The cyclicality of cash flow and investment in U.S. manufacturing

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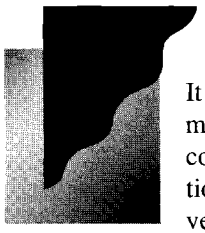

It is well-known that investment is the most cyclical component of GNP. In addition, the procyclicality of investment is extremely important in accounting for the "shortfalls" of GNP during downturns in the economy.[1] What is not well-understood is why investment is so cyclical. A number of theories have been proposed to explain the cyclicality of investment, and in this study, we bring some empirical evidence to bear on one in particular, the "cash flow" theory.

The cash flow theory maintains that, because capital markets are not perfect, many firms rely heavily on internal finance for investment purposes; since cash flow tends to be very procyclical, investment also is procyclical. While the theory has been around for years, it recently has garnered renewed attention in both the financial pages of the newspaper and in academic journals. Business forecasters and analysts are particularly interested because of the current sharp decline in corporate profits and the problems in credit availability.[2] In the academic world, theoretical work on the imperfections in capital markets—especially asymmetric information between firms and suppliers of finance—provides support for why credit rationing may occur and why external finance may be considerably more expensive than internal finance. In addition, there has been considerable recent effort in macroeconomics to link business cycle fluctuations to fluctuations in the available internal finance of firms in the economy.[3]

The primary aim of this study is to examine the relation between short-run fluctuations in investment and cash flow at the industry level. We build on our earlier study, Petersen and Strauss (1989), which focused on investment in the 20, two-digit Standard Industrial Classification (SIC) manufacturing industries. We found that a great deal of difference in the degree of cyclicality exists within manufacturing. In particular, we found that industries producing durable goods tended to exhibit much more cyclical investment behavior than industries producing nondurable goods.

To investigate the pattern of cyclicality of cash flow and investment in manufacturing, we use data from a panel of 261 industries covering the time period 1959 to 1986. Very little attention has been given to examining investment at this level. The lack of information about industry behavior is probably due to the fact that investment studies employing firm data typically do not have enough data points to produce estimates of cyclicality across a wide range of industries.

We find that cash flow is indeed more procyclical in the durable goods sector than in the nondurable goods sector. We estimate that the cash flow elasticity with respect to GNP is, on average, more than twice as great for durable goods industries as for nondurable goods industries. While we do not explore the

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causes of this differential pattern in cash flows, there are several very plausible explanations. One obvious explanation is that consumers engage in greater intertemporal substitution of durable goods purchases than nondurable good purchases; for example, uncertainty concerning future incomes should cause consumers to postpone the purchase of durable goods. In addition, greater uncertainty will cause firms to postpone the purchase of durable goods when these investments are irreversible.[4]

We consider a number of regressions of the first difference of investment regressed on the first difference of cash flow for individual industries. We find that the cash flow coefficient is statistically significant for most two-digit industries, and that, on average, the cash flow coefficient is larger for durable goods industries. In addition, movements in cash flow appear to "explain" more of the movements in investment over the cycle in durable goods industries. Thus, we find not only that cash flow is more cyclical in durable goods industries, but also that there is a higher correlation between movements in investment and cash flow in durable goods industries. The results in this study are therefore consistent with our previous findings and broadly support the view that fluctuations in cash flow may be an important determinant of fluctuations in investment.

The remainder of the article proceeds as follows. The next section briefly summarizes our previous findings on the pattern of investment cyclicality within manufacturing. The following section reviews the arguments for why capital market imperfections may cause firms to rely heavily on internal finance for investment. The final two sections report our findings on the cyclicality of cash flow and the statistical relationship between movements in cash flow and investment within manufacturing industries.

Summary of earlier results

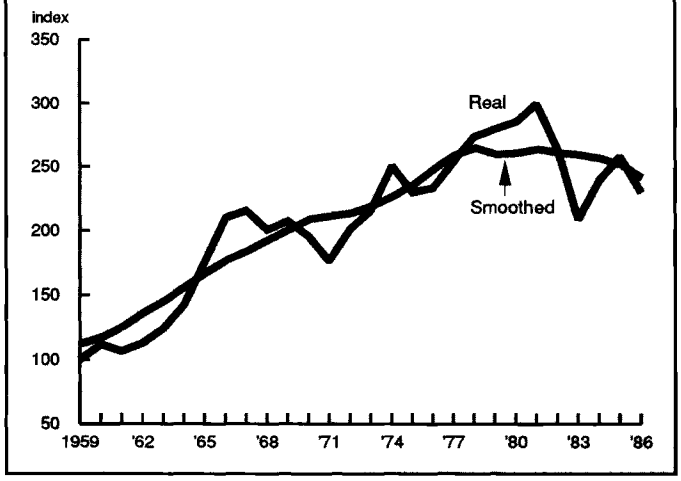
In our previous paper, we presented evidence on the volatility and the cyclicality of investment across the 20 two-digit SIC industries that make up the U.S. manufacturing sector. For each industry, we constructed a nine-year centered moving average investment series.[5] This series was compared to the actual investment figures to obtain a measure of the degree of cyclicality for each industry over the business cycle.

Figure 1, which is from our first study, plots the relationship between "smoothed" investment and actual investment for all manufacturing industries in our study over the period 1959-1986. Clearly, actual investment tends to be above smoothed investment during expansionary periods and below smoothed investment during contractions. In addition, although not reproduced here, we presented graphs showing that durable goods industries such as nonelectrical machinery and transportation equipment exhibited a more pronounced procyclical investment pattern than nondurable goods industries such as food products and chemicals

We also ran more formal tests on the data by regressing the ratio of actual to smoothed investment in each industry on various measures of the business cycle, such as the ratio of actual to potential GNP.[6] We found a procyclical investment pattern for all industries, with the exception of food products and tobacco products. What is particularly interesting is that, again, the investment pattern of durable goods industries was considerably more cyclical than that of nondurable goods

FIGURE 1

Total manufacturing
(Real indexed investment and real indexed smooth investment)



industries. The industries exhibiting the most cyclical investment series are transportation equipment, primary metals, nonelectrical machinery, instruments, and fabricated metals—all durable goods industries.

Cash flow as a determinant of investment

In a world of perfect capital markets, firms would, in theory, make investment decisions independent of their finance decisions. In other words, the availability of cash flow would not matter because firms could raise external finance at a cost equal to the opportunity cost of internal finance. This is the main message of the Modigliani and Miller (1958) theorem which has had such a dominant impact on investment studies for the last thirty years.

Only recently have economists begun to raise serious challenges concerning the general applicability of this theorem; some of its crucial underlying assumptions may in fact be seriously at odds with the real-world conditions that most firms face in financial markets.[7] For example, one of the key assumptions in the Modigliani and Miller theorem is that all information known by the firm is also known by potential suppliers of finance. However, it is likely that most firms are better informed about themselves than are potential investors. If this is the case, these firms may have incentives to act strategically at the expense of potential outside suppliers of finance, resulting in problems known as adverse selection and moral hazard.[8] Since outside investors are aware that such conflicts of interest exist, they rationally adjust the price they are willing to pay for the securities of firms who may be in a position to behave strategically.

When capital markets are not perfect, either because of asymmetric information or because of high transaction costs of new share and bond issues, then external finance may cost the firm considerably more than internal finance. Clearly, internally financed projects are not subject to problems of strategic behavior, and, of course, transaction costs are zero. Thus, many researchers have argued that there are compelling reasons to hypothesize that the investment levels of some firms may be sensitive to fluctuations in their internal finance levels. That is, because of the additional expense of external finance, some firms will not be willing to offset fluctuations in internal finance with either new share issues or debt.

Recently, many empirical tests have found support for this proposition.[9] For example, studies have shown that investment patterns of firms that exhaust all of their internal finance appear to be much more sensitive to fluctuations in cash flow than that of firms that do not exhaust all of their internal finance (that is, they pay dividends). These results are potentially important for macroeconomics, since well over half of all publicly traded corporations do not pay dividends.

Companies that pay dividends have more flexibility when it comes to dealing with a sudden shock to their cash flow: they can cut dividends instead of investment. But, if stockholders view dividends as a "signal" of the overall profitability of the firm, then cutting dividends is likely to depress stock prices, even though the fundamentals of the firm have not changed.[10] Therefore firms may find it optimal to react to a temporary decline in cash flow with some mix of cuts in both dividends as well as investment. There is empirical evidence that this is indeed how dividend-paying firms react. Future studies will no doubt pin down the trade-off firms face concerning cutting dividends or reducing investment or obtaining additional external finance.

In summary, a growing body of evidence suggests that some firms face financing constraints. Since most of these studies have worked with a relatively small sample of firms, the magnitude of the importance of financing constraints in explaining cyclical movements in aggregate investment remains unknown. We make some progress on this question in the following sections by providing evidence, at the industry level, for the entire manufacturing sector on the cyclicality of both investment and cash flow.

The data

The primary data sources we use are the *Census of Manufactures* and the *Annual Survey of Manufactures* (U.S. Department of Commerce). The advantages of these data sources for examining the cyclicality of investment at the industry level are discussed in our previous study.[11] *The Census of Manufactures* currently contains approximately 455 four-digit industries, of which 261 are included in our panel. Since, it is either impossible or

inconvenient to work with the entire population of Census industries, we excluded industries for any of the following three reasons. First, because we wished to examine a balanced panel of industries covering as many business cycles as possible, we excluded all industries for which the *Census of Manufactures* began gathering data later than 1958. Second, we excluded a number of industries having large gaps in the data. Finally, we excluded industries with inconsistencies in the industry classification or definition over time.

Table 1 provides a summary of the breakdown of our sample of Census industries. The first column lists the identity of the 20 industries that make up the *Census of Manufactures*. The second column lists the total number of four-digit industries that made up each of the two-digit industries in 1986 while the third column reports the breakdown of our sample of industries across the two-digit industries.[12] (A comparison of these two columns shows that our panel covers about 57 percent of all manufacturing industries.) The fourth column states the average real investment for our panel of two-digit industries. As reported in our previous study, the industries in the panel account for about 77 percent of total manufacturing investment. The last column reports the average real cash flow for our panel.

We measure cash flow in this study as sales less materials costs and all labor expenses. We are missing some elements of cost, such as interest expense. This is un-

TABLE 1

Database summary

	Total four-digit industries in 1986	Four-digit industries in FRB database	FRB database	
			Average investment (1958-1986)	Average cash flow (1959-1986)
			(millions of 1982 dollars)	
Total manufacturing	455	261	43976.0	204441.2
Nondurable manufacturing	224	125	20837.9	99262.7
Durable manufacturing	231	136	23138.2	105178.5
SIC				
20 - Food and kindred products	47	38	4463.2	27747.8
21 - Tobacco products	4	4	314.3	3659.9
22 - Textile mill products	30	19	1375.3	4952.4
23 - Apparel and related products	33	13	296.0	4130.2
24 - Lumber and wood products	17	4	984.7	2578.6
25 - Furniture and fixtures	13	7	258.1	2122.1
26 - Paper and allied products	17	11	3602.9	8755.2
27 - Printing and publishing	17	8	1348.8	11812.9
28 - Chemicals and allied products	33	16	4585.7	21064.6
29 - Petroleum and coal products	6	4	2971.9	8622.6
30 - Rubber and plastic products	6	4	1705.3	7070.2
31 - Leather and leather products	11	2	42.2	295.3
32 - Stone, clay, and glass products	27	23	2281.8	8022.9
33 - Primary metal industries	26	16	4893.5	11870.0
34 - Fabricated metal products	36	18	1953.0	11321.2
35 - Machinery, except electrical	44	29	4185.9	22290.3
36 - Electrical machinery	37	25	2848.8	18053.5
37 - Transportation equipment	18	8	4919.5	22463.6
38 - Instruments and related products	13	6	812.9	6456.2
39 - Miscellaneous manufacturing	20	6	132.3	1151.6

avoidable given the manner in which the *Census of Manufactures* collects firm level data. Thus, there is definitely measurement error in our definition of cash flow, the seriousness of which depends, in part, on how variable interest expenses are over the business cycle.

A comparison of the last two columns show that our measure of the average cash flow in each two-digit manufacturing industry is, on average, about five times greater than total physical investment. This is to be expected as there are many other types of investments that are financed by cash flow, including research and development, advertising, and working capital. In addition, a portion of cash flow, as defined here, is used to pay dividends and interest payments.

Most of the rest of our study deals with comparisons of the cyclicality of durable goods versus nondurable goods industries. As is conventionally done, the durable goods sector is taken to consist of SICs 24, 25 and 32-38. This division leads to approximately an even division of our panel of four-digit industries into the durable/nondurable categories.

The cyclicality of cash flow and investment

We turn now to the central question of this study, namely, is the cyclical pattern of cash flow, across manufacturing, consistent with the cyclical pattern of physical investment? One basic question to ask is whether in fact cash flow is more cyclical in the durable goods sector than in the nondurable goods sector. To consider this, we regress the percentage change in industry cash flow on the percentage change in GNP over the full time period covered by our panel.

Our results are reported in Table 2. We report the estimated cash flow elasticity for all industries in our panel, for the durable and nondurable sectors of our panel, and for all two-digit industries (a pooled regression of the four-digit industries making up each two-digit industry). For all industries, cash flow is very procyclical, with a cash flow elasticity of 2.29. More importantly, the next two rows show that the estimated elasticity for durable goods, 3.19, is much larger than the estimated elasticity for nondurable goods, which is 1.31, and the difference is statistically significant. The remaining rows of Table 2 indicate that all two-digit nondurable good industries have lower elasticity measures than the overall average for the durable goods industries.

TABLE 2

The cyclicality of cash flow in durable and nondurable industries

	Elasticity estimates[a]
Total manufacturing	2.29**
Nondurable manufacturing	1.31**
Durable manufacturing	3.19**
Nondurable manufacturing	
SIC	
20 - Food and kindred products	-0.44
21 - Tobacco products	3.11
22 - Textile mill products	2.68**
23 - Apparel and related products	1.60**
26 - Paper and allied products	1.47**
27 - Printing and publishing	1.61**
28 - Chemicals and allied products	2.44**
29 - Petroleum and coal products	1.88
30 - Rubber and plastic products	2.40**
31 - Leather and leather products	0.58
39 - Miscellaneous manufacturing	1.69**
Durable manufacturing	
SIC	
24 - Lumber and wood products	4.21**
25 - Furniture and fixtures	2.50**
32 - Stone, clay, and glass products	2.75**
33 - Primary metal industries	4.77**
34 - Fabricated metal products	2.50**
35 - Machinery, except electrical	3.26**
36 - Electrical machinery	3.01**
37 - Transportation equipment	4.02**
38 - Instruments and related products	2.06**

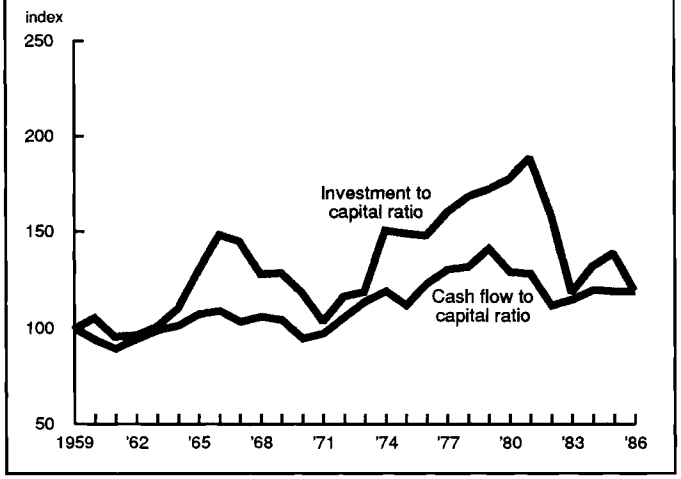
**Significant at the 1 percent level
*Significant at the 5 percent level
[a]Estimates of elasticity of cash flow with respect to GNP

To illustrate the cyclicality of cash flow, and as a lead-in to our regression results, we present graphs of cash flow and investment for all manufacturing (Figure 2) and four selected two-digit industries (Figures 3-4). Both cash flow and investment are scaled by the beginning of year stock of capital to remove trends in the data. We will use this same scaling of the data in our regressions in the next section.

Figure 2 plots the investment series and cash flow series for all manufacturing over the time period 1959-1986. Both the investment ratio and the cash flow ratio are indexed to 100 in 1959. We know from our previous study that investment for all manufacturing is quite procyclical. From Figure 2 it is apparent that cash flow is also procyclical, increasing in expansions of the economy and declining during contractions. This pattern would not surprise anyone familiar with the pattern of aggregate corporate profits in our economy.

FIGURE 2

Total Manufacturing
(Investment to capital ratio and cash flow to capital ratio)



Figures 3-4 present investment and cash flow ratios for four two-digit industries, two in nondurables (food and paper products) and two in durables (primary metal and nonelectrical machinery). These industries have a large share of total investment in manufacturing and illustrate different patterns of cash flow and investment activity. The two durable goods industries' cash flows, along with investment, appear to be quite procyclical over the business cycle. In contrast, cash flow and investment, appear to be less cyclical for the two nondurable goods industries. As will be apparent when we discuss our regression results, this pattern holds up for most industries in manufacturing.

Investment regressions

We now present some descriptive regressions on the relationship between physical investment and cash flow over the business cycle. We consider the following pooled regression of the first difference of investment on the first difference of current and lagged cash flow:

$$(1) \quad \Delta(I/K)_{it} = b_1\Delta(CF/K)_{it} + b_2\Delta(CF/K)_{it-1} + e_{it}$$

where i denotes the industry level (four-digit) and t denotes the time period. Both industry investment (I) and cash flow (CF) are scaled by the beginning of year capital stock (K) to control for heteroscedasticity. This regression captures our basic intent of seeing how cyclical variation in cash flow is correlated with cyclical variation in investment. We look at changes in both current and lagged cash flow because some time is required for firms to adjust investment plans and to install new plant and equipment.

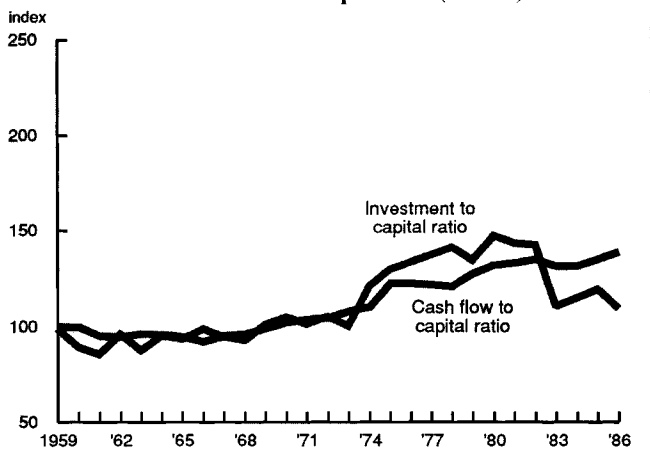
There are, of course, many other variables that one should consider in an investment study. Some, such as measures of the cost of capital, are briefly discussed later in this paper. Variables such as the rate of depreciation and the degree of imperfect competition may be important determinants of why the level of investment differs across industries. But variables such as these are likely to change very slowly over time, and as a result may be viewed as industry fixed effects. With panel data, a standard method of controlling for unobservable fixed effects is to difference the data as we have done, thereby removing the time invariant components.[13] We also included year dummies in the regression, which has only a small effect on the regression results.

We are not arguing that there is necessarily any causation running from cash flow to investment since there are fundamental variables which do vary over time, such as the industry demand curve, which may be driving both movements in industry cash flow and industry investment. While we mention such considerations at the end of the paper, they cannot readily be addressed with the data that we have at hand.[14]

FIGURE 3

Nondurables
(Investment to capital ratio and cash flow to capital ratio)

3A: Food and kindred products (SIC 20)



3B: Paper and allied products (SIC 26)

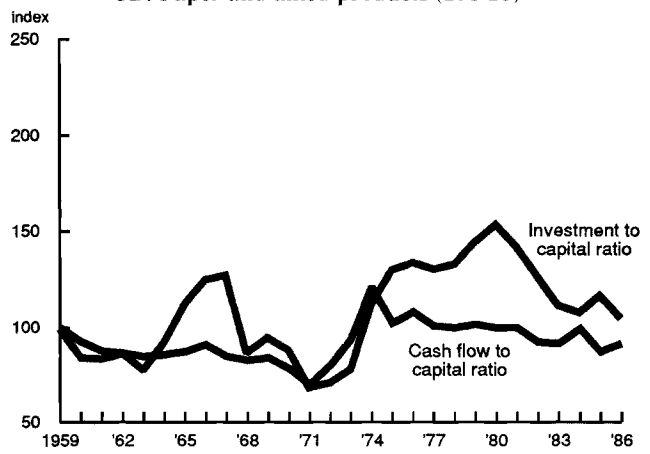


Table 3 reports the results from estimating equation (1) for the full time period (1961 to 1986).[15] The first row reports the results from pooling all 261 4-digit industries (the all manufacturing regression) while the second and third rows present results when industries are pooled according to whether they produce durable versus nondurable goods. The coefficients for current and lagged cash flow are presented, followed by the adjusted R-square. It should be pointed out that for some of the two-digit industries, as indicated in Table 1, we have only a small number of the total population of 4-digit industries—the results for these industries should be viewed with extra caution.

For the manufacturing sector as a whole over the full time period, the coefficients of current and lagged cash flow are 0.052 and 0.024, respectively, and are statistically significant at the 1 percent level. While the absolute size of these coefficients is small, recall from Table 1 that average cash flow in manufacturing is over four times larger than average investment. Thus, the coefficients on the first difference of cash flow could potentially imply large investment effects.

Of more interest to our study are the results in the next two rows which examine nondurable versus durable goods industries. The cash flow coefficient for the first difference of cash flow is 0.040 for nondurable goods and 0.072 for durable goods. The standard errors are small enough such that an F-test at any conventional level of significance will reject the hypothesis that the cash flow coefficient for durable goods is no greater than that for nondurable goods. In addition, the adjusted R-square for durable goods is nearly twice as great as the adjusted R-square for nondurable goods.

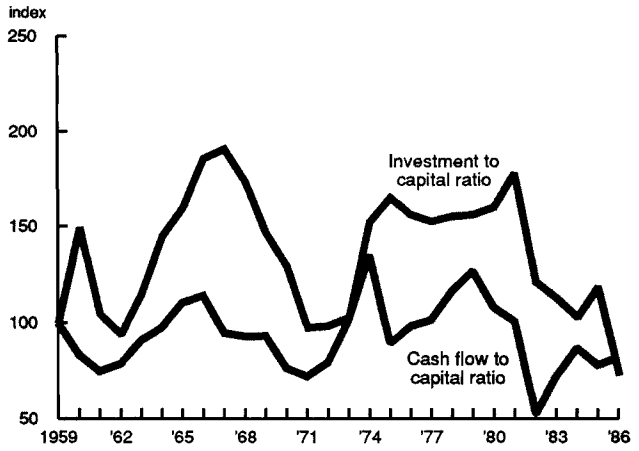
The remaining rows of Table 3 report the regression results for the individual two-digit industries. The first difference of current cash flow is significant at the 5 percent level or greater, with the exception of SIC 24 (lumber and wood products) and SIC 31 (leather and leather products). The coefficient on the lagged first difference of cash flow is also significant for some of the industries, although the size of the coefficient tends to be much smaller. It is obvious that there is a fair amount of dispersion in the estimated cash flow coefficients, although none of the results look to be unreasonable.

We considered the stability of our regression results in Table 3 by dividing our panel into an early time period (1961 to 1973) and a

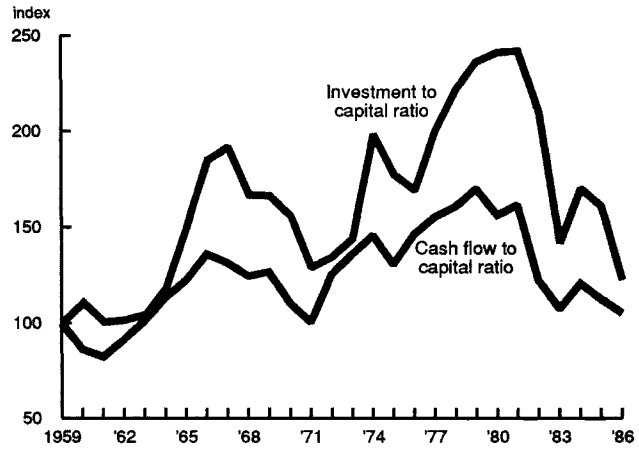
FIGURE 4

Durables
(Investment to capital ratio and cash flow to capital ratio)

4A: Primary metal industries (SIC 33)



4B: Industrial machinery and equipment (SIC 35)



late time period (1974 to 1986), the results for which appear in the Appendix. Perhaps the most noteworthy result here is the stability of the cash flow coefficients for both the durable and nondurable goods industry categories. As can been seen in rows two and three, there is very little difference in the estimates between the early and late time periods. There are, of course, some fairly large changes in the estimated coefficients for individual two-digit industries when the data are divided by time period. In particular, when the regressions are estimated over the shorter time frames, the cash flow coefficients remain significant for almost all of the durable goods industries, but this is not true for the nondurable goods industries.

We also considered a number of extensions to our basic results which we do not report here. We included the first difference of alternative measures of the cost of capital, as conventionally included in investment studies. These measures, when entered in the regression, typically had insignificant coefficients, often with the wrong sign, and had no effect on our basic results. We also considered whether there might be some asymmetry in the regression results depending on whether the change in cash flow was positive or negative: it seems plausible that firms might react differently to a downward shock in cash flow than to an upward shock in cash flow. However, our results showed little evidence of such asymmetry.

Summary of results and conclusion

This analysis extends our previous work, which found much more pronounced cyclicality of investment in durable goods industries than in nondurable goods industries. If capital markets are not perfect, then two explanations are (simultaneously) possible: (1) cash flow may be more cyclical in durable goods industries; (2) investment may be more sensitive to fluctuations in cash flow in durable goods industries.

Our results provide support for both explanations. Cash flow does appear to be more cyclical in durable goods industries than in nondurable goods industries. This is not unexpected given that demand for durable goods is likely to be more sensitive to the business cycle. In addition, we also find that cash flow coefficients are larger, indicating greater sensitivity to fluctuations in cash flow, for durable goods industries. This finding appears to be robust to various time splits of the panel of industries that we consider. Thus, the results in this study are consistent with our previous findings.

TABLE 3

Regression results for investment on cash flow

	Full time period 1961-1986		
	First difference cash flow[a]	Lagged first difference cash flow	Adjusted R-square
Total manufacturing	0.052**	0.024**	0.117
Nondurable manufacturing	0.040**	0.020**	0.084
Durable manufacturing	0.072**	0.026**	0.164
SIC			
20 - Food and kindred products	0.042**	0.021**	0.111
21 - Tobacco products	0.064**	0.051*	0.219
22 - Textile mill products	0.091**	0.030**	0.153
23 - Apparel and related products	0.025**	0.012	0.078
24 - Lumber and wood products	0.029	0.059*	0.304
25 - Furniture and fixtures	0.035**	-0.012	0.139
26 - Paper and allied products	0.097**	0.012	0.052
27 - Printing and publishing	0.046**	0.011	0.122
28 - Chemicals and allied products	0.071**	-0.003	0.101
29 - Petroleum and coal products	0.043*	0.022	0.070
30 - Rubber and plastic products	0.070**	0.006	0.090
31 - Leather and leather products	0.008	0.001	0.389
32 - Stone, clay, and glass products	0.155**	0.041*	0.151
33 - Primary metal industries	0.083**	0.015	0.137
34 - Fabricated metal products	0.095**	0.013	0.182
35 - Machinery, except electrical	0.058**	0.024**	0.241
36 - Electrical machinery	0.083**	0.040**	0.237
37 - Transportation equipment	0.051**	0.012	0.174
38 - Instruments and related products	0.095**	0.041*	0.150
39 - Miscellaneous manufacturing	0.023*	0.029*	0.093

**Significant at the 1 percent level
*Significant at the 5 percent level
[a]Year dummies were used in all regressions

It is, of course, important to point out that there are explanations other than capital market imperfections for why investment is more procyclical in durable goods industries than in nondurable goods industries. One possibility is that, as already argued, demand is more cyclical in durable goods industries, and that firms rapidly adjust their capital stocks in response to temporary changes in demand. The plausibility of this alternative explanation depends on how high the adjustment costs are to making sharp changes in the rate of investment, something that is very difficult to measure.

We hope that this paper has generated some additional facts concerning the post-war investment cycle in the United States. In addition, we hope that this paper has provided some additional evidence concerning the possible link between fluctuations in internal finance and investment. It is clear from the financial press that many forecasters put considerable weight behind this linkage as a driving force behind business cycles. Indeed, given the sharp recent decline in corporate profits and cash flows, forecasters have expressed concern over the future direction of investment and the economy, and there is evidence that this concern may be justified.

APPENDIX

Regression results for investment on cash flow

	Split time period, 1961-1973		Split time period, 1961-1973		Significant difference test between time splits
	First difference cash flow[a]	Lagged first difference cash flow	First difference cash flow	Lagged first difference cash flow	
Total manufacturing	0.055**	0.029**	0.051**	0.021**	
Nondurable manufacturing	0.045**	0.019**	0.037**	0.020**	
Durable manufacturing	0.070**	0.038**	0.072**	0.021**	
SIC					
20 - Food and kindred products	0.057**	0.055**	0.038**	0.013	**
21 - Tobacco products	0.062	0.073	0.065	0.047	
22 - Textile mill products	0.157**	0.040	0.059**	0.019	**
23 - Apparel and related products	0.035**	0.011	0.018	0.013	
24 - Lumber and wood products	-0.031	0.126*	0.042	0.045	
25 - Furniture and fixtures	0.020	-0.046	0.040	-0.005	
26 - Paper and allied products	0.140	-0.010	0.074**	0.023	
27 - Printing and publishing	0.055**	0.008	0.041**	0.013	
28 - Chemicals and allied products	0.070**	-0.005	0.072**	-0.001	
29 - Petroleum and coal products	0.077*	-0.014	0.036	0.029	
30 - Rubber and plastic products	0.047	-0.042	0.074*	0.013	
31 - Leather and leather products	0.010	0.016	0.006	-0.006	
32 - Stone, clay, and glass products	0.108**	0.027	0.171**	0.046	
33 - Primary metal industries	0.153**	0.021	0.060**	0.012	*
34 - Fabricated metal products	0.082**	0.039**	0.108**	-0.005	
35 - Machinery, except electrical	0.049**	0.028**	0.064**	0.023**	
36 - Electrical machinery	0.081**	0.063**	0.080**	0.025**	
37 - Transportation equipment	0.081**	0.044	0.040*	0.001	
38 - Instruments and related products	0.125**	-0.009	0.085**	0.055*	
39 - Miscellaneous manufacturing	0.021	0.022	0.024	0.034	

**Significant at the one percent level
*Significant at the five percent level
[a]Year dummies were used in all regressions

FOOTNOTES

[1]Robert Barro (1987) concludes that if all categories of investment are added together, fluctuations in investment account for around 88 percent of the GNP "shortfall" during recessions.

[2]See for example the "Outlook" column of the *Wall Street Journal*, April 2, 1990, for a discussion of how declines in profits can "drag" an economy into a recession. See also articles in the "Business Day" section of the *New York Times* on August 8, 1990 and September 7, 1990.

[3]Among the many recent papers are Gertler (1988), Greenwald and Stiglitz (1990), and Gertler, Hubbard, and Kashyap (1990).

[4]See, for example, the arguments and evidence in Romer (1990) and the arguments presented in Bernanke (1983).

[5]For further detail, see Equation (1) of Petersen and Strauss (1989).

[6]We reported results for the following regression:

$$I_t/\tilde{I}_t = a + bA_{t-1} + e_t$$

where I_t is actual investment in year t, $\tilde{I}_t$ is the smoothed investment series, and A is a measure of the state of the aggregate economy.

[7]For a discussion of the recent theoretical developments, see Fazzari, Hubbard, and Petersen (1988).

[8]Moral hazard problems arise when leverage gives the firm incentives to undertake riskier projects than it would without debt finance. In the presence of leverage, debt

holders will bear a portion of the downside losses resulting from high risk projects. Adverse selection refers to the situation where above-average quality firms drop out of the market for external finance because of the unfavorable terms offered by suppliers of finance who are unable to distinguish between high quality and low quality firms.

[9]This list of studies has grown dramatically in the last few years. Two of the early studies include Fazzari, Hubbard and Petersen (1988) and Hoshi, Kashyap, and Scharfstein (forthcoming).

[10]See for example Bhattacharya (1979).

[11]The origins of this data base are described in Domowitz, Hubbard, and Petersen (1986). Three of the advantages include: (1) the Census reports investment data at the four-digit level, which is very disaggregated, (2) Census data assign individual plants, rather than whole companies, to their primary SIC industry, (3) data for Census industries are available back to at least 1958, allowing for a panel of substantial length.

[12]We have nine fewer industries than our previous study because of missing information required to construct the cash flow measure.

[13]See Hsiao (1986) for a discussion of procedures for dealing with unobservable industry fixed effects.

[14]Previous studies have used Tobin's q, a measure of the stock market value of the firm to its replacement cost, in an attempt to control for changes in the demand for investment. Unfortunately, the information necessary to construct Tobin's q is not available for Census industries.

[15]Our time period begins in 1961 because we lose two years due to inclusion of both first and second differences of cash flow in the regression. We lose a third year because we need the lagged capital stock as a scale factor.

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