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Investment and internal funds of distressed firms

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Abstract

The investment-cash flow sensitivity literature excludes financially distressed firms because their investment behavior is presumably different from that of healthy firms. First, we find that the investment behavior of distressed firms with operating profits is similar (positive sensitivity). Second, distressed firms with operating losses typically invest less than the previous year. They downsize regardless of cash flows (near-zero sensitivity). Finally, 40% of the time distressed firms with operating losses invest more than the previous year. They surprisingly invest more when cash flows are lower (negative sensitivity). The investment is funded by equity holders, consistent with a gamble for resurrection.

JEL classification: G31; G32
Keywords: Financing constraints; Cash flow; Investment; Financial distress

1. Introduction

Firms may choose to finance their investment from a wide array of sources of funds. In the presence of market imperfections, firms may prefer one source of funds over another. One possible type of market imperfection is the presence of information asymmetry between the firm and the market. Myers and Majluf (1984) recognize that, when the market cannot distinguish between high-quality and low-quality investment opportunities,

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firms with high-quality opportunities are more likely to finance their projects internally. The resulting adverse selection raises the cost of external financing compared to internal financing, forming a clear hierarchy for firms' sources of financing. In the presence of asymmetric information, internally generated cash flow is the most likely source of funds for corporate investments.

Fazzari et al. (1988) test the financing hierarchy hypothesis. They find that firms' investment policies are indeed sensitive to their cash flow fluctuations and that most financially constrained firms have a greater cash flow sensitivity than least constrained firms. The literature now includes numerous papers that support Fazzari et al.'s finding, as well as others, including Kaplan and Zingales (1997) and Cleary (1999), providing evidence to the contrary.[1] Because the degree of financial constraint is not observable, different papers use different proxies for financial constraints and obtain different cash flow sensitivity results.

The existing cash flow sensitivity literature excludes firms in financial distress, presumably because such firms are not expected to react to internal funds fluctuations in the same way as firms in normal financial conditions. We examine multiple measures of financial distress, including Ohlson's (1980) bankruptcy probabilities and Altman's (1968) *Z*-scores. We investigate whether or not the investment policy of distressed firms differs from that of healthy firms. We find that it does: financially distressed firms have a negative cash flow sensitivity.

We divide financially distressed firms into two groups based on operating performance: the group of firms with operating profits and the group of firms with operating losses. For the most part, we find that financially distressed firms with operating profits exhibit a positive cash flow sensitivity, as observed for financially healthy firms. We find that distressed firms with operating losses exhibit a negative cash flow sensitivity. In other words, the investment behavior of financially distressed firms is not different from the investment behavior of financially healthy firms, as long as they face profitable investment opportunities.

We were surprised by the investment behavior of financially distressed firms with operating losses. Given that a firm is in financial trouble and that it does not foresee any immediate profitable opportunities, it might opt to size down its operations. Its investment policy should not react to fluctuations in internal funds, thereby generating a zero cash flow sensitivity. Instead of observing a zero cash flow sensitivity, we find a negative sensitivity.

We further examine financially distressed firms with a negative operating income by dividing them into two groups: the group of firms that have reduced their investment from the previous year and the group of firms that have increased their investment from the previous year. For most part (60% of firm-year observations), financially distressed firms with operating losses invest less than the previous year. These firms respond as expected to their lack of profitable opportunities. They invest with little regard to their cash flow fluctuations, as evidenced by their very small cash flow sensitivity. Despite their bad

[1] Papers providing support to Fazzari et al. (1988) include Allayannis and Mozumdar (2004), Gilchrist and Himmelberg (1995), Hoshi et al. (1991), Oliner and Rudebusch (1992), Schaller (1993) and Fazzari et al. (2000). See Hubbard (1998) for an extensive literature review. Papers providing support to Kaplan and Zingales (1997) include Cleary (1999), Kadapakkam et al. (1998) and Kaplan and Zingales (2000).

situation, financially distressed firms with operating losses sometimes (40% of firm-year observations) invest more than the previous year. It is that sub-sample of financially distressed firms that is responsible for the negative cash flow sensitivity. Internal funds decrease, yet these firms invest more.

We find that the increase in investment for these financially distressed firms is funded by equity claimants. These distressed firms with operating losses do not close operations but continue investing. Equity claimants want to keep the firm alive in the hope that conditions may improve thereby increasing the value of their equity claims. The negative sensitivity is consistent with a gamble for resurrection by equity claimants. Equity claimants, who are protected by limited liability, have the incentive to invest in riskier projects. Jensen and Meckling (1976) describe this well-known agency problem.

Our paper adds to the existing literature on the investment behavior of financially distressed firms in a number of ways. Allayannis and Mozumdar (2004) explain Cleary's result with negative cash flow observations. They show that the most constrained group of firms includes firms with negative cash flow observations that are likely to be financially distressed. Financially distressed firms have already cut back on their investment as much as possible and cannot cut investment any further in response to cash flow shortfalls. Consequently, financially distressed firms exhibit a lower cash flow sensitivity. When the most financially constrained firms are grouped with financially distressed firms, their cash flow sensitivity becomes lower than that of least constrained firms. Allayannis and Mozumdar also attribute Kaplan and Zingales's result to a few influential observations.

Cleary et al. (2004) develop a model of a U-shaped relation between investment and internal funds. As is standard, the firm invests less when it faces a decrease in internal funds. For low levels of internal funds, however, the firm must invest more to generate enough revenues to meet its contractual obligations. Investment therefore forms a U-shape over all internal fund levels.[2] Consistent with the model prediction, Cleary et al. empirically document a negative cash flow sensitivity for the sub-sample of negative cash flow observations and a positive sensitivity for the sub-sample of positive cash flow observations. Our paper complements the work of Allayannis and Mozumdar and Cleary et al. by further investigating financially distressed firms. By focusing on the firms' operating performance, we obtain similar results. We document a negative cash flow sensitivity for distressed firms with operating losses and a positive sensitivity for all other firms. Moreover, we show that the negative cash flow sensitivity is generated by distressed firms with operating losses that invest more than the previous year. These firms invest more when their cash flows are decreasing. Because the investment is funded by equity claimants, the evidence suggests a gamble for resurrection.

Andrade and Kaplan (1998) examine the investment behavior of financially distressed firms that remain in good economic health. Their sample consists of thirty-one highly leveraged transactions in the 1980s whose coverage ratio dips below one in distress but whose operating income remains positive. They find that firms in financial distress but in good economic health decrease their capital expenditures, sell assets at depressed prices,

[2] Moyen (2004) also graphs a U-shaped relation between investment and cash flows for unconstrained firms. In bad conditions, firms invest more to generate more revenues next period, thereby decreasing the probability of defaulting and paying default costs.

but do not undertake riskier investment projects. Our paper adds to the work of Andrade and Kaplan by providing evidence consistent with an asset substitution problem only for the subset of financially distressed firms with operating losses that invest more than the previous year.

John et al. (1992) examine voluntary restructurings of financially distressed firms during the 1980–1987 period. Their data include firms with at least US$1 billion in assets and with 1 year of negative net income followed by at least 3 years of positive net income. They find that firms that come out of financial distress reduce their number of business segments, their labor force, their debt-to-asset ratio, their research and development expenditures, and increase their investments. Our descriptive statistics also suggest that healthy firms invest more and have a lower leverage than financially distressed firms.

2. Firms not in financial distress

We begin by documenting the sensitivity of investment to cash flow fluctuations for firms that are not in financial distress. The sample consists of COMPUSTAT manufacturing firms (SIC codes between 2000 and 3999) during the 1979–1996 period. The sample excludes financially distressed firms identified by a net income less than or equal to zero in the previous year or by a negative real sales growth rate as in Fazzari et al. The sample ends before the tech "bubble" period of the late 1990s because of its effect on some manufacturing sectors such as computer and telecom equipment. To remove the effect of outliers, we winsorize the top and bottom 1% of firm-year observations.

Fazzari et al. identify firms' degree of financial constraint by their dividend payout ratio. Low dividend firms may payout very little in order to retain most of their internal funds to finance their investment. The payout ratio is measured by the sum of common stock dividends (item 21) and preferred stock dividends (item 19), divided by net income (item 172). The payout ratio classifies firm-year observations into three classes. Similar to Fazzari et al., class 1 includes firm-year observations with a payout ratio less than or equal to 0.1, class 2 observations with a payout ratio greater than 0.1 but less than or equal to 0.2, and class 3 observations with a payout ratio greater than 0.2. The data availability using the payout ratio yields an unbalanced panel of 17,563 firm-year observations.[3] This sample size is large compared to the previous literature. For example, Cleary requires a balanced panel and obtains 9219 firm-year observations.

We estimate Fazzari et al.'s regression specification:

$$\left(\frac{I}{K}\right)_{it} = \alpha_i + \alpha_t + \alpha_1 Q_{it} + \alpha_2 \left(\frac{\mathrm{CF}}{K}\right)_{it} + \epsilon_{it}, \tag{1}$$

[3] Our sample size varies throughout the paper, because we use all possible data for the task at hand. For example, using the tangibility ratio rather than the payout ratio to identify financial constraint, the sample size increases to 28,653 firm-year observations.

where I denotes investment, K capital stock, Tobin's Q the tax-adjusted value of investment opportunities, CF the cash flow, α_i the firm fixed effect, α_t the time fixed effect and ϵ_{it} the error term. Investment is represented by capital expenditures (COMPUSTAT data item 128). Capital stock is measured by net property, plant and equipment (item 8). Investment opportunities, proxied by beginning-of-the-period Tobin's Q, are captured by the market value of assets (defined next) over the book value of assets (item 6). The market value of assets is computed as the sum of the market value of equity (defined next) and the book value of assets (item 6), minus the sum of the book value of equity (item 60) and balance sheet deferred taxes (item 74). The market value of equity is the stock price (item 24) multiplied by the number of shares outstanding (item 25). Cash flow is defined as the sum of net income (item 172) and depreciation (item 14). Investment and cash flow are standardized by the beginning-of-the-period capital stock.

We also perform three robustness checks. The first robustness check uses a different sample period than the period examined by Fazzari et al. We split our sample into the 1979–1984 sub-period, which overlaps which Fazzari et al. and the later 1985–1996 sub-period. The second robustness check uses a different measure of internal funds than cash flow: free cash flow. Free cash flow is essentially constructed from cash flow by subtracting funds already committed to claimants and the government. Following Gul and Tsui (1998), free cash flow is measured as the operating income before depreciation (item 13) minus the tax payment (item 16), the interest expense (item 15), preferred stock dividends (item 19) and common stock dividends (item 21). The third robustness check uses a different proxy of the degree of financial constraint than the payout ratio: the tangibility ratio. Firms with fewer tangible assets are more likely to experience greater information asymmetry when communicating their value to outside investors and therefore a greater degree of financial constraint. The tangibility ratio is defined as the book value of tangible assets (item 8) divided by total assets (item 6). The tangibility ratio classifies firm-year observations into three groups of equal size, with group 1 observations having less tangible assets.

Table 1 provides descriptive statistics for firms not in financial distress. In addition to the variables defined above, Table 1 includes statistics on operating income, size, leverage, the market-to-book value of equity and the real sales growth rate. Operating income (item 13) is standardized by the capital stock (item 8). Size is measured as the logarithm of total assets (item 6) deflated by the gross national product price index. Leverage denotes the total debt (item 181) to total asset (item 6) ratio. The market-to-book value of equity is sometimes used to proxy for investment opportunities in lieu of Tobin's Q, as in Cleary. It is defined as the market value of equity (item 24 multiplied by item 25) divided by the book value of equity (item 60). The growth rate of real sales is computed from sales (item 12) deflated by the gross national product price index.

The payout and tangibility ratios identify as most financially constrained those firms with more investment, a larger Tobin's Q, larger (free) cash flows, a larger income from operations, a smaller size, a lower leverage, a higher market-to-book value of equity and a higher growth rate of sales. In other words, most constrained firms invest more as a proportion of their capital stock. They have more cash flows but less debt to finance this investment. They are smaller but are growing more rapidly. Their market value is larger than their book value. The descriptive statistics suggest that constrained firms are by no

Table 1
Descriptive statistics of financially healthy firms

Classification	No. obs.	Investment I/K					Tobin's Q					Cash flow CF/K				
		Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
A. Payout ratio																
Class 1	9,168	0.534	0.539	0.355	0.004	2.682	1.975	1.491	1.482	0.541	10.320	0.899	1.607	0.559	−11.844	6.492
Class 2	2,045	0.346	0.276	0.277	0.004	2.682	1.627	1.026	1.331	0.541	10.320	0.720	0.736	0.516	0.077	6.492
Class 3	6,350	0.268	0.206	0.225	0.004	2.682	1.514	0.858	1.279	0.541	10.320	0.546	0.646	0.409	0.061	6.492
B. Tangibility ratio																
Group 1	9,551	0.453	0.481	0.296	0.004	2.682	1.829	1.429	1.346	0.541	10.320	0.932	2.072	0.744	−11.844	6.492
Group 2	9,551	0.321	0.337	0.228	0.004	2.682	1.521	0.995	1.225	0.541	10.320	0.410	0.551	0.410	−11.844	6.492
Group 3	9,551	0.291	0.316	0.211	0.004	2.682	1.408	0.884	1.162	0.541	10.320	0.270	0.388	0.264	−11.844	6.492

Classification	Free cash flow FCF/K					Operating income/K					Size				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Med.	Min.	Max.	Mean	S.D.	Median	Min.	Max.
A. Payout ratio															
Class 1	0.865	1.510	0.544	−11.669	5.849	1.325	1.870	0.811	−11.323	7.840	12.007	1.582	11.895	8.050	17.975
Class 2	0.711	0.712	0.509	0.077	5.849	1.047	1.009	0.757	−0.201	7.840	13.287	1.775	13.142	9.237	17.975
Class 3	0.541	0.609	0.410	−0.478	5.849	0.804	0.828	0.616	−2.441	7.840	14.118	1.886	14.022	8.570	17.975

B. Tangibility ratio															
Group 1	0.899	1.953	0.731	−11.669	5.849	1.409	2.299	1.069	−11.323	7.840	12.030	1.812	11.878	8.050	17.975
Group 2	0.409	0.524	0.407	−11.669	5.849	0.656	0.601	0.613	−10.220	7.840	12.986	1.907	12.815	8.050	17.975
Group 3	0.268	0.370	0.262	−11.669	5.849	0.413	0.423	0.383	−11.323	7.840	13.562	2.100	13.462	8.050	17.975

Classification	Total debt-to-total asset ratio					Equity market-to-book value ratio					Real sales growth rate				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
A. Payout ratio															
Class 1	0.452	0.214	0.446	0.059	1.685	2.561	2.445	1.940	−4.319	20.439	0.283	0.365	0.175	0.000	2.677
Class 2	0.456	0.171	0.455	0.059	1.541	2.210	1.799	1.802	−4.319	20.439	0.167	0.194	0.116	0.000	2.677
Class 3	0.481	0.166	0.491	0.059	1.685	2.145	1.810	1.670	−4.319	20.439	0.123	0.182	0.077	0.000	2.677
B. Tangibility ratio															
Group 1	0.428	0.234	0.412	0.059	1.685	2.276	2.434	1.601	−4.319	20.439	0.119	0.366	0.062	−0.675	2.677
Group 2	0.478	0.194	0.476	0.059	1.685	2.003	2.034	1.508	−4.319	20.439	0.072	0.266	0.038	−0.675	2.677
Group 3	0.510	0.179	0.508	0.059	1.685	1.874	1.942	1.424	−4.319	20.439	0.053	0.245	0.027	−0.675	2.677

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample excludes financially distressed firms identified by a net income less than or equal to zero in the previous year. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Section 2. Class 1 firms are identified as most financially constrained by their lower payout ratio. Following Fazzari et al. (1988), class 1 to class 3 also exclude firms with a negative real sales growth rate. Group 1 firms are identified as most financially constrained by their lower tangibility ratio.

means experiencing disastrous conditions. They are simply constrained on external financing markets.

Because we have excluded firms in financial distress, the descriptive statistics reported in Table 1 are not directly comparable to those provided in the literature. For example, Cleary reports an average cash flow CF/K value of 0.47, while our cash flow average is larger and varies from 0.899 for class 1 firms to 0.546 for class 3 firms. Similar to Table 1 for financially healthy firms, Table 6 describes financially distressed firms. Depending on the definition of financial distress, the cash flow average varies between −0.770 and

Table 2
Cash flow sensitivities of financially healthy firms

	Class 1	Class 2	Class 3
A. Full sample			
Q	0.098 (17.138)*	0.018 (1.739)	0.031 (6.706)*
CF/K	**0.096** (19.787)*	**0.371** (20.798)*	**0.213** (26.034)*
Adj. R^2	0.406	0.491	0.481
No. obs.	9,168	2,045	6,350
B. 1979–1984			
Q	0.109 (6.608)*	0.063 (2.416)*	0.078 (5.229)*
CF/K	**0.218** (11.507)*	**0.718** (15.417)*	**0.355** (11.928)*
Adj. R^2	0.439	0.554	0.531
No. obs.	2,242	804	2,276
C. 1985–1996			
Q	0.085 (12.440)*	0.007 (0.598)	0.025 (4.571)*
CF/K	**0.079** (14.975)*	**0.345** (11.955)*	**0.212** (22.916)*
Adj. R^2	0.429	0.568	0.484
No. obs.	6,926	1,241	4,074
D. Free cash flow			
Q	0.098 (17.153)*	0.021 (2.027)*	0.029 (6.232)*
FCF/K	**0.105** (19.965)*	**0.387** (20.757)*	**0.234** (26.397)*
Adj. R^2	0.406	0.490	0.483
No. obs.	9,166	2,045	6,350
	Group 1	Group 2	Group 3
E. Tangibility ratio			
Q	0.097 (18.557)*	0.063 (14.418)*	0.093 (18.526)*
CF/K	**0.059** (21.357)*	**0.327** (46.688)*	**0.268** (24.042)*
Adj. R^2	0.428	0.572	0.503
No. obs.	9,551	9,551	9,551

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample excludes financially distressed firms identified by a net income less than or equal to zero in the previous year. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Section 2. Class 1 firms are identified as most financially constrained by their lower payout ratio. Following Fazzari et al. (1988), class 1 to class 3 also exclude firms with a negative real sales growth rate. Group 1 firms are identified as most financially constrained by their lower tangibility ratio. T-statistics are in parenthesis, and the asterisk denotes statistical significance at 5%.

−1.436. Combining healthy and distressed firms, our overall average would be much lower than in Table 1, consistent with Cleary.

Table 2 presents the regression results. Firms' investment policies clearly depend on their internal funds: all cash flow sensitivities are positive and statistically significant. However, in contrast to Fazzari et al., firms' investment sensitivities to internal funds fluctuations are not decreasing as firms become less financially constrained. Panel A shows that most constrained class 1 firms exhibit a sensitivity of 0.096, class 2 firms a sensitivity of 0.371 and least constrained class 3 firms a sensitivity of 0.213. The lack of monotonicity obtains irrespective of the time period (panels B and C on the 1979–1984 and 1985–1996 sub-periods), the measure of internal funds (panel D on free cash flow) or the proxy for financial constraint (panel E on the tangibility ratio).[4] Another pattern stands out in panels B and C: cash flow sensitivities are lower for the latter sub-period, consistent with the observation of Allayannis and Mozumdar.

3. Firms in financial distress

A firm experiences financial distress when its inflow is inadequate to meet its contractual obligations. We identify financially distressed firms using five alternative proxies. The distress 1 group includes firm-year observations with a negative net income (COMPUSTAT data item 172) in the previous year. The distress 2 group further restricts the distress 1 group by including only firm-year observations with a negative net income in the 2 previous years. John et al. also use negative net income to identify financial distress.

The distress 3 group includes firm-year observations with a coverage ratio less than or equal to one in the previous year. The coverage ratio is defined as the sum of income before extraordinary items (item 18) and interest expense (item 15), divided by interest expense. When a firm's coverage ratio is less than or equal to one, the firm's income is less than or equal to its interest expense. Andrade and Kaplan also use the coverage ratio to identify financial distress.

The distress 4 group is based on Ohlson's predicted bankruptcy probabilities p, where

$$p = \frac{1}{1 + e^{-y_{it}}}, \tag{2}$$

$$\begin{aligned} y_{it} = & -1.32 - 0.407*\mathrm{SIZE}_{it} + 6.03*\mathrm{TLTA}_{it} - 1.43*\mathrm{WCTA}_{it} \\ & + 0.757*\mathrm{CLCA}_{it} - 2.37*\mathrm{NITA}_{it} - 1.83*\mathrm{FUTL}_{it} + 0.285*\mathrm{INTWO}_{it} \\ & - 1.72*\mathrm{OENEG}_{it} - 0.521*\mathrm{CHIN}_{it}, \end{aligned} \tag{3}$$

SIZE is the log of total assets (item 6) to GNP price-level index ratio, TLTA is total liabilities (item 181) to total assets (item 6) ratio, WCTA is the working capital (item 4 minus item 5) to total assets (item 6) ratio, CLCA is the current liabilities (item 5) to

[4] Combining the three robustness checks yield similar results.

current assets (item 4) ratio, NITA is the net income (item 172) to total assets (item 6) ratio, FUTL is the funds from operations (item 110) to total liabilities (item 181) ratio, INTWO is equal to one if net income (item 172) is negative in the previous 2 years or zero otherwise, OENEG is equal to one if total liabilities (item 181) are greater than total assets (item 6) or zero otherwise, CHIN=$(NI_t - NI_{t-1})/(|NI_t| - |NI_{t-1}|)$, where NI_t is the net income (item 172) for year t. The GNP price-level index uses 1968 as a base year, assigning it a value of 100.

The distress 4 group is obtained from a variant of Ohlson's bankruptcy probability model. Because the FUTL variable greatly restricts the sample size, pseudo-bankruptcy probabilities $\tilde{p}$ are calculated by ignoring the effect of FUTL in predicting bankruptcy probabilities:

$$\tilde{p} = \frac{1}{1 + e^{-\tilde{y}_{it}}}, \tag{4}$$

where

$$\begin{aligned}\tilde{y}_{it} = & -1.32 - 0.407*\mathrm{SIZE}_{it} + 6.03*\mathrm{TLTA}_{it} - 1.43*\mathrm{WCTA}_{it} + 0.757*\mathrm{CLCA}_{it} \\ & - 2.37*\mathrm{NITA}_{it} + 0.285*\mathrm{INTWO}_{it} - 1.72*\mathrm{OENEG}_{it} - 0.521*\mathrm{CHIN}_{it}.\end{aligned} \tag{5}$$

The distress 4 group includes firm-year observations with a pseudo-bankruptcy probability greater than or equal to 50%.

The use of Ohlson's estimated parameters to predict bankruptcy probabilities would be inappropriate in the presence of structural changes between Ohlson's study during the 1970–1976 period and the later 1979–1996 period covered in this paper. To investigate whether such structural changes may have taken place, we compare the descriptive statistics of our regressors to those provided by Ohlson. Table 3 confirms that means are indeed quite similar. Panels A and B show that the variable means from Ohlson's bankrupt firms have the same magnitude as the variable means from the distress 4 group. The variable means from Ohlson's non-bankrupt firms also have the same magnitude as the variable means from the remaining COMPUSTAT sample. Structural changes, if any, are not likely to distort bankruptcy probability predictions. In addition, panel C shows that the bankruptcy probabilities estimated using all COMPUSTAT manufacturing firms with available data from 1979 to 1996 are reasonable. About 83% of firms have less than a 10% bankruptcy probability, while less than 6.7% of firms have a greater than 50% probability of bankruptcy.

The distress 5 group is based on Altman's Z-score. Altman estimates the financial health of a firm using an overall index Z, where

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5, \tag{6}$$

X_1 is the working capital (item 4 minus item 5) to total assets (item 6) ratio, X_2 is the retained earnings (item 36) to total assets (item 6) ratio, X_3 is the earnings before interest and tax (item 13 minus item 14) to total assets (item 6) ratio, X_4 is the market value of equity (item 24 multiplied by item 25) to total liabilities (item 181) ratio and X_5 is the sales

Table 3
Ohlson's (1980) bankruptcy probabilities

A. Descriptive statistics from Ohlson's sample

	Bankrupt firms		Non-bankrupt firms	
	Mean	S.D.	Mean	S.D.
Size	12.134	1.380	13.260	1.570
TLTA	0.905	0.637	0.488	0.181
WCTA	0.041	0.608	0.310	0.182
CLCA	1.320	2.520	0.525	0.740
NITA	−0.208	0.411	0.053	0.076
FUTL	−0.117	0.421	0.281	0.360
INTWO	0.390	0.488	0.043	0.203
OENEG	0.180	0.385	0.004	0.066
CHIN	−0.322	0.644	0.038	0.458

B. Descriptive statistics from our sample

	Distress 4 firms		Healthy firms	
	Mean	S.D.	Mean	S.D.
Size	10.971	1.746	12.980	2.022
TLTA	0.765	0.565	0.431	0.156
WCTA	0.159	0.506	0.377	0.177
CLCA	0.980	4.075	0.417	0.207
NITA	−0.205	0.524	0.068	0.116
FUTL	−0.295	1.055	0.340	0.460
INTWO	0.442	0.497	0.034	0.180
OENEG	0.108	0.310	0.001	0.028
CHIN	−0.266	0.633	0.080	0.456

C. Distribution of bankruptcy probabilities

Bankruptcy probability	Frequency	Percent	Cumulative frequency	Cumulative percent
$0.0 \le p < 0.1$	15,305	83.19	15,305	83.19
$0.1 \le p < 0.2$	900	4.89	16,205	88.08
$0.2 \le p < 0.3$	445	2.42	16,650	90.50
$0.3 \le p < 0.4$	292	1.59	16,942	92.09
$0.4 \le p < 0.5$	231	1.26	17,173	93.34
$0.5 \le p < 0.6$	161	0.88	17,334	94.22
$0.6 \le p < 0.7$	154	0.84	17,488	95.05
$0.7 \le p < 0.8$	176	0.96	17,664	96.01
$0.8 \le p < 0.9$	178	0.97	17,842	96.98
$0.9 \le p < 1.0$	556	3.02	18,398	100.00

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. Distress 4 firms are identified by pseudo-bankruptcy probabilities greater or equal to 50%. All variables are defined in Section 3.

(item 12) to total assets (item 6) ratio. The distress 5 group consists of firm-year observations with Altman's *Z*-scores less than one.

As with Ohlson's estimated bankruptcy probability model, we investigate whether a structural change may have taken place between Altman's study covering the 1946–1965 period and the later 1979–1996 period of this paper. Not only does Altman's data originate from very long ago, but his sample is also extremely small (33 observations for bankrupt

firms and 33 observations for non-bankrupt firms). We compare the descriptive statistics of our regressors to those provided by Altman. Panels A and B of Table 4 show that the variable means do differ in magnitude. In addition, panel C shows that Z-scores exhibit little dispersion: 74% of Z-scores are concentrated between the 0.6 and 1.8 values, and it is rare to observe Z-scores smaller than 0 or larger than 10. Keeping those caveats in mind, Z-scores are nevertheless explored as a proxy for financial distress.

Table 5 provides a correlation matrix of the different proxies for financial distress. We expect the net income, coverage ratio and Z-score to be all positively correlated, and negatively correlated with the pseudo-bankruptcy probability. Indeed, all correlation coefficients have the expected signs, except for the low but positive correlation between the Z-score and the pseudo-bankruptcy probability.

Table 6 provides descriptive statistics on financially distressed firms. Similar to the most financially constrained firms which have a higher Tobin's Q, a smaller size and a larger market-to-book of equity than least constrained firms, distressed firms in turn have a

Table 4
Altman's (1968) Z-scores

A. Descriptive statistics from Altman's sample

Variables	Bankrupt firms	Non-bankrupt firms
	Mean	Mean
X_1	−0.061	0.414
X_2	−0.626	0.355
X_3	−0.318	0.153
X_4	0.401	2.477
X_5	1.500	1.900

B. Descriptive statistics from our sample

	Distress 5 firms		Healthy firms	
	Mean	S.D.	Mean	S.D.
X_1	0.297	0.372	0.322	0.331
X_2	−0.571	3.163	0.029	1.681
X_3	−0.099	0.407	0.072	0.217
X_4	7.538	14.777	4.662	27.044
X_5	0.626	0.258	1.565	0.649

C. Distribution of Z-scores

Z-score	Frequency	Percent	Cumulative frequency	Cumulative percent
Z-score<−0.6	3	0.01	3	0.01
−0.6≤Z-score<0.0	75	0.20	78	0.20
0.0≤Z-score<0.6	2,985	7.83	3,063	8.03
0.6≤Z-score<1.2	13,177	34.56	16,240	42.60
1.2≤Z-score<1.8	15,018	39.39	31,258	81.99
1.8≤Z-score<2.4	4,954	12.99	36,212	94.98
2.4≤Z-score<3.0	1,110	2.91	37,322	97.89
3.0≤Z-score<10.0	799	2.10	38,121	99.99
10.0≤Z-score	5	0.01	38,126	100.00

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. Distress 5 firms are identified by Z-scores less than 1. All variables are defined in Section 3.

Table 5
Correlation coefficients of financial distress proxies

	Net income	Coverage ratio	Pseudo-bankruptcy probability	*Z*-score
Net income	1.000 (0.0000)			
Coverage ratio	0.685 (<0.0001)	1.000 (0.0000)		
Pseudo-bankruptcy probability	−0.593 (<0.0001)	−0.711 (<0.0001)	1.000 (0.0000)	
Z-score	0.093 (<0.0001)	0.183 (<0.0001)	0.052 (<0.0001)	1.000 (0.0000)

Note: All variables are defined in Section 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a *Z*-score less than one. *P*-values are reported in parenthesis.

higher Tobin's *Q*, a smaller size and a larger market-to-book value of equity than most constrained firms. However, the similarities stop here. In contrast to most financially constrained firms which invest more, have larger (free) cash flows, a larger income from operations, a lower leverage and a higher growth rate of sales than least constrained firms, distressed firms invest less, have smaller (free) cash flows, a smaller income from operations, a higher leverage and a lower growth rate of sales than most constrained firms. It is not surprising to find firms in financial trouble with lower inflows and a higher leverage than healthy firms. It is also not surprising to see that firms in distress invest less and grow less rapidly than healthy firms. Financially distressed firms therefore behave differently from financially constrained firms.

Table 6 reports that distressed firms on average experience negative cash flows. For example, the average cash flow for the distress 1 firms is −1.071. Healthy firms on average do not experience negative cash flows. Consistent with our above comparison of distressed and healthy firms, Allayannis and Mozumdar document that firms with negative cash flows are smaller, less profitable, have a higher leverage and declining sales.

Table 7 presents the regression results of distressed firms.[5] As expected, firms invest more as investment opportunities improve: Tobin's *Q* sensitivities are positive and statistically significant. In contrast to healthy firms, distressed firms do not rely on their internal funds to finance their investments: cash flow sensitivities are negative and statistically significant. Negative cash flow sensitivities imply that financially distressed firms invest more when their internal funds decrease, and vice versa, that they invest less when their internal funds increase. Clearly, this behavior does not support the financing hierarchy hypothesis according to which firms first rely on their internal funds to finance their investment.

Our negative cash flow sensitivity for distressed firms is consistent with the findings of Allayannis and Mozumdar and Cleary et al. Both papers document a lower cash flow sensitivity for negative cash flow observations. More specifically, Allayannis and

[5] The free cash flow sensitivity results are similar to the cash flow sensitivity results presented in this paper. The free cash flow sensitivity results of financially distressed firms are available upon request.

Table 6
Descriptive statistics of financially distressed firms

Classification	No. obs.	Investment I/K					Tobin's Q					Cash flow CF/K				
		Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	10,512	0.293	0.447	0.146	0.004	2.682	2.158	2.208	1.233	0.541	10.320	−1.071	2.978	−0.083	−11.844	6.492
Distress 2	6,041	0.311	0.483	0.139	0.004	2.682	2.538	2.466	1.460	0.541	10.320	−1.436	3.270	−0.303	−11.844	6.492
Distress 3	9,475	0.278	0.428	0.139	0.004	2.682	2.057	2.107	1.200	0.541	10.320	−0.953	2.804	−0.075	−11.844	6.492
Distress 4	2,429	0.332	0.478	0.174	0.004	2.682	1.870	1.936	1.162	0.541	10.320	−0.770	2.241	−0.095	−11.844	6.492
Distress 5	10,600	0.295	0.432	0.156	0.004	2.682	1.906	1.883	1.209	0.541	10.320	−1.029	2.731	−0.113	−11.844	6.492

Classification	Free cash flow FCF/K					Operating income/K					Size				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	−1.101	2.892	−0.073	−11.669	5.849	−0.898	2.873	0.026	−11.323	7.840	11.138	1.964	10.881	8.050	17.975
Distress 2	−1.490	3.162	−0.294	−11.669	5.849	−1.297	3.136	−0.156	−11.323	7.840	10.751	1.812	10.521	8.050	17.975
Distress 3	−0.992	2.718	−0.067	−11.669	5.849	−0.757	2.667	0.040	−11.323	7.840	11.143	1.943	10.887	8.050	17.975
Distress 4	−0.747	2.171	−0.064	−11.669	5.849	−0.493	2.303	0.053	−11.323	7.840	10.990	1.708	10.863	8.050	17.384
Distress 5	−1.009	2.661	−0.072	−11.669	5.849	−0.599	2.584	0.094	−11.323	7.840	11.001	1.780	10.824	8.050	17.975

Classification	Total debt-to-total asset ratio					Equity market-to-book value ratio					Real sales growth rate				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	0.612	0.363	0.577	0.059	1.685	2.971	4.724	1.417	−4.319	20.439	0.150	0.650	0.003	−0.675	2.677
Distress 2	0.630	0.402	0.584	0.059	1.685	3.555	5.336	1.762	−4.319	20.439	0.184	0.708	0.011	−0.675	2.677
Distress 3	0.640	0.359	0.601	0.059	1.685	2.852	4.711	1.338	−4.319	20.439	0.135	0.626	−0.002	−0.675	2.677
Distress 4	0.726	0.296	0.693	0.059	1.685	2.613	4.589	1.224	−4.319	20.439	0.060	0.560	−0.043	−0.675	2.677
Distress 5	0.783	0.296	0.729	0.059	1.685	2.947	5.078	1.357	−4.319	20.439	0.069	0.553	−0.031	−0.675	2.677

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a Z-score less than one.

Table 7
Cash flow sensitivities of financially distressed firms

	Distress 1	Distress 2	Distress 3	Distress 4	Distress 5
Q	0.055	0.053	0.056	0.043	0.084
	(16.272)*	(11.986)*	(15.709)*	(6.048)*	(20.604)*
CF/K	**−0.028**	**−0.032**	**−0.029**	**−0.062**	**−0.012**
	(−13.241)*	(−11.039)*	(−12.755)*	(−13.700)*	(−4.444)*
Adj. R^2	0.232	0.217	0.262	0.312	0.293
No. obs.	10,512	6,041	9,475	2,429	10,600

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a Z-score less than one. T-statistics are in parenthesis, and the asterisk denotes statistical significance at 5%.

Mozumdar demonstrate that negative cash flow observations reduce the estimated cash flow sensitivity of constrained firms, explaining why Cleary obtains a lower cash flow sensitivity for most constrained firms. When distressed firms are considered with most constrained firms, the negative cash flow sensitivity of distressed firms reduces the cash flow sensitivity of most constrained firms.

Cleary et al. develop a model of a U-shaped relation between investment and internal funds. In accord with the model, they empirically document a negative cash flow sensitivity for the sub-sample of negative cash flow observations and a positive sensitivity for the sub-sample of positive cash flow observations. We find that the U-shaped relation arises irrespective of the proxy for financial distress. We consistently obtain a negative cash flow sensitivity for the sub-sample of distressed firms and a positive sensitivity for healthy firms.

4. Distress from operations

There appears to exist an overriding phenomenon influencing the investment behavior of distressed firms—not captured by the traditional financing hierarchy hypothesis. Given that investment does not respond to internal funds in the expected manner, we examine whether the investment behavior has more to do with the "real" performance of the firm than with its financing. More specifically, we investigate whether the investment behavior of distressed firms is related to their operating performance. When distress is so severe that firms operate at a loss, their investment policy may be driven by other factors than fluctuations in their internal funds.

We divide financially distressed firms into two groups: the group of firms with a negative operating income (item 13) and the group with a positive operating income. Tables 8 and 9 report that firms with operating losses differ substantially from firms with operating profits. Firms with operating losses invest more, have a higher Tobin's Q, smaller (free) cash flows, a smaller size, have a lower leverage, have a higher market-to-

Table 8
Descriptive statistics of financially distressed firms with a negative operating income

Classification	No. obs.	Investment I/K					Tobin's Q					Cash flow CF/K				
		Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	6,235	0.356	0.533	0.160	0.004	2.682	2.771	2.591	1.687	0.541	10.320	−1.866	3.548	−0.623	−11.844	6.492
Distress 2	4,205	0.363	0.545	0.158	0.004	2.682	3.061	2.710	1.982	0.541	10.320	−2.088	3.644	−0.841	−11.844	6.492
Distress 3	5,537	0.336	0.513	0.150	0.004	2.682	2.632	2.493	1.592	0.541	10.320	−1.674	3.376	−0.535	−11.844	6.492
Distress 4	1,587	0.341	0.544	0.139	0.004	2.682	2.800	2.709	1.586	0.541	10.320	−1.878	2.967	−0.824	−11.844	6.492
Distress 5	3,211	0.311	0.513	0.123	0.004	2.682	2.806	2.609	1.685	0.541	10.320	−2.429	3.577	−1.034	−11.844	6.492

Classification	Free cash flow FCF/K					Operating income/K					Size				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	−1.905	3.439	−0.603	−11.669	5.849	−1.748	3.388	−0.513	−11.323	7.840	10.365	1.486	10.216	8.050	17.975
Distress 2	−2.145	3.523	−0.830	−11.669	5.849	−1.994	3.468	−0.747	−11.323	7.840	10.249	1.455	10.121	8.050	17.272
Distress 3	−1.724	3.266	−0.510	−11.669	5.849	−1.517	3.189	−0.394	−11.323	7.840	10.411	1.511	10.236	8.050	17.975
Distress 4	−1.868	2.900	−0.783	−11.669	5.849	−1.724	2.961	−0.629	−11.323	7.840	10.074	1.507	9.890	8.050	17.272
Distress 5	−2.430	3.492	−0.998	−11.669	5.849	−2.029	3.372	−0.725	−11.323	7.840	9.966	1.407	9.798	8.050	17.272

Classification	Total debt-to-total asset ratio					Equity market-to-book value ratio					Real sales growth rate				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	0.582	0.409	0.515	0.059	1.685	3.843	5.527	2.010	−4.319	20.439	0.245	0.783	0.032	−0.675	2.677
Distress 2	0.596	0.431	0.517	0.059	1.685	4.314	5.886	2.385	−4.319	20.439	0.262	0.806	0.038	−0.675	2.677
Distress 3	0.621	0.404	0.557	0.059	1.685	3.702	5.532	1.818	−4.319	20.439	0.224	0.757	0.027	−0.675	2.677
Distress 4	0.735	0.408	0.685	0.059	1.685	3.932	6.236	1.745	−4.319	20.439	0.171	0.768	−0.031	−0.675	2.677
Distress 5	0.818	0.383	0.744	0.059	1.685	4.406	6.723	2.029	−4.319	20.439	0.168	0.770	−0.041	−0.675	2.677

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a Z-score less than one.

Table 9
Descriptive statistics of financially distressed firms with a positive operating income

Classification	No. obs.	Investment I/K					Tobin's Q					Cash flow CF/K				
		Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	4,255	0.200	0.248	0.135	0.004	2.682	1.261	0.908	1.034	0.541	10.320	0.083	1.067	0.149	−11.844	6.492
Distress 2	1,822	0.189	0.254	0.117	0.004	2.682	1.336	1.045	1.061	0.541	10.320	0.042	1.221	0.124	−11.844	6.492
Distress 3	3,918	0.189	0.254	0.117	0.004	2.682	1.336	1.045	1.061	0.541	10.320	0.042	1.221	0.124	−11.844	6.492
Distress 4	839	0.326	0.435	0.186	0.004	2.682	1.347	0.992	1.063	0.541	10.320	−0.147	1.350	0.055	−11.844	6.492
Distress 5	7,376	0.284	0.376	0.170	0.004	2.682	1.388	0.971	1.108	0.541	10.320	−0.226	1.620	0.069	−11.844	6.492

Classification	Free cash flow FCF/K					Operating income/K					Size				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	0.077	0.961	0.151	−11.669	5.849	0.343	0.962	0.275	−11.323	7.840	12.278	2.026	12.026	8.050	17.975
Distress 2	0.020	1.044	0.121	−11.669	5.849	0.306	1.022	0.250	−11.323	7.840	11.919	2.011	11.627	8.050	17.975
Distress 3	0.020	1.044	0.121	−11.669	5.849	0.306	1.022	0.250	−11.323	7.840	11.919	2.011	11.627	8.050	17.975
Distress 4	−0.116	1.235	0.071	−11.669	5.849	0.197	1.424	0.210	−11.323	7.840	11.505	1.595	11.352	8.050	17.384
Distress 5	−0.190	1.515	0.090	−11.669	5.849	0.221	1.460	0.265	−11.323	7.840	11.598	1.697	11.445	8.050	17.975

Classification	Total debt-to-total asset ratio					Equity market-to-book value ratio					Real sales growth rate				
	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
Distress 1	0.656	0.277	0.631	0.059	1.685	1.723	2.818	1.094	−4.319	20.439	0.010	0.330	−0.018	−0.675	2.677
Distress 2	0.709	0.314	0.674	0.059	1.685	1.847	3.239	1.098	−4.319	20.439	0.002	0.333	−0.021	−0.675	2.677
Distress 3	0.709	0.314	0.674	0.059	1.685	1.847	3.239	1.098	−4.319	20.439	0.002	0.333	−0.021	−0.675	2.677
Distress 4	0.722	0.209	0.695	0.059	1.685	1.900	3.162	1.098	−4.319	20.439	−0.003	0.381	−0.046	−0.675	2.677
Distress 5	0.763	0.229	0.725	0.126	1.685	2.140	3.639	1.222	−4.319	20.439	0.011	0.362	−0.029	−0.675	2.677

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a Z-score less than one.

book value of equity and a higher growth rate of sales than firms with operating profits. It is surprising to observe that, despite their operating losses, these firms invest more (0.356>0.200) and grow at a faster rate (0.245>0.010).

Panel A of Table 10 shows that distressed firms with operating losses have investment policies that are negatively related to internal funds. The cash flow sensitivity is statistically significant regardless of the proxy for financial distress. The negative cash flow sensitivity, inconsistent with the financing hierarchy hypothesis, remains puzzling.

Panel B of Table 10 suggests that firms with operating profits have investment policies that are positively related to internal funds. A positive cash flow sensitivity is consistent with the financing hierarchy hypothesis as documented in the literature for healthy firms. For three of the five proxies of financial distress, the cash flow sensitivity is positive and statistically significant. For distress 2 firms, the sensitivity is positive but not statistically significant. For distress 4 firms, the cash flow sensitivity is not positive. We discount the conflicting distress 4 result, as it is obtained from a very small sample size (839 firm-year observations). We therefore discount this conflicting result.

Another way to define operating profitability is with respect to industry sectors. This definition assumes that profitable opportunities are systematic to the industry rather than idiosyncratic to the firm. If an industry suffers from 2 consecutive years of decreasing operating income, firms in that industry are classified as bad performers. We expect this measure to be a very noisy proxy of a firm's operating performance. Nevertheless, Table 11 indicates that the cash flow sensitivity of financially distressed firms is negative and of

Table 10
Cash flow sensitivities of financially distressed firms, according to operating performance

	Distress 1	Distress 2	Distress 3	Distress 4	Distress 5
A. Financially distressed firms with a negative operating income					
Q	0.048	0.048	0.051	0.044	0.043
	(10.787)*	(8.943)*	(10.869)*	(4.837)*	(6.325)*
CF/*K*	**−0.035**	**−0.038**	**−0.036**	**−0.067**	**−0.051**
	(−12.499)*	(−10.640)*	(−11.794)*	(−10.740)*	(−10.867)*
Adj. R^2	0.200	0.187	0.225	0.308	0.230
No. obs.	6,235	4,205	5,537	1,587	3,211
B. Financially distressed firms with a positive operating income					
Q	0.056	0.026	0.058	0.049	0.104
	(7.289)*	(2.391)*	(7.832)*	(2.761)*	(16.995)*
CF/*K*	**0.023**	**0.011**	**0.020**	**−0.050**	**0.078**
	(4.783)*	(1.610)	(4.133)*	(−5.458)*	(16.173)*
Adj. R^2	0.402	0.489	0.433	0.451	0.475
No. obs.	4,255	1,822	3,918	839	7,376

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a *Z*-score less than one. *T*-statistics are in parenthesis, and the asterisk denotes statistical significance at 5%.

Table 11
Cash flow sensitivity of distress 1 firms, according to industry performance

	Bad industry performers	Good industry performers
Q	0.013 (0.684)	0.011 (−3.909)*
CF/*K*	**−0.055** (−9.167)*	**−0.014** (−14.000)*
Adj. R^2	0.489	0.256
No. obs.	847	4,288

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. Bad industry performers are defined as industries that have 2 consecutive years of decreasing operating margins. *T*-statistics are in parenthesis, and the asterisk denotes statistical significance at 5%.

a greater magnitude for bad performers than for good ones. Different operating performances again produce different cash flow sensitivities.

Tables 8 and 9 show that firms with operating losses on average experience negative cash flows. The cash flow average is −1.866 for distressed firms with operating losses versus 0.083 for distressed firms with operating profits. Our cash flow sensitivity results with respect to operating performance are again consistent with previous findings. In accord with Allayannis and Mozumdar, the negative cash flow sensitivity of distressed firms with operating losses reduces the overall positive cash flow sensitivity for financially healthy firms. Restating the U-shaped investment curve of Cleary et al. in terms of operating performance, we find a negative cash flow sensitivity for the sub-sample of distressed firms with operating losses and a positive sensitivity for all other firms.

5. Gamble for resurrection

We further investigate the negative cash flow sensitivity of distressed firms with operating losses. Given that such firms are in financial distress and that they do not foresee any immediate profitable opportunities, they may choose to downsize their operations. In addition, their investment policy may not react to fluctuations in internal funds, thereby showing no cash flow sensitivity. We divide the sample of firms in financial distress with operating losses into two groups: the group of firms that invest less than the previous year and the group of firms that, against the odds, invest more than the previous year.

Table 12 shows that most firms with operating losses invest less than the previous year. For the case of distress 1 firms in panel A, nearly 60% of firm-year observations occur when firms invest less than the previous year. Firms investing less than the previous year exhibit very little cash flow sensitivity. The cash flow sensitivity is small, but negative and statistically significant for most proxies of financial distress. Firms without immediate profitable investment opportunities down size operations without much regard to fluctuations in their internal funds.

However, there remain over 40% of firm-year observations characterized by distress 1 firms with operating losses that nevertheless invest more than the previous year. These firms display a strong, negative and statistically significant sensitivity to cash flow. The

Table 12
Cash flow sensitivity of financially distressed firms with a negative operating income, according to change in investment

	Decreasing investment	Increasing investment
A. Distress 1 firms with a negative operating income		
Q	0.011 (4.994)*	0.044 (4.758)*
CF/*K*	**−0.003** (−2.078)*	**−0.039** (−6.564)*
Adj. R^2	0.329	0.210
No. obs.	3,577	2,607
B. Distress 2 firms with a negative operating income		
Q	0.010 (3.890)*	0.052 (5.048)*
CF/*K*	**−0.006** (−3.358)*	**−0.040** (−5.567)*
Adj. R^2	0.405	0.268
No. obs.	2,285	1,880
C. Distress 3 firms with a negative operating income		
Q	0.013 (5.499)*	0.048 (4.999)*
CF/*K*	**−0.003** (−1.948)	**−0.045** (−7.030)*
Adj. R^2	0.394	0.285
No. obs.	3,194	2,306
D. Distress 4 firms with a negative operating income		
Q	0.010 (2.172)*	0.063 (2.610)*
CF/*K*	**−0.004** (−1.338)	**−0.105** (−6.139)*
Adj. R^2	0.510	0.467
No. obs.	1,028	539
E. Distress 5 firms with a negative operating income		
Q	0.009 (2.833)*	0.034 (2.505)*
CF/*K*	**−0.009** (−3.642)*	**−0.050** (−5.596)*
Adj. R^2	0.383	0.260
No. obs.	1,710	1,482

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. All variables are defined in Sections 2 and 3. The distress 1 group identifies firms with a negative net income in the previous year. The distress 2 group further restricts the distress 1 group by including only firms with a negative net income in the previous 2 years. The distress 3 group includes firms with a coverage ratio less than or equal to one in the previous year. The distress 4 group is composed of firms with a pseudo-bankruptcy probability greater than or equal to 50%. The distress 5 group consists of firms with a Z-score less than one. Firms that maintain same level of capital investments as the previous year are grouped with those that increase their capital investments. T-statistics are in parenthesis, and the asterisk denotes statistical significance at 5%.

negative sensitivity implies that the firms invest more when their cash flows are decreasing.

These results are robust to the different proxies for financial distress. In panels B and E, distress 2 and distress 5 firms that invest less than the previous year have a small but negative and statistically significant sensitivity. In panels C and D, distress 3 and distress 4 firms that invest less than the previous year have in fact a zero cash flow sensitivity, downsizing irrespective of fluctuations in their internal funds. In all panels, distressed firms that invest more than the previous year exhibit the strong negative cash flow sensitivity.

The finding that some distressed firms invest more than the previous year when their cash flows are decreasing is at first surprising. A clue to this puzzle is to emphasize that an increase in investment takes place when internal funds are decreasing. Necessarily, the funding for the investment does not originate from internal sources but comes from external sources. Table 13 reports the main sources and uses of funds for distressed firms.

Table 13
Sources and uses of funds of distress 1 firms

	Major sources of funds				Major uses of funds			
	RetEarn/K	SalePPE/K	EIssue/K	DIssue/K	Div/K	I/K	DRed/K	ERep/K
A. Firms with a negative operating income decreasing investment								
No. obs.=2,607								
Median	**−2.200**	**0.000**	**0.010**	**0.000**	**0.000**	**0.094**	**0.065**	**0.000**
Mean	−8.002	0.046	0.973	0.335	0.007	0.147	0.304	0.019
S.D.	14.747	0.113	2.613	0.970	0.049	0.162	0.715	0.111
Min.	−64.164	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Max.	10.100	0.549	14.634	7.573	0.593	2.682	5.021	1.104
Obs. not missing	84.71%	81.60%	96.06%	95.61%	98.85%	100.00%	97.12%	94.97%
B. Firms with a negative operating income increasing investment								
No. obs.=3,577								
Median	**−4.572**	**0.000**	**0.121**	**0.000**	**0.000**	**0.379**	**0.069**	**0.000**
Mean	−12.904	0.039	2.515	0.673	0.012	0.643	0.433	0.030
S.D.	19.258	0.112	4.493	1.627	0.069	0.704	1.000	0.152
Min.	−64.164	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Max.	10.100	0.549	14.634	7.573	0.593	2.682	5.021	1.104
Obs. not missing	80.40%	83.01%	96.20%	96.55%	98.58%	100.00%	97.05%	93.40%
C. Firms with a positive operating income decreasing investment								
No. obs.=2,450								
Median	**0.250**	**0.005**	**0.000**	**0.026**	**0.000**	**0.101**	**0.139**	**0.000**
Mean	−0.616	0.039	0.105	0.316	0.015	0.126	0.397	0.020
S.D.	4.880	0.091	0.632	0.863	0.045	0.112	0.760	0.098
Min.	−64.164	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Max.	10.100	0.549	12.462	7.573	0.593	2.682	5.021	1.104
Obs. not missing	93.88%	76.08%	96.04%	93.71%	98.45%	100.00%	96.37%	96.12%
D. Firms with a positive operating income increasing investment								
No. obs.=1,798								
Median	**0.149**	**0.005**	**0.003**	**0.047**	**0.000**	**0.211**	**0.137**	**0.000**
Mean	−1.303	0.037	0.313	0.437	0.020	0.300	0.426	0.031
S.D.	6.964	0.090	1.386	1.084	0.061	0.333	0.841	0.131
Min.	−64.164	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Max.	10.100	0.549	14.634	7.573	0.593	2.682	5.021	1.104
Obs. not missing	91.05%	76.75%	96.77%	95.88%	98.55%	100.00%	95.55%	96.00%

Note: The sample consists of manufacturing COMPUSTAT firms from the 1979–1996 period. The sample is winsorized at the top and bottom 1% of firm-year observations. The sources and uses of funds are defined in Section 5. The distress 1 group identifies firms with a negative net income in the previous year. Firms that maintain same level of capital investments as the previous year are grouped with those that increase their capital investments.

Sources of funds include the beginning-of-the-period retained earnings *RetEarn* (item 36), the sale of property, plant and equipment *SalePPE* (item 107), equity issues *EIssue* (item 108) and debt issues *DIssue* (item 111). Uses of funds include cash dividend payments *Div* (item 127), investment *I* (item 128), long-term debt reductions *Dred* (item 114) and equity repurchases *Erep* (item 115). All sources and uses are standardized by the firm's capital stock *K* (item 8).

Table 13 shows that the investment is financed by equity claimants. The median firm with operating losses that invests *more* than the previous year raises much more funds from the equity market than the median firm with operating losses that invests *less* than the previous year *EIssue*/*K* (0.121>0.010). Equity claimants invest in their firm despite difficult financial and operating conditions.

Naturally, the median firm with operating losses that invests more has larger capital expenditures than the median firm with operating losses that invests less *I*/*K* (0.379>0.094). Table 13 also shows that it has smaller retained earnings *RetEarn*/*K* (−4.572<−2.200). The retained earnings are negative and of a greater magnitude than the tangible assets of the firm. This indicates that distressed firms with operating losses have in fact accumulated losses for some time.

The reliance on equity issues to fund investment is specific to firms with operating losses. Table 13 shows that, compared to the median firm with operating profits that invests less than the previous year, the median firm with operating profits that invests more than the previous year has larger capital expenditures *I*/*K* (0.211>0.101), smaller retained earnings *RetEarn*/*K* (0.149<0.250), but about the same minimal amount of equity issues *EIssue*/*K* (0.003 ≈ 0.000).

In fact, among the distressed firms that invest more than the previous year, the ones with *operating losses* differ from those with *operating profits* in terms of their investment, retained earnings and equity issues. The median firm with operating losses has smaller retained earnings (−4.572<0.149), invests more (0.379>0.211) and relies more on equity issues to fund the investment (0.121>0.003). In other words, firms with operating losses invest more and have less internal funds to finance their investment. Instead, they turn to equity claimants.

The evidence is consistent with Jensen and Meckling's asset substitution problem. Because equity claimants are protected by limited liability, they prefer riskier projects to those maximizing total firm value. In our context, they finance the increased investment of financially distressed firms operating at a loss.

Décamps and Faure-Grimaud (2000) describe the gamble for resurrection as an agency problem arising when equity claimants of a distressed firm decide to continue operations when liquidation would have been optimal. Continuing operations allows equity claimants to be exposed to future uncertain but perhaps better operating conditions. Equity claimants hope that some fortunate event occurs and lifts the value of their claims. In such distress, equity claimants who are protected by limited liability may have very little to lose, and thus gamble for resurrection.

Our evidence complements the work of Andrade and Kaplan. In their sample of distressed firms with operating profits, they do not find support for any risk shifting behavior. Indeed, we uncover evidence consistent with the agency problem only for a subset of distressed firms with operating losses.

6. Conclusion

The relation between investment and internal funds for financially distressed firms is diverse. First, they exhibit a positive cash flow sensitivity if firms operate at a profit, similar to the cash flow sensitivity results already documented in the literature for financially healthy firms. Second, they exhibit little cash flow sensitivity if firms operate at a loss and invest less than the previous year. Third, they exhibit a strong negative cash flow sensitivity if firms operate at a loss but nevertheless invest more than the previous year.

Our results clearly emphasize that not all manufacturing firms rely on their internal funds to finance their investments. The increase in investment of financially distressed firms with operating losses is funded by equity claimants. Equity claimants may lose from providing financing to an unprofitable firm, but nevertheless gamble for the firm's resurrection. Equity claimants bet that this investment allows for the possibility of a good event turning around the fortunes of the firm. Thus, for this group of firms, the gamble for resurrection appears to overrule the financing hierarchy hypothesis as an explanation of firms' investment behavior. Further empirical research into the gamble for resurrection would be helpful.

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References

Allayannis, G., Mozumdar, A., 2004. The impact of negative cash flow and influential observations on investment-cash flow sensitivity estimates. Journal of Banking and Finance 28, 901–930.

Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. Journal of Finance 23, 589–609.

Andrade, G., Kaplan, S.N., 1998. How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed. Journal of Finance 53, 1443–1493.

Cleary, S., 1999. The relationship between firm investment and financial status. Journal of Finance 54, 673–692.

Cleary, S., Povel, P., Raith, M. 2004, The U-shaped investment curve: Theory and evidence. Working Paper from St. Mary's University, University of Minnesota, and University of Rochester.

Décamps, J.-P., Faure-Grimaud, A., 2000. Bankruptcy costs, ex post renegotiation and gambling for resurrection. Finance 21, 71–84.

Fazzari, S.M., Hubbard, R.G., Petersen, B.C., 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity 1, 141–195.

Fazzari, S.M., Hubbard, R.G., Petersen, B.C., 2000. Investment-cash flow sensitivities are useful: a comment on Kaplan and Zingales. Quarterly Journal of Economics 115, 695–705.

Gilchrist, S., Himmelberg, C.P., 1995. Evidence on the role of cash flow in reduced-form investment equations. Journal of Monetary Economics 36, 541–572.

Gul, F.A., Tsui, J.S.L., 1998. A test of the free cash flow and debt monitoring hypotheses: evidence from audit pricing. Journal of Accounting and Economics 24, 219–237.

Hoshi, T., Kashyap, A.K., Scharfstein, D., 1991. Corporate structure, liquidity, and investment: evidence from Japanese panel data. Quarterly Journal of Economics 106, 33–60.

Hubbard, R.G., 1998. Capital-market imperfections and investment. Journal of Economic Literature 36, 193–225.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3, 305–360.

John, K., Lang, L.H.P., Netter, J., 1992. The voluntary restructuring of large firms in response to performance decline. Journal of Finance 47, 891–918.

Kadapakkam, P.-R., Kumar, P.C., Riddick, L.A., 1998. The impact of cash flows and firm size on investment: the international evidence. Journal of Banking and Finance 22, 293–320.

Kaplan, S.N., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 169–215.

Kaplan, S.N., Zingales, L., 2000. Investment-cash flow sensitivities are not valid measures of financing constraints. Quarterly Journal of Economics 115, 707–712.

Moyen, N., 2004. Investment-cash flow sensitivities: constrained versus unconstrained firms. Journal of Finance 59, 2061–2092.

Myers, S.C., Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13, 187–221.

Ohlson, J.A., 1980. Financial ratios and the probabilistic prediction of bankruptcy. Journal of Accounting Research 18, 109–131.

Oliner, S.D., Rudebusch, G.D., 1992. Sources of the financing hierarchy for business investment. Review of Economics and Statistics 74, 643–654.

Schaller, H., 1993. Asymmetric information, liquidity constraints, and Canadian investment. Canadian Journal of Economics 26, 552–574.