into the High-MVC (Low-MVC) group according to the magnitude of dividends scaled by average firm size paid by firm i in year t. The High-MVC (Low-MVC) group is defined as the upper (lower) 30% percentile of the distribution. Sample period is 1995-2005. The number of firm-year observations in the High-MVC group OLS, resp. IV are 63,504 and 41,837. The number of firm-year observations in the Low-MVC group OLS, resp. IV are 30,983 and 19,582. Estimated coefficients in bold script indicates significance at the 5 percent level. Firm clustered standard errors are reported in parentheses. ***, **, and * indicate significant difference between High-MVC and Low-MVC group coefficients at the 1, 5, and 10 percent level in a two-sided Wald test.

Table 7:
Effect of Bank Shocks on Cash Flow Sensitivities; Arellano-Bond Dynamic Panel GMM Estimator

	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)
	High-MVC Firms					Low-MVC Firms				
AVERAGE CASH HOLDINGS										
$\text{EBITDA}_{t/t-1}$	**13.15*****	**4.32*****	**13.77*****	**5.38*****	**25.66*****	**33.28*****	**50.37*****	**8.55*****	**−6.02*****	**13.11*****
	(0.46)	(0.30)	(1.46)	(1.11)	(1.80)	(0.92)	(1.39)	(1.27)	(1.08)	(1.69)
$\text{EBITDA}_t \cdot \text{Prov}_{t/t-1}$	-1.28†	0.25	**−8.33****	-2.32	**12.90***	1.55†	-1.08	-0.41**	0.14	4.10*
	(0.90)	(0.59)	(2.88)	(2.20)	(3.56)	(1.69)	(2.55)	(2.32)	(1.98)	(3.09)
Prov_t	-0.10	0.02	-0.01	-0.15	0.65	-0.24	-0.32	-0.10	-0.01	0.47
	(0.09)	(0.06)	(0.28)	(0.21)	(0.35)	(0.20)	(0.30)	(0.27)	(0.23)	(0.36)
Prov_{t-1}	0.14	-0.04	**0.66****	-0.02	-0.53	-0.17	-0.25	-0.10**	-0.31	-0.01
	(0.09)	(0.06)	(0.28)	(0.22)	(0.35)	(0.19)	(0.29)	(0.26)	(0.23)	(0.35)
$\text{EBITDA}_{t-1} \cdot \text{Prov}_{t-1}$	0.08	**−1.08****	0.81	-0.75	-1.12*	0.89	4.30**	-1.97	**−3.67**	**6.90***
	(0.79)	(0.52)	(2.53)	(1.93)	(3.13)	(1.47)	(2.22)	(2.03)	(1.73)	(2.70)
DIVIDENDS										
$\text{EBITDA}_{t/t-1}$	**5.71*****	**17.87*****	**14.04*****	**2.09*****	**20.54**	**42.76*****	**38.73*****	**7.68*****	**−5.93*****	**18.49**
	(0.32)	(0.49)	(0.97)	(0.75)	(1.21)	(0.93)	(1.16)	(1.34)	(1.06)	(1.74)
$\text{EBITDA}_t \cdot \text{Prov}_{t/t-1}$	-1.16	-0.85	**−5.23**†	-2.25	**9.91*****	0.77	0.69	-1.03†	1.68	0.13***
	(0.60)	(0.91)	(1.81)	(1.39)	(2.26)	(1.54)	(1.93)	(2.22)	(1.75)	(2.89)
Prov_t	0.05	-0.01	0.05*	**0.32****	**0.62**	-0.15	-0.24	**−0.53***	0.23**	0.55
	(0.07)	(0.11)	(0.21)	(0.16)	(0.26)	(0.16)	(0.20)	(0.22)	(0.18)	(0.29)
Prov_{t-1}	0.11	-0.16	**0.55***	0.13**	**−0.58**	0.10	-0.34	-0.03*	0.25**	-0.29
	(0.07)	(0.10)	(0.20)	(0.15)	(0.25)	(0.17)	(0.21)	(0.24)	(0.19)	(0.32)
$\text{EBITDA}_{t-1} \cdot \text{Prov}_{t-1}$	-0.65*	-0.01	1.65	-1.11†	0.87	1.98*	1.59	-1.50	-0.47†	-0.64
	(0.52)	(0.80)	(1.59)	(1.23)	(1.99)	(1.37)	(1.71)	(1.96)	(1.55)	(2.56)

The table shows the coefficients from the regressions reported in Table 6, estimated with the Arellano-Bond Dynamic Panel GMM estimator.

Table A-1:
Effect of Bank Loan Loss Provisions on Cash Flow Sensitivities: Full Specification

	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)	Dividend Paid to Owners	Increase in Deposits	Repayment of Loans (net)	Repayment of Trade Credit (net)	Invest-ments (gross)
	High-MVC Firms					Low-MVC Firms				
AVERAGE CASH HOLDINGS (OLS)										
$EBITDA_t$	**11.72*****	**3.89*****	**18.85*****	**5.83*****	**8.53****	**27.69*****	**44.01*****	**7.13*****	**−4.58*****	**4.74****
	(0.44)	(0.21)	(1.00)	(0.81)	(1.41)	(0.57)	(0.82)	(0.73)	(0.70)	(1.07)
$EBITDA_{t-1}$	**1.77*****	**−0.42**†	**−6.30*****	-0.87	**12.88*****	-0.19***	-1.82†	-1.83***	-1.24	**5.41*****
	(0.28)	(0.21)	(0.97)	(0.79)	(1.19)	(0.52)	(0.92)	(0.88)	(0.72)	(1.11)
$EBITDA_t \cdot Prov_t$	-1.96	0.03**	-3.14	-2.22	5.37	0.67	-4.76**	-1.44	1.23	0.42
	(1.13)	(0.60)	(3.08)	(1.99)	(3.98)	(1.48)	(2.38)	(1.85)	(1.90)	(2.79)
$EBITDA_t \cdot Prov_{t-1}$	-0.02	0.20	-5.59†	0.18	5.39	0.13	1.01	-0.24†	-0.42	2.40
	(1.16)	(0.59)	(3.03)	(1.98)	(4.02)	(1.42)	(2.39)	(1.92)	(1.80)	(2.75)
$EBITDA_{t-1} \cdot Prov_{t-1}$	-0.50	-0.25	1.49	-1.54	-0.78	1.82	1.21	-2.38	-0.24	5.74
	(0.95)	(0.48)	(3.10)	(1.97)	(3.74)	(1.47)	(2.35)	(1.89)	(1.85)	(2.68)
$Prov_t$	-0.11	0.01	**−0.52***	-0.05	0.53	-0.11	-0.08	0.08*	0.01	0.08
	(0.06)	(0.05)	(0.24)	(0.16)	(0.29)	(0.13)	(0.21)	(0.20)	(0.17)	(0.26)
$Prov_{t-1}$	0.08	-0.03	**0.67***	0.12	**−0.60**	0.09	-0.01	0.10*	0.02	-0.16
	(0.08)	(0.05)	(0.23)	(0.17)	(0.28)	(0.13)	(0.21)	(0.19)	(0.17)	(0.25)

The table shows the coefficients from panel regressions of the column headings variables on the variables reported in Equation (6) according to a sample split by average cash holdings. For brevity, the estimated coefficients on lagged stock levels are omitted from the table. The table reports results from a panel OLS regression where firms are split into the High-MVC (Low-MVC) group according to their average cash holdings over the sample. The High-MVC (Low-MVC) group is defined as the upper (lower) 30% percentile of the distribution. Sample period is 1995-2005. The number of firm-year observations in the High-MVC, resp., Low-MVC group are 32,522 and 25,896. Estimated coefficients in bold script indicates significance at the 5 percent level. Firm clustered standard errors are reported in parentheses. ***, **, and * indicate significant difference between High-MVC and Low-MVC group coefficients at the 1, 5, and 10 percent level in a two-sided Wald test.

Appendix B

Deriving the cash flow sensitivities

From the identities

$$s'' \Delta \text{DEP}_t = \frac{2 \mathrm{d} r^b}{\mathrm{dL}} \Delta \mathrm{L}_t = f''_t \mathrm{I}_t = \frac{U''_t}{\beta U'_{t+1}} \Delta \text{DIV}_t \ ,$$

we relate the cash flow components to dividends. This delivers an intuitive interpretation although one could relate to, say, deposits in a similar fashion in the case of zero dividends. We have $\beta U'_{t+1} s'' \Delta \text{DEP}_t = U''_t \Delta \text{DIV}_t$. The right-hand side is the change in marginal utility of dividends associated with a change in dividends of ΔDIV while the left-hand side is the change in marginal value of cash associated with a change in deposits of ΔDEP_t—this change is proportional to s'' which captures how fast the marginal value of cash changes with deposit balances, and, because deposits transfers fund to the next period, it is further proportional to the discounted marginal utility of dividends in period $t+1$. The marginal utility of dividends will be equal to the marginal value of cash before the allocation of cash flows and the marginal utility will equal MVC also after allocation of cash flows, which is why the change in the marginal values need to be equal. U'' is negative and so is s'', implying that dividends and deposits will both increase or both decrease as illustrated in Figure 1. For loans $2\beta U'_{t+1} r^{b'} \Delta \mathrm{L}_t = U''_t \Delta \text{DIV}$, implying that the change in marginal utility will equal two times the change in borrowing rate times the change in the stock of loans times $\beta U'_{t+1}$.[31] The borrowing rate will increase with borrowing, so $r^{b'} > 0$, and net lending will change in the opposite direction of dividends as can also be seen from Figure 1. Finally, investment (the change in the physical capital stock) will satisfy $\beta U'_{t+1} f'' I_t = U''_t \Delta \text{DIV}_t$, with a similar interpretation. Because the marginal product of capital, f', is declining, f'' is negative and the change in the capital stock is of the same sign as the change in dividends.

[31] The factor 2 occurs because there is an effect on the marginal borrowing rate and because the stock of loans change. A similar pattern would occur for deposits if there was a change in the deposit rate but this is not our preferred interpretation of the s function.

Dividends, deposits, loans, and investments sum (in our approximation) to total cash flows ("CF") and expressing all components in terms of dividends using the relations just discussed, we obtain

$$\Delta\mathrm{DIV}_t + \frac{U''_t}{\beta U'_{t+1} s''}\Delta\mathrm{DIV} + \frac{U''_t}{2\beta U'_{t+1}\, r^{b\prime}}\Delta\mathrm{DIV} + \frac{U''_t}{\beta U'_{t+1} f''}\Delta\mathrm{DIV}_t = \mathrm{CF}_t \ ,$$

from which

$$\Delta\mathrm{DIV}_t = \frac{1}{1 + U''_t/(\beta U'_{t+1} s'') + U''_t/(\beta U'_{t+1} 2r^{b\prime}) + U''_t/(\beta U'_{t+1} f'')}\,\mathrm{CF}_t \,.$$

We observe that the change in dividends paid out is inversely proportional to the second derivative of the utility function relative to the second derivatives of the costs or benefits of other sources and uses of funds. This is intuitive, because dividends will increase or decrease simultaneously with deposits, loans, and capital while keeping marginal utility equal to marginal product and interest rates. The faster marginal utility changes relative to those interest rates and marginal product, the less dividends will change while maintaining the identities. For deposits we obtain

$$\Delta\mathrm{DEP}_t = \frac{1}{(\beta U'_{t+1}\, s''/U''_t + 1 + s''/2r^{b\prime} + s''/f'')}\mathrm{CF}_t \ ,$$

which says that deposits adjust in an amount inversely proportional to the rate at which the marginal shadow interest rate on cash changes compared to the other derivatives.

Similarly, we have

$$\Delta\mathrm{L}_t = \frac{1}{\beta U'_{t+1}\, 2r^{b\prime}/U''_t + 2r^{b\prime}/s'' + 1 + 2r^{b\prime}/f''}\mathrm{CF}_t \,.$$

Again, the change in loan demand is inversely proportional to the (relative) speed at which the lending rate changes with loans demanded. Finally, we have that gross investment (the change in capital in our approximation which ignores depreciation) is

$$\mathrm{I}_t = \frac{1}{\beta U'_{t+1}\, f''/U''_t + f''/s'' + f''/2r^{b\prime} + 1}\mathrm{CF}_t \ .$$

Firms adjust capital in an amount inversely proportional to the rate of decline in the marginal product of capital.

The deterministic model with binding constraint on period t dividends

If the non-negativity constraint for dividends is binding, the Euler equations are replaced by inequalities. Consider for instance capital. If no dividends are paid out it must be because the value of the marginal dollar is higher when invested than paid out as dividends (disregarding the case where the firm utilize the full cash flows for loan repayment). Assuming dividends in period $t+1$ are non-zero, the "Euler equation" for capital becomes an inequality

$$U'(0) < \beta\, U'(\text{DIV}_{t+1})(1 + f'(K_t)) \ .$$

(Too handle the possibility of zero dividends in period $t+1$ one needs the more general value function framework sketched in Section 2.) Intuitively, this situation will occur when the marginal product of capital is relatively high and the MV-curve for dividends is relatively flat. This may be a state when earnings are low and the firm has few funds (K low and $f'(\text{K})$ is a decreasing function in K), or it may arise because the productivity of capital, $f'(\text{K})$, is especially high caused by technological or particular market conditions.

Even if dividend payments are zero, the firm can, a the margin, trade off repayment of loans against investment and in optimum the marginal value of each use will have to be equal (assuming no non-negativity constraint binds for investments or loans) giving the equality

$$\beta U'(\text{DIV}_{t+1})(1 + r^b + L_t \frac{dr^b}{dL}) = \beta U'(\text{DIV}_{t+1})(1 + f'(K_{t+1}) \ .$$

Similarly, a firm can trade off cash holdings against loan repayment and in equilibrium (ignoring non-negativity constraints for loans) we would have:

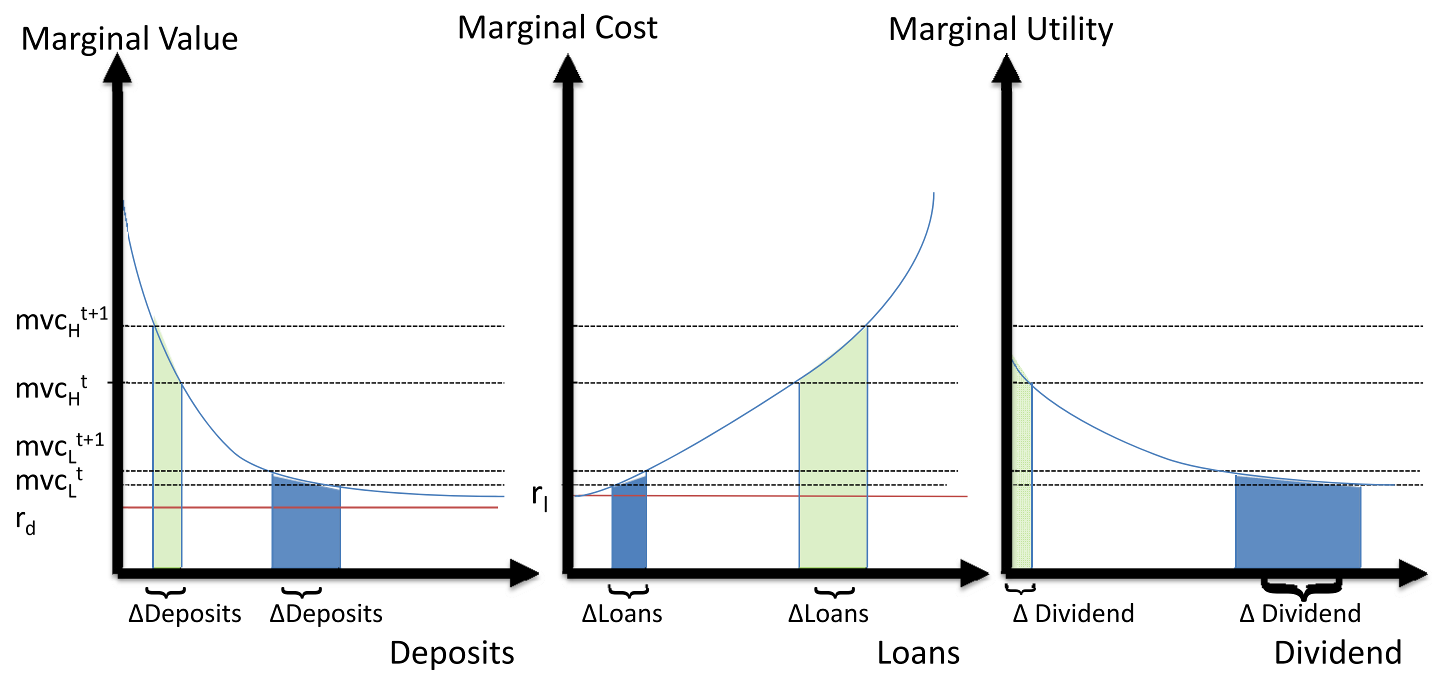
$$\beta U'(\text{DIV}_{t+1})(1 + r^b + L_t \frac{dr^b}{dL}) = \beta U'(\text{DIV}_{t+1})(1 + r^d + s'(\text{DEP}_t)) \ .$$

In this case a firm will have a high marginal value of cash in the sense that keeping the cash within the firm exceed the marginal value of dividend pay-outs and we have:

$$\mathrm{MVC_t} \equiv \beta U'(\mathrm{DIV_{t+1}})(1{+}r^d{+}s'(\mathrm{DEP_t})) = \beta U'(\mathrm{DIV_{t+1}})(1{+}r^b{+}\mathrm{L_t}\,\frac{dr^b(\mathrm{L_{t+1}})}{d\mathrm{L}}) = \beta(U'(\mathrm{DIV_{t+1}})(1{+}f'(\mathrm{K_t}))\ .$$

In this setting, the marginal sensitivities of cash will satisfy relations similar to those derived above, with the difference that the period t marginal utility will not enter the relations. The situation of zero dividend-payments is illustrated in Figure B-1 below.

Figure B-1: Effect of a Cash Flow Shortfall on High-MVC vs. Low-MVC Firms: The Case of a Binding Dividend Constraint



The figure illustrates the effect of a cash flow shortfall on the firm's demand for cash balances (deposits), bank loans, and dividend payments in the case where dividend payments fall to zero.