Effects of Leverage on Corporate Investment and Hiring Decisions

by Richard Cantor

The rising indebtedness of the U.S. business sector raises some issues for macroeconomic stabilization policy.[1] Recent studies have investigated whether this rise in corporate leverage has increased the risk of bankruptcies or liquidations in economic downturns.[2] This article presents evidence that increases in leverage at the firm level are associated with increased volatility in capital expenditures and employment growth rates. Such a relationship implies that an increase in the average level of indebtedness across firms may cause the economy to become more vulnerable to macroeconomic shocks and more sensitive to changes in monetary policy.

The potential effects of leverage are assessed in this article by comparing investment and employment patterns of firms with different average levels of indebtedness. The highly leveraged firms are shown to have experienced greater than average volatility in their expenditures on plant, equipment, and labor. Even after controlling for a variety of other firm characteristics, the empirical analysis shows a positive statistical relationship between leverage and volatility in investment and employment.

The analysis also suggests an explanation for the greater average volatility of highly leveraged firms: a heightened sensitivity to fluctuations in cash flow. Because these firms typically face substantial debt service obligations and have limited ability to borrow additional funds, they may feel extra pressure to maintain a positive cash flow cushion. Thus they will be more likely than their less leveraged counterparts to respond to changes in cost and demand by sharply adjusting their input expenditures. Most notably, when sales drop off, even temporarily, highly leveraged firms may choose to postpone investment or to lay off workers until demand strengthens.[3]

The empirical methodology used in this article to relate leverage to cash flow sensitivities follows that employed in a recent study by Fazzari, Hubbard, and Petersen.[4] These authors show that small, fast-growing firms with low dividend-payout rates tend to have heightened correlations between their investment rates

[1]For documentation of the recent rise in corporate leverage, see Ben Bernanke and John Campbell, "Is There a Corporate Debt Crisis?" *Brookings Papers on Economic Activity*, 1:1988, pp. 83-125; and Richard Kopke, "The Roles of Debt and Equity in Financing Corporate Investments," *New England Economic Review*, July-August 1989, pp. 25-48. For a discussion of the potential effects of leverage on macroeconomic stability and monetary policy transmission, see Benjamin Friedman, "Implications of Corporate Indebtedness for Monetary Policy," unpublished paper, Harvard University, September 1989; and William Lee, "Corporate Leverage and the Consequences of Macroeconomic Instability," in *Studies on Financial Changes and the Transmission of Monetary Policy*, Federal Reserve Bank of New York, 1990, pp. 135-68.

[2]See, for example, Bernanke and Campbell, "Is There a Corporate Debt Crisis?" and David Wyss, Christopher Probyn, and Robert de Angelis, "The Impact of Recession on High Yield Bonds," Alliance for Capital Access, Washington, D.C., July 1989, mimeo.

[3]Bernanke and Campbell state that "the way financial distress distorts decisions may depend on how close to bankruptcy a firm is. The managers of a firm that is doing poorly but is not in immediate danger may become conservative...to avoid potentially fatal mistakes....Once bankruptcy becomes likely, on the other hand, gambling becomes a better strategy for the managers."

[4]Steven Fazzari, R. Glenn Hubbard, and Bruce Petersen, "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, 1:1988, pp. 141-95.

and fluctuations in their cash flows. The highly leveraged firms examined here are also shown to have investment rates with sharp sensitivities to fluctuations in sales and cash flow. Thus the methodology produces similar results in the two studies although the sample of leveraged firms in this analysis is more heavily weighted toward larger and less rapidly growing companies. This article also extends its analysis to the relationship between cash flow and employment, a topic not covered in the earlier study.

Background

Over the years, economists have shifted their assessment of the effects of cash flows or internally generated funds on firms' capital expenditures. It was traditionally believed that cash flow was important for firms' investment decisions because firm managers regarded internal funds as less expensive than external funds. In the 1950s and 1960s, this view led to numerous empirical assessments of the role of internal funds in firm investment behavior.[5] These studies found strong relationships between cash flow and investment. However, because sales, output, and cash flow have historically been highly correlated in aggregate data, these studies could not isolate the variable that was actually driving investment. Thus the results obtained may also have been consistent with theories of investment that deemphasize internal funds.

The literature's emphasis on the interaction of real and financial variables declined after a theoretical paper by Modigliani and Miller showed that, under certain theoretical conditions (perfect capital markets, no taxes, and no bankruptcy), the market would not consider a firm's capital structure when valuing its assets.[6] By implication, the marginal cost of equity, debt, and internal funds financing would then be equal, and financial policy would be irrelevant to investment and employment decisions. If a firm's internal funds exceeded its real investment needs, this free cash flow would be either returned directly to stockholders through dividends or stock buybacks or invested for them by acquiring income-earning assets.

The theoretical case for the independence of real and financial decisions was reinforced when Jorgenson presented empirical evidence that aggregate cash flow or profits variables provided no additional explanatory power for aggregate investment regressions if sales or output variables were included in the equations.[7] Models that denied a role to internal funds therefore dominated the investment literature until recently, largely because of their theoretical appeal.

Newly developed formal models, however, challenge the assumptions underlying the so-called Modigliani-Miller theorem and argue that a firm's investment and employment decisions do depend on the availability of internal finance. The theoretical arguments supporting these models generally describe how the existence of informational asymmetries between firm managers and lenders can raise the cost of external funds over the cost of internal funds.[8] The main argument is that because managers can only be imperfectly monitored by investors, lenders will require a higher rate of return to be compensated for the possibility that the manager is wasting resources. The increased availability of internally generated funds lowers the cost of capital and thus affects real economic decisions by inducing more investment than would occur if managers had to seek external finance. Internally generated funds are therefore cheaper at the margin than external funding. It follows that firms with plenty of internally generated cash may tend to invest more, other factors equal.

This argument has implications for the relative responsiveness of different types of firms to fluctuations in their cash flows. A firm with a large average cash flow typically accumulates a substantial reserve of internal funds that can be drawn upon to maintain an investment program when cash flow drops off in a particular year. By contrast, a highly leveraged firm with a small average cash flow does not have such a reserve and may need to cut investments back sharply in response to a decline in cash flow. When revenues and internal funds pick up, the leveraged firm is more apt to increase its capital expenditures. Overall, the leveraged firm is therefore likely to exhibit greater variability in its investments over time.

The recent availability of quality historical data on individual firms and the increasing popularity of these asymmetric-information models of the firm's capital structure have renewed interest in the empirical estimation of the interaction between financial variables and firm investment.[9] Articles exploring this relation-

[5]See, for example, the joint work of Edwin Kuh and John Meyer, *The Investment Decision* (Cambridge: Harvard University Press, 1957); and "Investment, Liquidity and Monetary Policy," in *Commission on Money and Credit: Impacts of Monetary Policy* (Englewood Cliffs, N.J.: Prentice Hall, 1963).

[6]Franco Modigliani and Merton Miller, "The Cost of Capital, Corporate Finance, and the Theory of Investment," *American Economic Review*, vol. 48 (June 1958), pp. 261-97.

[7]Dale Jorgenson, "Econometric Studies of Investment Behavior," *Journal of Economic Literature*, vol. 9 (1971), pp. 1111-47.

[8]This recent literature is surveyed by Mark Gertler and R. Glenn Hubbard, "Financial Factors in Business Fluctuations," in *Financial Market Volatility*, Federal Reserve Bank of Kansas City, 1988.

[9]An article by Steven Fazzari and Michael Athey, "Asymmetric Information, Financing Constraints and Investment," *Review of Economics and Statistics*, August 1989, pp. 481-87, uses Compustat data to show that if one adds internal finance (after-tax profits plus

ship confirm that fluctuations in internal funds are important determinants of investment.

Fazzari, Hubbard, and Petersen show that internal funds are more important for explaining the investment of certain cash-constrained firms (specifically, those that have low average dividend-payout rates) than the investment of other firms. In the authors' data set, these firms are smaller, faster growing, and more subject to sales volatility than the rest of the sample. These characteristics, combined with the firms' practice of using most of their earnings for investment, make the firms more likely to face a large differential cost between internal and external funds. The novelty of the Fazzari, Hubbard, and Petersen approach lies in demonstrating that the behavior of certain classes of firms depends on capital market imperfections and the availability of internal funds while other firms behave as if they face relatively perfect capital markets.[10]

The analysis that follows uses the logic and methodology of the Fazzari, Hubbard, and Petersen study to investigate whether highly leveraged firms — firms that are cash-constrained because of debt service obligations — exhibit increased sensitivity to cash flow. These firms, like the small, rapidly growing firms studied by Fazzari and his colleagues, are likely to face higher borrowing costs than less leveraged firms. In addition, the analysis tests whether leveraged firms have heightened sensitivities to current demand conditions when cash flow is held constant. Particularly when high leverage encourages a risk-averse attitude on the part of management, a drop in current sales may lead firms to postpone investment and strenuously avoid inventory buildup, even if they are experiencing offsetting improvements in interest or other expenses. Since the maintenance of employment in a downturn can be viewed as an investment by firms, these effects may also be present in the employment patterns of leveraged firms. In sum, the statistical analysis presented below is designed to assess the effect of leverage on overall cyclical variability by studying the interaction of financial and real variables for both firm employment and investment in plant and equipment.

Footnote 9 continued
depreciation less dividends) and interest expense variables to a sales accelerator model with fixed firm effects, internal finance is positively, and interest expense negatively, related to investment.

Using Value Line data and somewhat different econometric techniques, Steven Fazzari and Tracy Mott ("The Investment Theories of Kalecki and Keynes: An Empirical Study of Firm Data, 1970-1982," *Journal of Post Keynesian Economics*, Winter 1987-88, pp. 171-87) show that these financial variables are also important in CAPM-based models, neoclassical models of investment, and sales accelerator models.

[10]A related article by Takeo Hoshi, Anil Kashyap, and David Scharfstein, "Corporate Structure, Liquidity and Investment: Evidence from Japanese Industrial Groups," *Quarterly Journal of Economics*, vol. 109 (September 1988), identifies a group of Japanese firms that face relatively small differentials between their costs of internal and external finance because they have close ties to individual banks. The authors find that firms without such relationships alter their capital expenditures much more in response to cash flow and liquid asset fluctuations than do those firms with special banking relationships.

In an unpublished paper, "Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data," Princeton University, 1989, Toni Whited adopts an Euler equation estimation approach and shows that for most firms the neoclassical model is not rejected by the Compustat data while for firms that are classified a priori as experiencing "financial distress," the model needs to be amended to incorporate a potentially binding financing constraint. The financially constrained or distressed firms, like the low dividend-payout firms identified by Fazzari, Hubbard, and Petersen, are smaller and faster growing than the rest of the sample.

These three papers do not reveal, however, whether firms that have increased their leverage in recent years are likely to change their behavior as a result of their restructuring. Many of the recent leveraged buyouts have involved large, mature firms in noncyclical, stable industries such as medical services, retailing, and entertainment. Fazzari, Hubbard, and Petersen did not report the leverage ratios of their low dividend-payout firms, but the recent leveraged buyouts have typically involved firms that have very different characteristics than the low dividend-payout firms examined by these authors.

Characteristics of the data

The basic data source for this article is the Compustat annual financial data tapes, which contain information on firms between 1968 and 1987.[11] Only 778 nonfinancial firms have complete data sets for all variables (including necessary lags) used in this study. Firms that had large acquisitions over this period were eliminated from the sample because the statistical procedures (the model's lag structure and the estimation of the fixed firm effects) employed in the study required that the general characteristics of the firms be constant over time.[12]

Of the remaining 586 firms, a surprisingly large number, 176, had lower sales revenue (in 1982 dollars) in 1987 than in 1971. These negative-growth firms were not dropped from the sample (as they were in the Fazzari, Hubbard, and Petersen analysis) because this study is particularly concerned with the ways in which firms respond to adverse shocks. Nevertheless, many of the regressions reported below for the sample of 586 firms were also run on a sample limited to the 410 firms that showed positive growth, and the results

[11]The general quality of the Compustat data and its merits relative to the Value Line data have been discussed in an unpublished paper by Terry Zivney and Richard Marcus, "A Comparative Analysis of Compustat and Value Line Financial Data Tapes," University of Tennessee, February 1989.

[12]Firms were dropped if they had a capital stock acquisition in one year exceeding 15 percent of their existing capital stock. Fazzari, Hubbard, and Petersen used a slightly different rule, eliminating firms that had asset acquisitions exceeding 10 percent of existing assets. Whited, in "Debt, Liquidity Constraints, and Corporate Investment," eliminated firms that had asset acquisitions exceeding 15 percent of existing assets. Various rules were tried and appeared to have little effect on the main results of this paper.

changed very little.[13]

The definition of cash flow used in this paper is net income (earnings after interest and taxes) plus depreciation and amortization.[14] Investment is defined as capital expenditures other than those obtained through acquisitions of other firms. Compustat's employment data are usually measured at the end of the year, but some firms may report midyear or year-average data. The rest of the data are reported on a fiscal-year basis; the median reporting date among firms is December 31, but there is wide dispersion.

The market value of the end-of-year capital stock is calculated in the same manner as in Fazzari, Hubbard, and Petersen. Physical depreciation rates are estimated for each firm from its reported depreciation and gross book value of capital. As a benchmark starting value, the reported book value of the net capital stock is assumed to be an accurate measure of the market value of the stock in 1968. Subsequent capital stocks are calculated by adding capital expenditures (investment and net capital acquisitions), subtracting estimated physical depreciation, and adjusting the total by changes in the aggregate price of capital goods.[15]

Summary statistics describing the more and less leveraged firms

The 586 firms are split into two groups according to their average degree of leverage over the sample. Associated with each firm is a single debt-to-asset ratio that equals its median book value debt-to-asset ratio over the seventeen years between 1971 and 1987. The firms are ranked on the basis of this ratio: the most leveraged 20 percent, 118 firms, are placed in the highly leveraged "group H," and the remaining 80 percent, 456 firms, are assigned to the less leveraged "group L."[16] Other methods of splitting the sample were considered, and one method based on interest coverage ratios is discussed below, but this article focuses primarily on the book-value debt-to-asset ratio grouping.[17]

Table 1 shows that the firms' debt-to-asset ratios range between 0.32 and 0.69 for group H and between 0.00 and 0.32 for group L. Splitting the sample into groups on a year-by-year basis would lead to some switching of firms in and out of the two groups, but

[13]A noticeable difference did occur when the sample was split, as in Fazzari, Hubbard, and Petersen, into two groups: firms with low dividend-payout rates and firms with high dividend-payout rates. In the sample of 410 firms, the high retention rate firms are, on average, smaller and faster growing than other firms, and their investment rates are more sensitive to cash flow variations. The firms in the high-leverage group do not have higher than average retention rates.

[14]Some experimentation suggested that the results presented here are not sensitive to modifications of the definition of cash flow — such as excluding preferred or ordinary dividends or including taxes.

[15]Unlike other authors, I add to the previous year's capital stock the physical capital obtained through acquisitions of other firms.

[16]Firms ranked in the "top 20 percent" by their dividend-payout ratios were also singled out for study by Fazzari, Hubbard, and Petersen, but this percentage is essentially an arbitrary cutoff point. The effect of splitting the top 20 percent into the top 10 percent and the next 10 percent is discussed below.

[17]The debt-to-asset ratio is intended to measure a firm's capacity to respond to investment opportunities and its ability to absorb shocks. The choice of book value over market value is somewhat arbitrary, but it is based in part on the relative ease of the former's calculation. Market value and book value measures of debts and assets may not accurately reflect a liquidation value or capacity to borrow. Bernanke and Campbell, "Is There a Corporate Debt Crisis?" and Kopke, "The Role of Debt and Liquidity," compare trends in book value debt to market value debt for Compustat firms.

Table 1

Sample Statistics for the Highly Leveraged (Group H) and Less Leveraged (Group L) Firms

(Median, Means, and Standard Deviations Calculated for Individual Firms over Seventeen Years: 1971-87)

	Group H	Group L
Number of firms	118	468
Median debt/asset ratio — highest in group	0.69	0.32
Median debt/asset ratio — lowest in group	0.32	0.00
Median Values in Each Group		
Median debt-to-asset ratio	0.39	0.20
Debt-to-asset ratio in 1971	0.40	0.21
Debt-to-asset ratio in 1987	0.38	0.21
Assets in 1971 (in millions of 1982 dollars)	262	263
Assets in 1987 (in millions of 1982 dollars)	371	481
Median cash flow†–to–interest coverage	2.95	6.84
Mean annual real sales growth rates	0.033	0.035
Mean annual employment growth rates	0.008	0.011
Mean annual investment-to-capital ratios	0.13	0.14
Mean annual real cash flows‡ (in millions of 1982 dollars)	21.2	37.3
Standard deviations of annual investment-to-capital ratios	0.095	0.071
Standard deviations of annual employment growth rates	0.142	0.114
Standard deviations of real sales growth rates	0.153	0.122
Standard deviations of annual real cash flows‡ (in millions of 1982 dollars)	15.4	15.4
Mean Values in Each Group		
Standard deviations of annual investment-to-capital ratios	0.126	0.085
Standard deviations of mean employment growth rates	0.191	0.136

†Cash flow = net income + interest expense + depreciation + amortization.
‡Cash flow = net income + depreciation + amortization.

overall the relative indebtedness of the firms in the two groups is fairly stable. The median debt-to-asset ratio of group H firms is almost twice that of group L firms in both 1971 and 1987.

This median debt-to-asset ratio is a "stock" measure of leverage, but it has a natural "flow" counterpart, the firm's median cash flow–to–interest coverage ratio over the 1971 to 1987 period. The average values of this ratio among firms in groups H and L are 2.95 and 6.84, respectively, indicating that the group H firms are more highly leveraged in this flow sense as well.[18] These measures also indicate, however, that the differences in leverage are moderate compared to the debt-to-asset and interest-coverage ratios of many of the firms that underwent financial restructurings through leveraged buyouts in 1980s.[19]

The typical firms of groups H and L are similar in asset size. The average group H firm had assets (in current dollars) in 1971 and 1987 of about $262 million and $371 million, respectively, and the corresponding group L averages were $263 million and $481 million. In line with their somewhat faster asset growth, the group L firms had slightly higher sales growth, employment growth, and investment rates. The group H firms had significantly lower average cash flow (net income plus depreciation and amortization), a finding which reflects their higher leverage.

The most interesting difference between the two groups for the purposes of this study is that the highly leveraged firms experienced more volatility (that is, greater seventeen-year standard deviations) in their investment and employment rates. These firms also had higher sales volatility, because of more variable demand and/or more variable production.[20] The two groups experienced similar volatility in their cash flows. Differences in leverage for this sample, therefore, cannot readily be explained or justified by arguing that firms with less volatile cash flows or revenues can "afford" higher leverage without increased risk of bankruptcy.

These summary statistics are consistent with the view that highly leveraged firms experience greater volatility, both in sales and input expenditures. The following two sections study reduced form relationships that may clarify the source of these different characteristics. Since the group H firms were neither particularly small nor rapidly growing, the results of this study may be relevant for understanding the impact of the recent trend toward increased leverage among large, mature firms.

Explaining differences in investment and employment volatilities across firms

This section provides evidence that the differences in investment and employment volatilities may in fact be due to differences in leverage rather than firm-specific or industry characteristics that happen to be correlated with leverage. The regressions presented attempt to explain the differences across firms with respect to their investment rate (investment divided by the prior year-end capital stock) and employment growth rate volatilities, where volatilities are measured by standard deviations calculated over seventeen years.

Table 2 displays the main results. The dependent variables in the two regressions are cross sections of the standard deviations of firms' investment rates and employment growth rates. Some industries may have systematically higher leverage ratios[21] and greater investment and employment volatilities. All cross-sectional regressions therefore include industry dummies (coefficient estimates not reported) to ensure that the measured correlation between leverage and volatility is not simply capturing special industry effects.[22]

Because previous studies have shown that small and rapidly growing firms tend to experience greater volatility, variables for growth and size are included as controls in all the regressions as well. Firm size is measured by the dollar value of assets in 1979, the midpoint of the sample. The estimated coefficient on firm size is indeed negative, as expected, and statistically significant. Firm growth is measured by average investment and average employment growth rates in the investment and employment volatility regressions, respectively. The estimated coefficient is positive, as expected, and statistically highly significant.

Sales and cash flow volatility measures are also included in the regressions to control for variability of demand, input costs, and interest payments facing each firm. The explanatory variables used are the standard deviations of each firm's real sales and real cash

[18]For the calculation of this particular ratio, interest expenses are included (added back) to cash flow. Of the 118 firms that make up the top 20 percent of firms with respect to their debt-to-asset ratios, 79 are among the 118 firms that make up the bottom 20 percent with respect to interest coverage.

[19]The Compustat database excludes firms that are not publicly traded, such as those that have become highly indebted as a result of leveraged buyouts.

[20]Input cost variations might induce production changes even if the demand curve facing the firm were constant.

[21]The determinants of differences in leverage across industries are discussed by Robert Bowen, Lane Daley, and Charles Huber in "Evidence on the Existence and Determinants of Inter-Industry Differences in Leverage," *Financial Management*, Winter 1982, pp. 10-20.

[22]Industries were classified at the two-digit standard industry classification level. The dummies were always significant as a group; however, dropping them had little effect on the other estimated coefficients.

flows (divided by the real capital stock in the investment regressions and divided by the number of employees in the employment regressions). As expected, these two variables have positive coefficient estimates in both sets of regressions. Firm investment and employment volatilities appear somewhat more correlated with the variability of sales than with the variability of cash flow.

The most important regression results concern the estimated coefficients on the so-called dummy variables. These variables allow for marginal, constant-term effects on volatility for members of group H. The estimated coefficients on the dummy variables measure the extent to which volatility differences across firms are explained by the leverage grouping alone rather than industry- or firm-specific differences captured by the other included variables.

The estimate of the marginal group H effect in the investment volatility regression is 0.033—not very different from the difference (0.041) between the mean standard deviations of investment rates for groups H and L, shown in Table 1. This finding suggests that the difference in average investment volatility is not due to special industry factors, differences in firm growth rates, or differences in firm sizes.

Similar results hold for the employment volatility regression. The estimate of the marginal group H effect in the first employment volatility regression is 0.058—very similar to the difference (0.055) between the mean standard deviations of employment growth rates for groups H and L shown in Table 1. This suggests that the difference in employment volatilities across the two groups is not due to special industry factors, differences in firm growth rates, or differences in firm sizes.

Table 3 presents regressions that probe somewhat deeper into the ways in which higher leverage may lead to greater volatility. To the basic investment and employment volatility specifications in Table 2, the regressions in Table 3 add marginal sales and cash flow volatility effects. These specifications allow the coefficients on the sales and cash volatility variables to vary between group H firms and the rest of sample.

For example, the left-most columns of Tables 2 and 3 report specifications that are identical except for the inclusion of the "group H sales volatility" dummy variable in the Table 3 regression. This variable consists of sales volatilities for group H firms and zeros for group L firms.[23] The effect of sales volatility on investment volatility for group L firms is measured simply by the sales volatility coefficient, 0.001, reported in the second row of Table 3. For group H firms, the total effect is 0.022, that is, the sum of 0.001 and 0.021, the group H sales volatility coefficient shown in the fifth row of Table 3.

The results suggest that the greater volatility of group H firms is not simply exogenous, separate from the other observable forces affecting the firms; rather, the volatility of group H firms seems to arise from their greater sensitivity to sales and cash volatilities. In the specifications of Table 3, the significance of the group H dummy for the constant term is greatly reduced. This result is consistent with findings, reported in the next section, that increased leverage heightens the sensitivity of investment and employment to sales and cash flow shocks.

The evidence presented in this section argues that

Table 2

The Marginal Effects of Leverage on Investment and Employment Volatilities: Basic Regressions

Explanatory Variables	Dependent Variables: Volatility of Firms' Investment Rates	Dependent Variables: Volatility of Firms' Employment Growth Rates
Firm size	−1.543	−2.442
	(2.2)	(2.2)
Average growth rate	0.979	1.975
	(17.3)	(12.0)
Sales volatility	0.009	0.002
	(8.0)	(8.8)
Cash flow volatility	0.047	−0.000
	(2.4)	(0.2)
	Group H Dummy for the Constant Term	
Group H dummy variable	0.033	0.058
	(3.8)	(4.4)
R^2	0.79	0.76

Notes: Sample consists of 586 observations (firms). Means and standard deviations are calculated over the period 1971-87. All regressions include industry dummies (estimates not reported). Absolute t-statistics are shown in parentheses beneath coefficients.

Explanation of variables:

Volatility of firms' investment rates: standard deviations of investment-to-capital ratios.

Volatility of firms' employment growth rates: standard deviations of firms' employment growth rates.

Firm size: the firms' dollar value of assets in 1979.

Average growth rates: mean investment rates and mean employment growth rates in the investment and employment volatility equations, respectively.

Sales volatility: standard deviation of firms' real sales–to–real capital or real sales–to–employment ratios in the investment and employment volatility equations, respectively.

Cash flow volatility: standard deviation of firms' real cash flow–to–real capital or real cash flow–to–employment ratios in the investment and employment volatility equations, respectively.

[23]This variable can be thought of as the product of a group H dummy variable (unity if a firm is a group H member, zero otherwise) times the firms' sales volatilities.

Table 3

The Marginal Effects of Leverage on Investment and Employment Volatilities: Robustness Tests

	Dependent Variables					
	Volatility of Firms' Investment Rates			Volatility of Firms' Employment Growth Rates		
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Firm size	−1.760	−1.741	−1.756	−2.202	−2.454	−2.312
	(3.0)	(3.0)	(3.0)	(2.1)	(2.3)	(2.2)
Average growth rate	0.813	0.798	0.802	0.925	0.964	0.916
	(17.2)	(16.8)	(16.9)	(10.3)	(10.9)	(10.3)
Sales volatility	0.001	0.002	0.001	0.001	0.001	0.001
	(1.3)	(2.0)	(1.4)	(2.1)	(2.3)	(2.2)
Cash flow volatility	0.062	0.053	0.058	0.000	−0.001	−0.001
	(4.0)	(3.4)	(3.7)	(0.7)	(2.4)	(1.9)
	Group H Dummies for the Constant Term and the Slope Coefficients					
Constant term	−0.018	−0.032	−0.017	0.012	0.029	0.013
	(0.2)	(3.9)	(1.8)	(0.8)	(2.2)	(0.9)
Sales volatility	0.021		0.012	0.002		0.001
	(16.3)		(2.8)	(6.2)		(2.8)
Cash flow volatility		0.486	0.231		0.005	0.003
		(16.2)	(2.4)		(6.4)	(3.3)
R^2	0.86	0.86	0.86	0.77	0.77	0.78

Notes: Columns 1-3 present alternative specifications for the investment regression; columns 4-6 present alternative specifications for the employment regression. Variables and sample are defined in Table 2. Group H dummies are marginal constant terms or slope coefficients. All regressions include industry dummies (estimates not reported). Absolute t-statistics are shown in parentheses beneath coefficients.

Table 4

The Cash Flow Sensitivities of Firms' Investment and Employment Demands: Variations across Leverage Groups

	Dependent Variables			
Explanatory Variables	Firm Investment	Firm Investment	Firm Employment Growth	Firm Employment Growth
Current sales	1.1	1.5	32.4	29.8
	(16.7)	(18.1)	(40.7)	(35.4)
Sales lagged one year	−1.0	−0.4	−24.5	−24.5
	(12.3)	(4.9)	(22.2)	(22.8)
Sales lagged two years	0.2	−0.4	5.8	5.5
	(2.1)	(4.2)	(5.8)	(5.7)
Sales lagged three years	−0.2	0.3	0.3	−1.1
	(3.0)	(4.0)	(0.4)	(1.7)
Cash flow	6.8		−8.1	
	(11.1)	*	(4.4)	*
	Group H Dummy on the Cash Flow Slope Coefficient			
Cash flow (group H effect)	45.2	20.0	37.8	18.0
	(29.0)	(10.1)	(13.1)	(5.6)
R^2	0.40	0.46	0.23	0.29

Notes: All regressions are based on a sample of 586 firms over seventeen years and include fixed-firm and year effects (not reported). All estimated coefficients in the investment and employment equations have been multiplied by 100 and 10,000, respectively. Absolute t-statistics are shown in parentheses beneath the estimated coefficients. The dependent and explanatory variables in the investment and employment equations are deflated by the lagged capital stock (divided by the capital goods deflator) and employment level, respectively. Sales and cash flows are divided by the GNP deflator.

*These regressions include marginal coefficients on cash flow estimated separately for each industry (not reported). These coefficients render a unique overall slope coefficient unidentifiable.

the more leveraged firms experience more investment and employment volatility and that the differences cannot be attributed to industry, firm-size, or firm-growth-rate effects. Furthermore, differences in standard deviations of investment and employment among group H firms are strongly correlated with differences in their sales and cash flow variability. Although it is not surprising that the firms with high (low) sales and cash volatility have tended toward high (low) investment and employment volatility as well, it is significant that this relationship is more pronounced for group H than for group L firms.

The effects of leverage on the sensitivities of firms' investment and employment demand to changes in sales and cash flows

This section presents estimates of simple models of firm investment and employment demands. The basic specifications relate capital expenditures and employment growth to current and lagged values of sales and current cash flow. The main result is that, when the specifications permit different coefficients on cash flow for the two groups, the highly leveraged firms exhibit significantly greater responsiveness of both investment and employment to cash flow.

The rest of the section presents regression estimates demonstrating that these findings are robust to the following changes in model specification: (1) allowing the cash flow coefficient to vary systematically by industry, (2) splitting the highly leveraged group into two subgroups, (3) using an alternative interest-coverage measure to identify the highly leveraged group, (4) making the cash flow coefficient a smooth function of firms' average leverage ratios, and (5) replacing current cash flow by lagged cash flow as an explanatory variable.

The dependent variables are real investment and changes in employment, and the explanatory variables are current real cash flow, current real sales, and three lags of real sales.[24] The estimation procedure used removes from the data any part of a firm's investment or employment demand that is correlated with changing

[24]In all the regressions, the data for the investment and employment equations are deflated by the lagged real capital stock and employment, respectively, in order to obtain homoscedastic residuals. Real sales and cash flows are obtained by deflating current dollar values by the GNP deflator. Real investment and capital stocks are obtained by deflating current dollar values by the GNP capital goods deflator.

Table 5

The Cash Flow Sensitivities of Firms' Investment and Employment Demands: Variations across Leverage and Interest Coverage Groups

	Dependent Variables			
Explanatory Variables	Firm Investment	Firm Investment	Firm Employment Growth	Firm Employment Growth
Current sales	1.1	1.4	32.4	32.4
	(15.7)	(21.8)	(40.6)	(40.7)
Sales lagged one year	−0.9	−1.4	−24.5	−24.5
	(10.8)	(19.4)	(22.2)	(22.2)
Sales lagged two years	0.1	0.6	5.8	5.8
	(1.7)	(6.7)	(5.8)	(5.8)
Sales lagged three years	0.2	−0.4	0.3	0.3
	(2.8)	(4.8)	(0.4)	(0.4)
Cash flow	6.9	5.9	−8.1	−8.1
	(11.2)	(9.3)	(4.4)	(4.4)
	Dummies for H1, H2, and Low Interest Coverage Groups on the Cash Flow Coefficients			
Cash flow (group H1 effect)	39.3		37.6	
	(12.9)		(12.8)	
Cash flow (group H2 effect)	47.1		41.3	
	(26.6)		(3.6)	
Cash flow (low interest coverage effect)		30.2		37.8
		(22.2)		(13.1)
R^2	0.40	0.38	0.23	0.23

Notes: All regressions are based on a sample of 586 firms over seventeen years and include fixed-firm and year effects (not reported). All estimated coefficients in the investment and employment equations have been multiplied by 100 and 10,000, respectively. Absolute t-statistics are shown in parentheses beneath the estimated coefficients. The dependent and explanatory variables in the investment and employment equations are deflated by the lagged capital stock (divided by the capital goods deflator) and employment level, respectively. Sales and cash flows are divided by the GNP deflator.

macroeconomic conditions or with the relatively fixed characteristics of a firm such as size, leverage, or industry.[25]

The first and third regressions reported in Table 4 present the main results of this section. The models for investment and employment are estimated using the full sample of 586 firms over seventeen years. The cash flow coefficient is allowed to vary between the high-leverage firms and the rest of the sample.[26] The responsiveness of the investment or employment growth rates to changes in cash flow for group L firms is given in the coefficient estimates of the fourth row of the table. The responsiveness of group H firms is given by the sum of the fourth and fifth rows in that table. The "group H effect" marginal coefficients of the fifth row indicate that the highly leveraged firms have greater sensitivities to cash flow.

These results are quantitatively as well as statistically significant. The regression in the first column indicates that, when other variables are held constant, each extra dollar of cash flow (in 1982 dollars) generates about 45 cents more investment for group H than for group L firms. The regression in the third column indicates that, when other variables are held constant, each increase of 1 percentage point in the cash flow–to–employment ratio causes the employment growth rate to rise four-tenths of 1 percent (37.8 divided by 10,000) more at the highly leveraged firms than at the less leveraged firms.

The second and fourth regressions reported in Table 4 follow the same specification as the other two equations except that a marginal cash flow coefficient is estimated for each industry (estimates not reported) as well as for group H. The extra sensitivity that is found for group H firms in the first and third regressions is still present, though somewhat reduced, under this specification.

The regressions reported in Table 5 examine the robustness of these results. In the first and third regressions, group H is split in half into groups H1 and H2. Group H1 contains the most leveraged firms (the most indebted 10 percent of the sample). A marginal coefficient on cash flow is estimated for both of these subgroups. Somewhat unexpectedly, the estimates indicate that group H2 is slightly more sensitive to cash variations than group H1. This evidence suggests that cash flow sensitivity is not a simple monotonic function of the degree of leverage.

The second and fourth regressions presented in Table 5 allow the cash flow coefficients to vary across firms grouped according to another measure of financial distress. Here, firms are ranked by their median interest coverage ratios over the 1971 to 1987 period; that is, firms are ranked by their average levels of interest coverage. The bottom 20 percent are separated from the total and labeled the "low-coverage group." The large estimates of the marginal coefficient on cash flow for the low-coverage firms suggest that the increased sensitivities to cash flow variations found in Table 4 are robust to alternative measures of financial strain.

Table 6

The Cash Flow Sensitivities of Firms' Investment and Employment Demands: Variations Proportional to Firms' Leverage Ratios

	Dependent Variables	
Explanatory Variables	Firm Investment	Firm Employment Growth
Current sales	1.5	31.3
	(24.1)	(39.2)
Sales lagged one year	−1.0	−24.2
	(13.1)	(22.1)
Sales lagged two years	0.2	5.8
	(2.0)	(5.8)
Sales lagged three years	−0.1	0.3
	(1.8)	(0.5)
Cash flow	−7.7	−12.0
	(9.8)	(6.3)
	Marginal Effect of Leverage on the Cash Flow Coefficient	
Cash flow multiplied by each firm's median debt-to-asset ratio	139.5	99.1
	(33.1)	(15.2)
R^2	0.41	0.24

Notes: All regressions are based on a sample of 586 firms over seventeen years and include fixed-firm and year effects (not reported). All estimated coefficients in the investment and employment equations have been multiplied by 100 and 10,000, respectively. Absolute t-statistics are shown in parentheses beneath the estimated coefficients. The dependent and explanatory variables in the investment and employment equations are deflated by the lagged capital stock (divided by the capital goods deflator) and employment level, respectively. Sales and cash flows are divided by the GNP deflator.

[25]That is, in accordance with the standard convention for this type of regression analysis (panel data studies), annual and company dummies are included in all the models (coefficient estimates not reported). The inclusion of the annual dummies provides more accurate estimates of the relationships between firms' rates of investment and hiring and firms' sales and cash flows. Moreover, this approach ensures that the relationships uncovered are, in fact, structural. The procedure does not reduce the macroeconomic significance of the results.

[26]This is accomplished by using all the observations on cash flow as one regressor and using all the group H observations on cash flow (with zeros for the group L firms) as another regressor.

Table 7

The Lagged Cash Flow Sensitivities of Firms' Investment and Employment Demands: Variations across Leverage Groups and Variations Proportional to Firms' Leverage Ratios

	Dependent Variables			
Explanatory Variables	Firm Investment	Firm Investment	Firm Employment Growth	Firm Employment Growth
Current sales	2.3	2.3	32.9	32.6
	(41.4)	(42.1)	(42.4)	(42.0)
Sales lagged one year	−2.9	−2.7	−25.7	−25.9
	(41.4)	(37.4)	(22.8)	(23.0)
Sales lagged two years	1.4	−1.4	7.5	7.5
	(17.2)	(16.9)	(7.5)	(7.7)
Sales lagged three years	−0.5	−0.6	−1.5	−1.4
	(7.3)	(7.8)	(2.3)	(2.2)
Cash flow lagged one year	10.2	4.7	4.0	−2.0
	(13.9)	(4.9)	(2.4)	(1.2)
	Group H Dummy on the Lagged Cash Flow Coefficient and the Marginal Effect of Leverage on the Lagged Cash Flow Coefficient			
Cash flow lagged one year (group H effect)	−1.5		11.5	
	(1.2)		(3.0)	
Cash flow lagged one year multiplied by each firm's median debt-to-asset ratio		27.2		36.9
		(6.9)		(5.7)
R^2	0.35	0.35	0.22	0.22

Notes: All regressions are based on a sample of 586 firms over seventeen years and include fixed-firm and year effects (not reported). All estimated coefficients in the investment and employment equations have been multiplied by 100 and 10,000, respectively. Absolute t-statistics are shown in parentheses beneath the estimated coefficients. The dependent and explanatory variables in the investment and employment equations are deflated by the lagged capital stock (divided by the capital goods deflator) and employment level, respectively. Sales and cash flows are divided by the GNP deflator.

Table 8

Separate Estimates of Firm Investment and Employment Demands by Leverage Groups

	Dependent Variables			
Explanatory Variables	Firm Investment (Group H)	Firm Investment (Group L)	Firm Employment Growth (Group H)	Firm Employment Growth (Group L)
Current sales	3.3	0.6	68.1	25.0
	(12.1)	(8.4)	(26.8)	(32.2)
Sales lagged one year	−1.3	−0.2	−51.2	−20.8
	(4.7)	(2.1)	(14.1)	(19.5)
Sales lagged two years	−1.2	−0.3	8.2	5.9
	(3.5)	(3.4)	(2.8)	(5.9)
Sales lagged three years	0.7	−0.1	0.3	−1.5
	(2.7)	(1.9)	(0.2)	(2.3)
Cash flow	23.6	8.7	3.9	−2.1
	(8.2)	(14.7)	(1.1)	(1.3)
R^2	0.70	0.10	0.43	0.17

Notes: All regressions are based on a sample of 586 firms over seventeen years and include fixed-firm and year effects (not reported). All estimated coefficients in the investment and employment equations have been multiplied by 100 and 10,000, respectively. Absolute t-statistics are shown in parentheses beneath the estimated coefficients. The dependent and explanatory variables in the investment and employment equations are deflated by the lagged capital stock (divided by the capital goods deflator) and employment level, respectively. Sales and cash flows are divided by the GNP deflator.

Further evidence of the effects of leverage on the sensitivities of firm investment and employment to cash flow variations is presented in Table 6. Here, the coefficients on cash flow are allowed to vary linearly with firms' median debt-to-asset ratios; that is, the explanatory variable is the multiplicative product of firms' average leverage ratios and their cash flows. This specification leads to an estimate of one cash flow–related coefficient for all firms, but the implied responsiveness of each individual firm to its cash flow equals the product of this coefficient estimate and that firm's debt-to-asset ratio.

For example, in the investment equation, the estimated coefficient on the leverage/cash flow interaction term is 139.5. This implies that, on average, a firm with a 50 percent debt-to-asset ratio spends about 70 cents of each extra dollar of cash flow on new investment; a firm with a 25 percent debt-to-asset ratio spends about 35 cents. The interaction effects of cash flow and leverage on employment are similar.

The evidence presented so far considers the effects of leverage on the sensitivity of employment and investment to cash flow changes in the same year. Table 7 presents estimates of the effects of lagged cash flow on these variables. When the lagged cash flow coefficient is allowed to vary between groups, the group H coefficient is significantly larger in the employment equation but is insignificantly different from zero in the investment equation. When the lagged cash flow coefficient is specified as a linear function of firms' debt-to-asset ratios, however, the previous result that sensitivity to cash flow rises with leverage is shown to hold for both dependent variables.

Experimentation reveals that leveraged firms' heightened sensitivity to cash flow is robust to other specification changes as well. When the sensitivity of investment and employment to sales is also allowed to vary across groups, however, some of the increased cash flow sensitivity of group H firms is apparently "transferred" to increased sensitivity to sales.

This transferral of explanatory power from cash flow to sales is apparent in Table 8, which displays simple investment and employment demand models based on lagged sales and current cash flow. In these regressions, however, the equations are estimated separately for the group H and group L firms. In both the investment and employment models, the more leveraged firms exhibit a stronger positive response to cash flow variations, but their heightened sensitivities to current sales fluctuations are even more dramatic. Perhaps one cannot clearly distinguish the relative importance of leveraged firms' heightened sensitivities to sales or to cash flow shocks because the two variables are highly correlated. It is possible that some of the heightened sensitivity to cash flow might find its way to the sales coefficient because sales revenue is probably the most accurately measured part of cash flow, which also includes various noncash expenses such as deferred taxes and deferred interest.

The regressions presented in this section demonstrate that firms with higher leverage vary their investment and employment more in response to cash flow (and perhaps sales) variations than do firms with less leverage. This conclusion appears robust to a variety of specifications and holds for a measure of leverage based on interest coverage, as well as one based on the debt-asset ratio. These heightened sensitivities are shown to be more than industry effects masquerading as leverage effects.

Conclusions

The firm-level analysis presented in this article shows that an increase in leverage may be associated with increased cyclical variability of investment and employment. The greater volatility of highly leveraged firms appears to arise from a greater responsiveness of investment and employment demands to fluctuations in internally generated funds.

One way in which monetary policy can influence aggregate investment and employment is by affecting firms' sales and interest expenses and hence firms' cash flows. The recent rise in corporate leverage may, therefore, signal an increased sensitivity of employment and investment to monetary policy, at least among corporations that have substantially raised their leverage.

It is conceivable that the microeconomic effects of leverage reported here may not hold as strongly in the aggregate. In particular, even if one highly leveraged firm cuts back sharply on employment in response to a downturn in sales or cash flow, perhaps a less leveraged firm will pick up some of the slack; that is, an industry's output might not be affected by the degree of indebtedness of individual firms. A sizable degree of such "canceling out" of the effects of leverage at the industry level seems plausible, however, only in the medium and long run. Therefore, when leverage increases are fairly widespread, the corporate sector is likely to become more volatile and more responsive to sales and cash flow fluctuations, including those that arise from interactions between the economy and monetary policy.