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Chapter Nine

A Final Note

Our results allow us to point to a good number of substantive findings with regard to inventory investment, capital expenditures, and capital expenditure plans and realizations. Inventory investment showed a very clear relationship to efforts to maintain some "equilibrium" or previous average of ratios of inventory sales in the face of changing expected demand. Capital expenditures were estimated primarily as a distributed lag function of a set of seven current and past actual sales changes, current and lagged profits, and depreciation charges. The bulk of net investment in plant and equipment was found to be accountable to increases in sales, with a "hump" in the distribution at a one year lag. The sales change coefficients were usually less in time series than in cross sections and generally summed to no more than 0.5 in individual firm regressions, rather than the unitary elasticity of capital stock to sales that might be expected from homogeneous production functions of the first degree, unitary elasticity of expectations, isoelastic shifts in demand, and sufficient time for adjustment.

Coefficients were higher, however, in regressions where observations were industry means rather than the individual firm data. It appeared that in some instances—where an essentially transitory variance was averaged out, expectational factors were taken into account, pressure of demand on capacity was high, and longer run adjustment was permitted—sums of sales change coefficients did approach a reasonable neighborhood of unity. (This should not be taken to imply rejection of the possibility of increasing returns to scale or declining capital intensity of production, both of which

might have contributed to sums of sales change coefficients of less than unity.)

As to profits, immediately past profits generally showed a positive association with capital expenditures, particularly in time series, less so in cross sections. This suggests that it is in the timing of investment rather than in its long-run magnitude that profits play a greater part. Further tests indicated that higher gross profits tended to accelerate the speed of adjustment of capital stock to increasing sales. There was also some evidence of a greater impact of past profits in relatively smaller firms.

Profits, further, also have a role in connection with the acceleration principle. Since profits prove to be a sharply positive function of sales changes, positive profits coefficients in investment functions, which are particularly noted in time series relations, enlarge the impact of sales changes on investment. Sales changes hence affect investment not only directly but also indirectly, via their impact on profits. The estimated total elasticity of capital stock to sales thus does rise somewhat above 0.5 in individual firm regressions and proves close to unity in some industry regressions.

Individual firm McGraw-Hill responses regarding the proportions of capital expenditures for replacement and modernization versus those for expansion enabled us to confirm findings by Feldstein and Foot that expenditures for replacement and modernization were not a constant proportion of capital (although much more constant than expenditures planned for expansion). The evidence did not suggest that replacement and modernization expenditures were a stabilizing force, inasmuch as they tended to move up and down with expansion expenditures. And, as might have been expected, expenditures for expansion related more clearly to past and expected sales changes, while replacement and modernization expenditures tied in more closely with previous depreciation charges and profits.

Our rather lengthy analysis of capital expenditure anticipations and realizations confirms that anticipations have essentially the same determinants as the expenditures to which they relate. Some differences between expenditures and anticipations can be explained by changes in these determinants between the time anticipations or plans are expressed and the time they are implemented. Anticipated capital expenditures themselves conform to an adaptive mechanism, manifesting a positive relation with the difference between current actual expenditures and their previously expressed anticipations.

Short-run capital expenditure anticipations account for a major share of the variance of capital expenditures both across firms and over time, far more than do previous capital expenditures or other

variables. Differences between capital expenditures and capital expenditure anticipations of individual firms were substantial, but less for means of observations within years or industries. Aggregation tended to wash out errors in anticipations.

The capital expenditure realizations variable—that is, the difference between actual and anticipated expenditures—showed some positive association with favorable or improving economic circumstances as measured by sales changes, sales realizations (the difference between actual and expected sales), and profits. In relations involving capital expenditures or capital expenditure realizations, variables reflecting conditions that should have been taken into account in anticipations usually had coefficients that were close to zero or slightly negative. Current variables, which postdated the information entering into anticipations, generally contributed significantly to the explanation of capital expenditure realizations. We inferred confirmation of the realizations function proposed by Modigliani, a confirmation of moderate proportions where predictive power for individual firms was concerned (although distinct even there) which took on greater weight at more aggregative levels.

Anticipations of capital expenditures three and four years ahead, while generally found to have determinants similar to those of short-run plans and of actual capital expenditures themselves, were seriously incomplete and understated actual expenditures by almost one-third. When fitted into regressions involving complete sets of past sales change and profit variables, however, stated long-run plans or anticipations were found to embody additional information or some commitment or independent influence on expenditures not captured in original or subsequent, more proximate, objective determinants.

As we warned initially, determinants of business investment are to be found largely in expectations—and probability distributions of expectations at that—of future conditions and opportunities. Yet in the main, our data, and a fortiori those of others, have involved current and past variables.

The difficulties of relying heavily on simple extrapolations of the past to understand or predict the future were presaged in our consideration of the sales expectation responses of the McGraw-Hill surveys. There we confirmed a significant regressive component in expectations of the year-to-year sales changes. Where firms had most recently experienced sales increases, they tended to report expectations of sales declines, and vice versa. At the industry level, however, this regressive element tended to wash out. In effect, individual firms apparently view much of their own short-run variation in sales as

transitory. Where mean sales of an entire industry group vary, firms in the group will view the variances as in larger part permanent or related to a long-run trend.

Long-run sales expectations manifested little of the regressive relation and more of the positive association with past experience. But for both long- and short-run sales change expectations, realizations were uneven. Apparent overall accuracy of short-run expectations masked wide, but offsetting, errors for individual firms and years. Cross section relations suggested a positive association between actual and expected long-run sales changes, as firms whose sales were increasing more rapidly than sales of other firms generally expected such a pattern to continue. Clearly, firms in more rapidly growing industries expected to grow more rapidly than those in less rapidly growing industries.

Firms were conspicuously inaccurate in predicting the timing of long-run changes in sales. Neither information from individual firms nor that from the means of firm observations for industries seemed of much use as forecasts of whether sales changes over the next three or four years would be greater or smaller than sales changes over any other three or four year period. Thus, business firms are no better at predicting cyclical fluctuations than economists or other observers and analysts. That, in turn, sheds some light on our general difficulty in predicting investment, which, for profit-maximizing firms, must depend on precisely those unpredictable future changes in demand. As Keynes pointed out in the *General Theory* (1936), the lack of solid information as to the future leads, on the one hand, to ready acceptance of the conventional wisdom of the moment and some tendency to assume, for want of better information, that tomorrow will be like today. On the other hand, it leads to substantial instability of expectations when the conventional wisdom is jarred and, consequently, to sharp and galloping adjustments of factors entrepreneurs think themselves able to control. Therefore, marginal efficiencies of investment, lag structures, and investment itself may all change in abrupt and relatively unpredictable fashion.

We may conjecture that it is these underlying expectational issues as much as omitted variables and ill-fitting functional forms that contribute both to the persistently large proportions of unexplained variance and to the differences in parametric estimates from different structurings of frequently identical samples. Thus, changes in sales and expected changes in sales prove major determinants of capital expenditures and investment in inventories. This is consistent with flexible accelerator models that have been developed and worked with over a number of years now. Yet clearly the covariance of ex

ante and ex post variables may be different in time series than in cross sections and different for observations of individual firms than for those that are means for broad industry groups.

We have chosen to put this in terms of differing components of "transitory" and "permanent" variance in the different decompositions of our data sets. In the case of capital expenditures, we look for a greater covariance between permanent changes in sales and investment; inventories may move relatively more with less permanent changes. But more generally, the frequent differences between estimates from time series and cross sections, individual firms and industries, may well be generalized further. Wherever (as is so often the case in empirical work in econometrics) the variables for which we have observations are not precisely those that fit a correct specification of the relation we wish to estimate, the resultant errors in variables will effect different proportions of variance and covariance in different structurings of the data. In our analysis, these differences have been brought forth again and again. This should affect our confidence not only toward the estimates presented here, but perhaps even more toward anyone else's estimated parameters, whether for investment functions or for other relations where those potential differences have not been revealed.

In conclusion, we should recognize, along with what we have attempted and accomplished, what we clearly have not: We have not here completed the nexus of the saving-investment relation in the economy.

For one thing, we have focused exclusively on business investment and on that in plant, equipment, and inventories only. We have ignored the larger amounts of physical capital formation in government and households, as well as human capital formation in all sectors.[1] And even within the business sector, we have considered only those components of investment included in the most conventional definitions and have excluded, in particular, nonphysical investment in research and development.[2]

Further, we have viewed business investment essentially from the demand side, with supply factors entering at best implicitly in some of the lag processes. There has been no attempt to come to grips here with implications of the simultaneous saving function, which may in the long run, if not in the short run as well, be decisive in determining aggregative investment. Where underemployment and idle capacity are substantial, there may be considerable play in the

[1] See Eisner (1978).

[2] Analysis of the McGraw-Hill data on research and development has been reported upon by Rasmussen (1969).

determinants of business investment focused upon in this work. Under conditions of full employment and full utilization of productive factors generally, expansion of business investment will clearly be limited by the elasticities of consumption, government demand, and other forms of investment. If none of these can "give," there is no scope for general expansion of business investment on the basis of the variables we have considered.[3]

Our own analysis of elements determining business investment may perhaps be noted as much for its caveats as for its positive findings. The role of the acceleration principle, distributed in its lags and sometimes subtle in its process and interaction with profits, does come through strongly. But the tricky wicket of expectations leaves some parameter estimates, like predictions of future behavior, less robust and certain than we might like.

Our caveats relate ultimately to the problem, more general than many investigators acknowledge, of fitting data on essentially proxy variables to those of our theoretical specifications and, proximately, to an occasionally embarrassing abundance of statistical inferences and parametric estimates. Indeed, a novelty of this work that should be emphasized is the very variety of estimates of parameters from various time series and cross sections, at different levels of aggregation, of the same basic body of data. In some instances, we have offered explanations of the significant differences. But in many cases, these, and all of the broad sets of results, both in the text and on microfiche, invite further conjecture and analysis.

[3] See, on this subject, Eisner (1968), and Taubman and Wales (1969).