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Chapter Five

Capital Expenditures—Some Further Analyses

ASSYMETRICAL ACCELERATOR RELATIONS

Throughout our analysis thus far we have spoken of reactions to sales changes—increases and decreases. But costs and speed of adjustment of capital stocks may well be different in the two cases. With more rapidly growing demand, firms may have to devise new plans for capital expansion and institute additional orders which merely give them a position on a long queue. On the other hand, with a slackening in the increase of demand, firms may be able to respond more quickly by delaying the execution of existing plans and canceling or delaying existing orders for fairly proximate delivery.

At least two factors, however, may point to more substantial investment response to positive sales changes. First, where sales have actually been declining, excess capacity may have come into being and the extent of decline may have little to do with the speed at which disinvestment can take place. Second, in a situation of generally rising sales, the few declines that occur may be viewed as largely transitory. To the extent that such negative sales changes, or at least their magnitudes, are ignored, coefficients will approach zero.

To test the extent of asymmetry in response to rising and falling sales, the following function was estimated:

$$i_t^* = b_0 + \sum_{j=1}^{7} (b_j + b_j^+ D_j^+)\Delta s^*_{t+1-j} + b_8 p^*_{t-1} + b_9 d_{53} + u_t \quad (5.1)$$

$$D_j^+ = 1 \text{ when } \Delta s^*_{t+1-j} \geqslant 0$$

$$D_j^+ = 0 \text{ when } \Delta s^*_{t+1-j} < 0$$

Thus, estimates of b_j^+ will indicate the extra effect (sometimes negative) of positive sales changes. The b_j coefficients themselves will relate to negative sales changes and the sums of corresponding b_j and b_j^+ will relate to positive sales changes.

The results for our basic relation, including variables for sales changes, profits, and the 1953 depreciation ratio, are shown in Table 5-1. Recall that the depreciation ratio does not vary in individual firm time series and varies only trivially in industry time series, with the partial variation in composition of firms contributing observations, from year to year, to the industry means.

The industry time series results suggest that the total response of investment is substantially greater to positive sales changes than to negative changes. There is one significant positive coefficient in the negative sales relation, that of 0.222 for the immediately lagged Δs^*_{t-1}. This might indicate some quick response in the way of reducing capital expenditures when sales decline. But the total of negative sales change coefficients was only 0.203, with a standard error of 0.199, in the industry time series. The sum of coefficients of the positive sales changes was a decidedly higher 0.704 (standard error of 0.159). The large difference of 0.501 in these sums, however, has a standard error of 0.306.

Striking differences appear in the cross sections. In the industry cross section the sum of the negative sales change coefficients of 0.754 is both substantially and significantly higher than the 0.213 sum of the positive sales change coefficients. About the only common point in the industry cross section and the time series results is the high coefficient of Δs^*_{t-1}, in this case 0.291, for negative sales changes. The regression based upon firm cross sections across industries, reflecting the industry cross section component, results in a lesser but still statistically significant excess in the sum of negative sales change coefficients.

The exceptionally high industry cross section coefficient of the depreciation variable—1.249—may catch (in addition to interfirm variance in durability and replacement requirements) a tendency for more rapidly growing firms to be those that traditionally invest in shorter-lived, more rapidly depreciating equipment. In comparisons of time series and cross section results without the depreciation variable (Table M5-2), only the industry time series confirms a substantial (but not statistically significant) difference between the sums of positive and negative sales change coefficients.

In view of the disparity of results and the paucity of statistically significant differences, interpretation must be approached with caution. It would appear from the industry time series that industry capital expenditures were more responsive to sales changes the greater the number of firms with sales increases in any year. The cross section results point the other way when the depreciation variable is included, but there is a virtual standoff when it is excluded. In the preponderance of cases involving rising sales, relatively shorter-lived equipment accounts in considerable part for the higher capital expenditure ratios of more rapidly growing industries. Where a large number of firms in an industry show negative sales changes, capital expenditures are significantly lower.

GROSS PROFITS AND THE SPEED OF REACTION

Economic theory suggests that the speed of adjustment of capital stock depends upon the relative costs of faster and slower adjustment. We have no explicit measures of those costs in the McGraw-Hill data. It may be hypothesized, however, that higher profits make possible more rapid increases in capital stock when those are in order, since the cost of relatively large acquisition of outside funds would slow down spending, particularly if low profits occasion not only shortages of internal funds but also difficulty in raising funds outside. Further, high depreciation charges would be associated with more abundant internal funds as well as with more rapidly depreciating capital, which would permit faster downward as well as upward adjustments in capital stock.

To get at the role gross profits play in the speed of reaction of capital expenditures to sales changes, we first calculated the mean of the gross profits ratio, $p^*_{t-1} + d^*_{t-1}$, which was 0.13545 in the available sample. A new variable for each observation was calculated as $G = \dfrac{p^*_{t-1} + d^*_{t-1}}{0.13545} - 1$. The following function was then estimated.

$$i^*_t = b_0 + \sum_{j=1}^{6} (b_j + b'_j G)\Delta s^*_{t+j-1} + b_7\, p^*_{t-1} + b_8 d_{53} + u_t \qquad (5.2)$$

In terms of this function, positive estimates of b'_j would indicate greater responses of capital expenditures to changes in sales where

Table 5-1. Asymmetrical Accelerator Relations: Capital Expenditures as a Function of Positive and Negative Sales Changes, Profits, and Depreciation, Industry Time Series and Firm and Industry Cross Sections, 1955-1968

$$i_t^* = b_0 + \sum_{j=1}^{7} (b_j + b_j^+ D_j^+) \Delta s^*_{t+1-j} + \sum_{j=8}^{9} b_j p^*_{t+8-j} + b_{10} d_{53} + u_t$$

$$\text{where } D_j^+ = 1, \text{ when } \Delta s^*_{t+1-j} \geq 0$$

$$D_j^+ = 0 \text{ when } \Delta s^*_{t+1-j} < 0$$

A. Asymmetric elements

(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
	Industry Time Series			*Firm Cross Section across Industries*			*Industry Cross Section*		
Variable or Statistic	*Positive sales changes*	*Negative sales changes*	*Difference*	*Positive sales changes*	*Negative sales changes*	*Difference*	*Positive sales changes*	*Negative sales changes*	*Difference*
Δs^*_t	.125	−.021	.146	.084	.061	.023	.084	.011	.074
	(.073)	(.115)	(.165)	(.012)	(.020)	(.026)	(.094)	(.160)	(.220)
Δs^*_{t-1}	.027	.222	−.195	.049	.100	−.051	−.091	.291	−.382
	(.068)	(.096)	(.150)	(.012)	(.017)	(.024)	(.094)	(.127)	(.195)
Δs^*_{t-2}	.144	−.014	.158	.025	.086	−.061	.072	.103	−.031
	(.068)	(.093)	(.150)	(.011)	(.017)	(.023)	(.097)	(.123)	(.197)
Δs^*_{t-3}	.073	.056	.017	.031	.072	−.041	.046	.149	−.104
	(.071)	(.095)	(.154)	(.011)	(.017)	(.024)	(.100)	(.117)	(.197)
Δs^*_{t-4}	.194	−.021	.215	.045	.038	.007	.117	.074	.043
	(.066)	(.095)	(.149)	(.011)	(.017)	(.023)	(.083)	(.114)	(.172)
Δs^*_{t-5}	.023	.035	−.012	.015	.050	−.035	−.064	.088	−.152
	(.058)	(.092)	(.136)	(.010)	(.017)	(.022)	(.080)	(.114)	(.172)
Δs^*_{t-6}	.118	−.053	.171	.015	.024	−.009	.049	.039	.011
	(.056)	(.084)	(.129)	(.010)	(.015)	(.021)	(.078)	(.101)	(.155)
$\Sigma\Delta s^*$ coefficients	.704	.203	.501	.264	.431	−.167	.213	.754	−.541
	(.159)	(.199)	(.306)	(.022)	(.033)	(.038)	(.110)	(.132)	(.164)

B. Parameters assumed common

(1)	*(2)*	*(3)*	*(4)*
Variable or Statistic	*Industry Time Series*	*Firm Cross Section across Industries*	*Industry Cross Section*
Constant	−.032	.030	.026
	(.037)	(.002)	(.006)
p^*_t	.067	−.001	−.255
	(.154)	(.023)	(.216)
p^*_{t-1}	.456	.099	.131
	(.153)	(.022)	(.209)
d_{53}	.315	.593	1.249
	(.667)	(.031)	(.134)

Table 5-1 continued

(1) Variable or Statistic	*(2)* Industry Time Series	*(3)* Firm Cross Section across Industries	*(4)* Industry Cross Section
Σp^* coefficients	.523 (.074)	.098 (.011)	.124 (.052)
$n(-228)$	140	4021	140
r.d.f.	113	3990	109
$\hat{R}^2$	.534	.247	.656
F	9.75	78.48	15.15

gross profits are above average. If higher gross profits ratios speed the reaction of capital expenditures to changes in sales, we should expect the initial b_j' to be positive and later ones to be negative. We should, in particular, look for positive values of b_1'.

Some substantiation of these hypotheses is offered by the results of cross section and overall regressions, reported in Table 5-3.[1] In each of the individual firm regressions, estimates of b_1' are significantly positive. In the industry regressions, both cross section and overall, the estimated values of b_1' have substantial standard errors and are no longer statistically significant, but are considerably higher. The long-lagged coefficients generally turn to zero or negative.

When 1953 depreciation ratios are excluded but results for time series included (Table M5-4), definitely positive estimates of b_1' emerge again in the time series and in all other regressions. Some further notion of the significance of the newly defined gross profits variable may be derived from its standard deviation—in the neighborhood of 0.7 in the individual firm cross section and overall regressions, 0.4 in the industry overall and cross section regressions, only slightly below that in the firm time series, but a low 0.132 in the industry time series. The greater the variation from zero (that is, the higher the absolute value of G), the greater the effect of any given b_j', for it is $b_j'G$ that is applied to sales changes. Thus, for example, in the firm time series a 10 percent greater real increase in current sales would be associated with a ratio of capital expenditures to gross fixed assets only 0.49 percent higher on the average (which, given a mean ratio of about 0.1, implies capital expenditures 5 percent higher). But for firms with relative gross profits one standard deviation above its mean, that capital expenditure ratio would be

[1] Table M5-2 appears only in microfiche.

Table 5-3. Gross Profits and the Speed of Reaction: Capital Expenditures as a Function of Sales Changes, Profits, Depreciation, and the Difference between Profits plus Depreciation and Their Mean, Firm and Industry Cross Sections and Overall Regressions, 1955-1968

$$i_t^* = b_0 + \sum_{j=1}^{6} (b_j + b_j' G)\, \Delta s_{t+1-j}^* + b_7\, p_{t-1}^* + b_8\, d_{53} + u_t$$

$$\text{where } G = \frac{p_{t-1}^* + d_{t-1}^*}{0.13545} - 1$$

(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Cross Sections				
	Firm			*Overall*	
Variable or Statistic	*Across industries*	*Within industries*	*Industry*	*Firm*	*Industry*
Constant	.026 (.002)	.037 (.002)	.006 (.008)	.025 (.002)	.006 (.008)
$b_1\ (\Delta s_t^*)$	.068 (.009)	.061 (.009)	.073 (.066)	.064 (.008)	.016 (.047)
$b_2\ (\Delta s_{t-1}^*)$	.051 (.009)	.039 (.008)	.107 (.062)	.051 (.008)	.074 (.039)
$b_3\ (\Delta s_{t-2}^*)$	.050 (.008)	.037 (.008)	.082 (.059)	.053 (.008)	.076 (.036)
$b_4\ (\Delta s_{t-3}^*)$	.026 (.008)	.014 (.008)	.054 (.057)	.035 (.008)	.107 (.036)
$b_5\ (\Delta s_{t-4}^*)$	.026 (.008)	.016 (.008)	.008 (.055)	.031 (.007)	.061 (.036)
$b_6\ (\Delta s_{t-5}^*)$	.026 (.008)	.016 (.008)	.065 (.059)	.026 (.007)	.048 (.041)
$b_7 (p_{t-1}^*)$	.077 (.015)	.089 (.015)	−.037 (.094)	.084 (.015)	.003 (.092)
$b_8\ (d_{53})$	.529 (.031)	.352 (.036)	.997 (.143)	.518 (.031)	.955 (.133)
b_1'	.063 (.010)	.060 (.010)	.130 (.097)	.065 (.010)	.156 (.093)
b_2'	.000 (.010)	.008 (.010)	−.024 (.094)	.001 (.010)	−.042 (.089)
b_3'	−.001 (.010)	.009 (.010)	−.101 (.088)	−.001 (.010)	−.084 (.082)
b_4'	−.013 (.011)	−.006 (.011)	−.004 (.082)	−.014 (.011)	.002 (.081)
b_5'	−.014 (.010)	−.007 (.010)	−.120 (.085)	−.018 (.011)	−.142 (.082)
b_6'	−.005 (.010)	.008 (.010)	−.081 (.088)	−.005 (.010)	−.069 (.083)

Table 5-3 cont

(1)
Variable or Statistic
Σb_j
$\Sigma b_j'$
σ_G
$n(-137)$
r.d.f.
$\hat{R}^2$
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F[(2) − (3) − (4)] =

Note: Table M5-2 a

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Table 5-3 continued

(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Cross Sections				
	Firm			*Overall*	
Variable or Statistic	*Across industries*	*Within industries*	*Industry*	*Firm*	*Industry*
Σb_j	.247 (.020)	.183 (.020)	.388 (.118)	.260 (.019)	.384 (.092)
$\Sigma b'_j$	.030 (.022)	.071 (.021)	−.200 (.166)	.027 (.022)	−.179 (.160)
σ_G	.726	.625	.406	.729	.394
$n(-137)$	3174	3174	110	3174	110
r.d.f.	3149	3050	85	3159	95
$\bar{R}^2$	.225	.136	.598	.232	.592
F	66.69	35.39	11.53	69.56	12.28

$F[(2) - (3) - (4)] = 12.76$; $F_{.01} = 2.08$.

Note: Table M5-2 appears only in microfiche.

another 0.23 percent higher. In the firm cross section across industries, the corresponding figures for a 10 percent increase in current sales would be 0.84 percent on the average in the capital expenditure ratio and 0.49 percent more than that for a firm with relative gross profits one standard deviation above the mean. The main factor in this greater cross section effect is the greater standard deviation, 0.726, of the relative gross profits variable, G (as against 0.355 in the firm time series).

To get some further impression of the possible impact of our interactive profits variable we note that in the usually sharp 1974-1975 recession, after-tax profits fell by about one-third. They were projected to rise that much in real terms, and did, in the recovery of 1976. On the basis of our definition of G, with mean values of p^*_{t-1} of about 0.09, this implies a swing of as much as $\pm 0.03/0.13545$, or about ± 0.22. Taking 0.102 from the industry time series in Table M5-4 as our estimate of b'_1, we see that the total effect is to decrease and then increase the current sales change coefficient by about 0.023. Cyclical fluctuations in profits (if we can ignore all of the aggregation problems of our mixture of numbers) appear to offer some slight short-term reinforcement of accelerator effects in recovery and a reduction in the decline phase.

ASYMMETRICAL ROLE OF PROFITS IN SPEED OF REACTION

Some of the same considerations that led us to look for an asymmetrical role for sales changes themselves similarly dictate a search for asymmetry in the role of profits. Following our formulation, in the case of a positive value of G, a positive estimate of b_j' would imply not only that capital expenditures would rise more with more rapidly rising sales, but also that they would fall more with more rapidly falling sales. Higher gross profits, however, might moderate the reduction in capital expenditures, while lower gross profits might force a greater correspondence between lower capital expenditures and falling sales.

To separate out the situations of rising and falling sales, we may define a set of dummy variables, D_j^+ and D_j^-:

$$D_j^+ = 1, D_j^- = 0 \text{ when } \Delta s_{t+1-j}^* \geqslant 0,$$

$$D_j^+ = 0, D_j^- = 1 \text{ when } \Delta s_{t+1-j}^* < 0,$$

and, as before

$$G = \frac{p_{t-1}^* + d_{t-1}^*}{0.13545} - 1.$$

Keeping the size of the regression manageable, we restrict our examination to the effect of gross profits on the parameters of current and two lagged sales change variables in regressions that include six sales change variables in all, one lagged profits variable, and where appropriate, the 1953 depreciation ratio. The general form of the function estimated is then

$$i_t^* = b_0 + \sum_{j=1}^{3} [b_j + (b_j^+ D_j^+ + b_j^- D_j^-)G] \, \Delta s_{t+1-j}^* \qquad (5.3)$$

$$+ \sum_{j=4}^{6} \Delta s_{t+1-j} + b_7 \, p_{t-1}^* + b_8 d_{53} + u_t$$

The cross section and overall results in Table 5-5[2] offer a fairly clear picture. Estimates of b_1^+, which applies to rising sales, are

[2] Table M5-4 appears only in microfiche.

positive. This suggests that higher ratios of gross profits (which may involve in large part greater depreciation charges and replacement requirements) are associated with faster increases in capital expenditures in response to more rapidly rising sales. The lower estimates of b_1^-, all close to zero, suggest, on the other hand, that the gross profits ratio has little to do with capital expenditures in the case of declining sales. While capital expenditures, according to our regression results, would be less in such a case, the extent to which this is so hardly depends on how the lagged gross profits ratio for a firm in a given year relates to the average gross profits ratio of all firms in all years.

Eliminating the 1953 depreciation variable (see Table M5-6) and examining time series results does not markedly affect our inferences from the cross sections and overall regressions. In the time series, we do pick up positive estimates of b_1^- and, indeed, of b_2^- and b_3^- as well. These would suggest that where our gross profits variable is above average, falling sales are associated with lesser capital expenditures than where the gross profits variable is below average. This could relate to the fact that a higher gross profits variable is associated with higher replacement requirements and a higher gross capital expenditures ratio to begin with, leaving more room for reducing capital expenditures with more rapidly falling sales. Attempts to reconcile these differences with the cross section and overall results do not appear fruitful in view of the doubtful statistical significance of the differences and the inability to confirm conjectures.

ROLE OF PROFITS AND SIZE OF FIRM

Imperfections in capital markets are a contributing factor in the role profits play in the capital expenditure function. If acquisition of money capital depends upon internal funds or external funds available on the evidence of profits, massive capital expenditures may require high current (or recently past) profits. This is probably more true of smaller firms than of large firms. Those should be able to raise funds easily in the market or through long-established relations with financial institutions, almost regardless of their current profits figure. Evidence of this was reported some years ago (Eisner, 1964) in comparisons of cross sections, on the basis of a much smaller body of data than that which underlies the current study. Now it is possible to examine further the influence that size of firm exerts on the role of profits.

To this end, the McGraw-Hill firms were divided into four reasonably comparable categories on the basis of gross fixed assets in

Table 5-5. Gross Profits and the Speed of Reaction, Rising and Falling Sales: Capital Expenditures as a Function of Sales Changes, Profits, Depreciation, and the Difference between Profits plus Depreciation and Their Mean, Firm and Industry Cross Sections and Overall Regressions, 1955-1968

$$i_t^* = b_0 + \sum_{j=1}^{3} [b_j + (b_j^+ D_j^+ + b_j^- D_j^-)G]\, \Delta s_{t+1-j}^* + \sum_{j=4}^{6} b_j\, \Delta s_{t+1-j}^*$$

$$+ b_7 p_{t-1}^* + b_8 d_{53} + u_t, \text{ where } G = \frac{p_{t-1}^* + d_{t-1}^*}{0.13545} - 1 \text{ and}$$

$$D_j^+ = 1, D_j^- = 0 \text{ when } \Delta s_{t+1-j}^* \geqslant 0$$

$$D_j^+ = 0, D_j^- = 1 \text{ when } \Delta s_{t+1-j}^* < 0$$

(1)	(2)	(3)	(4)	(5)	(6)
	Cross Section				
	Firm			Overall	
Variable or Statistic	Across industries	Within industries	Industry	Firm	Industry
b_0 (constant)	.031 (.002)	.041 (.003)	.006 (.017)	.031 (.002)	.008 (.014)
b_1 (Δs_t^*)	.067 (.009)	.059 (.009)	.087 (.065)	.062 (.009)	.016 (.047)
b_2 (Δs_{t-1}^*)	.048 (.009)	.036 (.009)	.093 (.066)	.048 (.008)	.058 (.045)
b_3 (Δs_{t-2}^*)	.048 (.009)	.035 (.008)	.096 (.063)	.051 (.008)	.098 (.041)
b_4 (Δs_{t-3}^*)	.026 (.008)	.014 (.008)	.083 (.062)	.035 (.008)	.127 (.040)
b_5 (Δs_{t-4}^*)	.025 (.008)	.017 (.008)	.034 (.055)	.031 (.007)	.083 (.036)
b_6 (Δs_{t-5}^*)	.025 (.008)	.016 (.008)	.094 (.057)	.026 (.007)	.070 (.039)
b_7 (p_{t-1}^*)	.028 (.017)	.050 (.017)	−.063 (.135)	.031 (.018)	−.046 (.133)
b_8 (d_{53})	.515 (.031)	.338 (.036)	.931 (.138)	.503 (.031)	.897 (.130)
b_1^+	.088 (.015)	.083 (.014)	.186 (.164)	.089 (.015)	.221 (.156)
b_2^+	.006 (.015)	.015 (.014)	−.089 (.167)	.007 (.015)	−.109 (.155)
b_3^+	.001 (.016)	.015 (.015)	−.189 (.158)	.002 (.016)	−.156 (.153)
b_1^-	.013 (.024)	.010 (.023)	.023 (.221)	.017 (.024)	.020 (.205)

Table 5-5 continued

(1)	(2)	(3)	(4)	(5)	(6)
	Cross Section				
	Firm			*Overall*	
Variable or Statistic	*Across industries*	*Within industries*	*Industry*	*Firm*	*Industry*
b_2^-	−.012 (.020)	.001 (.019)	−.006 (.251)	−.013 (.020)	−.035 (.232)
b_3^-	−.023 (.022)	−.018 (.021)	.019 (.206)	−.026 (.022)	.012 (.201)
$\sum_{j=1}^{6} b_j$	.239 (.020)	.177 (.020)	.488 (.136)	.251 (.019)	.452 (.104)
$\sum_{j=1}^{3} b_j^+$	.095 (.019)	.113 (.019)	−.093 (.177)	.099 (.019)	−.044 (.173)
$\sum_{j=1}^{3} b_j^-$	−.021 (.031)	−.007 (.030)	.036 (.313)	−.022 (.031)	−.003 (.298)
$n(-137)$	3174	3174	110	3174	110
r.d.f.	3149	3050	85	3159	95
$\hat{R}^2$	.227	.139	.589	.233	.579
F	67.23	36.20	11.12	69.99	11.73

$F[(2) - (3) - (4)] = 12.32$; $F_{.01} = 2.08$.

Note: Table M5-4 appears only in microfiche.

1966. The smallest firms, those with gross fixed assets below \$20 million, were taken as the base and designated as category zero. Category one includes firms with assets equal to or greater than \$20 million but less than \$66 million, while category two comprises firms with assets equal to or greater than \$66 million but less than \$325 million. Category three, the largest firms, are those with 1966 gross fixed assets equal to or greater than \$325 million. The following function was then estimated:

$$i_t^* = b_0 + \sum_{j=1}^{7} b_j \Delta s_{t+1-j}^* + (b_8 + \sum_{k=1}^{3} b_{8k} D_k) p_{t-1}^* + b_9 d_{53} + u_t$$

$D_1 = D_2 = D_3 = 0$ when GFA < \$20,000,000

$D_1 = 1$ and $D_2 = D_3 = 0$ when

\$20,000,000 ⩽ GFA_{66} < \$66,000,000

$$D_2 = 1 \text{ and } D_1 = D_3 = 0 \text{ when}$$

$$\$66{,}000{,}000 \leqslant \mathrm{GFA}_{66} < \$325{,}000{,}000$$

$$D_3 = 1 \text{ and } D_1 = D_2 = 0 \text{ when } \$325{,}000{,}000 \leqslant \mathrm{GFA}_{66} \quad (5.4)$$

Results presented in Table 5-7[3] indicate that the variance across industries does contribute to a greater role for profits in the smallest firms. This is seen most clearly in the industry cross section, where the estimate of $b_8 = 1.288$ suggests a major role for profits in the smallest firms. For category one, the profits coefficient is $b_8 + b_{81} = -0.365$. For category two, the next to the largest firms, the profits coefficient is $b_8 + b_{82} = 0.089$. For the largest firms, the profits coefficient is $b_8 + b_{83} = 0.214$. Thus, while outside the smallest firm category there is some suggestion of higher profits coefficients as firms become larger, the significant difference is overwhelmingly that between large profits coefficients for the smallest firms and smaller coefficients for all other firms.

The firm cross section across industries, with a substantial industry cross section component, again reveals higher profits coefficients for the smallest firm category, but the differences in coefficients from category to category are much less marked than in the industry cross section. And in the firm cross section within industries, the profits coefficient is largest, although not significantly so, in the largest firm category.

Results excluding the 1953 depreciation variable and including time series are shown in Table M5-8. The industry time series again shows a high profits coefficient, 0.915, for the smallest firm category, but the largest firm category has a profits coefficient of 0.837, which is almost as high. The firm time series, in fact, shows the smallest profits coefficient, 0.122, for the smallest firm category and the largest profits coefficient, 0.468, for the largest firm category. A regression based upon the cross section of firm means again shows the largest profits coefficient, 0.190, for the smallest firm category. The results of the industry cross section and firm cross section across industries are similar to those in the previous regressions where the depreciation variables were included. Regressions (not shown) involving capital expenditure anticipations for the subsequent year indicate essentially the same pattern.

Thus, some spotty confirmation in industry cross sections is evident for the hypothesis that profits affect capital expenditures more in smaller firms. This is to suggest that in industries with

[3] Tables M5-6 and M5-8 appear only in microfiche.

Table 5-7. R
of Sales Chang
Industry Cros

$i_t^* = b_0$

$D_1 = D_2 = D_3 = 0$ w

$D_1 = 1, D_2 = D_3 =$

$D_2 = 1, D_1 = D_3 =$

$D_3 = 1, D_1 = D_2 = 0$

(1)
Variable or Statistic
b_0 (constant)
b_1 (Δs_t^*)
b_2 (Δs_{t-1}^*)
b_3 (Δs_{t-2}^*)
b_4 (Δs_{t-3}^*)
b_5 (Δs_{t-4}^*)
b_6 (Δs_{t-5}^*)
b_7 (Δs_{t-6}^*)
b_8 (p_{t-1}^*)
$b_8 + b_{81}$
$b_8 + b_{82}$
$b_8 + b_{83}$
b_9 (d_{53})

GFA66 (5.4)

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Table 5-7. Role of Profits and Size of Firm: Capital Expenditures as a Function of Sales Changes, Profits and Gross Fixed Assets, and Depreciation, Firm and Industry Cross Sections, 1955-1968

$$i_t^* = b_0 + \sum_{j=1}^{7} \Delta s^*_{t+1-j} + [b_8 + \sum_{k=1}^{3} b_{8k} D_k]\, p^*_{t-1} + b_9 d_{53} + u_t, \text{ where}$$

$D_1 = D_2 = D_3 = 0$ when $GFA_{66} < \$20{,}000{,}000$

$D_1 = 1, D_2 = D_3 = 0$ when $\$20{,}000{,}000 \leqslant GFA_{66} < \$66{,}000{,}000$

$D_2 = 1, D_1 = D_3 = 0$ when $\$66{,}000{,}000 \leqslant GFA_{66} < \$325{,}000{,}000$

$D_3 = 1, D_1 = D_2 = 0$ when $\$325{,}000{,}000 \leqslant GFA_{66}$

(1)	*(2)*	*(3)*	*(4)*	*(5)*
	Regression Coefficients and Standard Errors			*Differences in Coefficients and Standard Errors*
Variable or Statistic	*Firm cross section within industries*	*Industry cross section*	*Firm cross section across industries*	*Firm cross section within industries minus industry cross section [(2) − (3)]*
b_0 (constant)	.038 (.006)	−.071 (.058)	.023 (.007)	– –
$b_1\ (\Delta s_t^*)$	.075 (.010)	.041 (.057)	.084 (.010)	.035 (.058)
$b_2\ (\Delta s_{t-1}^*)$	.052 (.009)	.082 (.056)	.069 (.010)	−.030 (.057)
$b_3\ (\Delta s_{t-2}^*)$	.031 (.009)	−.075 (.055)	.039 (.009)	.105 (.055)
$b_4\ (\Delta s_{t-3}^*)$	.031 (.009)	−.001 (.050)	.041 (.009)	.031 (.051)
$b_5\ (\Delta s_{t-4}^*)$	.030 (.009)	.085 (.049)	.042 (.009)	−.056 (.050)
$b_6\ (\Delta s_{t-5}^*)$	.031 (.008)	.005 (.047)	.036 (.009)	.026 (.048)
$b_7\ (\Delta s_{t-6}^*)$	.020 (.008)	.005 (.045)	.025 (.008)	.015 (.046)
$b_8\ (p_{t-1}^*)$	.140 (.038)	1.288 (.440)	.131 (.041)	−1.148 (.442)
$b_8 + b_{81}$	.131 (.021)	−.365 (.184)	.093 (.023)	.496 (.186)
$b_8 + b_{82}$	.112 (.022)	.089 (.212)	.080 (.023)	.023 (.213)
$b_8 + b_{83}$	.153 (.024)	.214 (.153)	.103 (.023)	−.060 (.155)
$b_9\ (d_{53})$	.330 (.045)	1.315 (.160)	.611 (.038)	−.985 (.166)

Table 5-7 continued

(1)	(2)	(3)	(4)	(5)
	Regression Coefficients and Standard Errors			*Differences in Coefficients and Standard Errors*
Variable or Statistic	*Firm cross section within industries*	*Industry cross section*	*Firm cross section across industries*	*Firm cross section within industries minus industry cross section [(2) − (3)]*
$\sum_{j=1}^{7} b_j$ (Δs^* coeff.)	.269 (.024)	.142 (.126)	.335 (.024)	.126 (.129)
$n(-125)$	2734	139	2734	
r.d.f.	2580	110	2705	
$\hat{R}^2$	.136	.657	.260	
F	28.32	16.97	64.81	15.91[a]

[a] $F[(4) - (2) - (3)]$; $F_{.01} = 2.04$.

Note: Table M5-6 appears only in microfiche.

relatively smaller firms, when industry profits are higher, capital expenditures are higher. The relationship seems to evaporate considerably, however, in cross sections within industries and tends to be reversed in the firm time series. These differences could be explained, at least partially, in terms of our arguments advanced earlier that profits may affect the timing of capital expenditures for most firms, but that in the case of smaller firms, capital expenditures are tied closely to the level of industry profits, even over the longer run.

SUMMARY AND CONCLUSIONS

Tests for asymmetrical relations between rising and declining sales yielded disparate results. Time series show some evidence of greater response by capital expenditures to variance in rising sales than to variance in falling sales. In cross sections, however, the reverse appears true. Perhaps an individual firm will not cut investment much in response to one relatively rare year of declining sales. Yet in a cross section, the firms with declining sales will represent observations with generally less secure investment programs—and these may prove quite susceptible to greater reductions the greater the sales decline.

Analyzing the effect of gross profits on the speed of adjustment of capital expenditures to changes in sales proved fruitful. Capital expenditures are apparently undertaken with lesser average lags when profits are above average. An attempt to delineate different influences of profits in situations of rising and falling sales leaves intact the inference that higher than average gross profits accelerate the adjustment of capital to rising sales. In the case of falling sales, however, differing time series and cross section results make any reasonably confident statistical inference impossible.

Relating the role of profits to size of firm (and presumably consequential cost and elasticity of supply of money capital), we find a greater association of profits with capital expenditures in the relatively smaller firms, but only in industry cross sections and industry time series. Results are blurred, if not reversed, in individual firm time series and cross sections within industries, and no clear resolution of these differences has been achieved thus far.

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