

UC Irvine

Papers

Title

Corporate Planning and Capital Investment

Permalink

<https://escholarship.org/uc/item/3024n0pm>

Journal

Journal of Economic Behavior and Organization, 7(2)

Author

Bromiley, P

Publication Date

1986

Peer reviewed

CORPORATE PLANNING AND CAPITAL INVESTMENT*

Philip BROMILEY

University of Minnesota, Minneapolis, MN 55455, USA

Received June 1983, final version received August 1985

Based on interviews with corporate managers and reviews of corporate planning documents, corporate planning and implementation processes related to capital investment are examined in four large corporations. From the examination, models are developed and estimated on corporate plans and actual outcomes to explain corporate forecasts of capital investment, forecasts of changes in debt, and actual capital investment. The results of both the qualitative and quantitative data analyses are summarized and a new conceptual framework for the determinants of corporate capital investment is proposed.

1. Introduction

In spite of the long and vigorous history of capital investment studies in economics [see Meyer and Kuh (1959), Eisner and Strotz (1963), and Jorgenson (1971) for partial reviews of this literature], the mainstream of capital investment research remains open to three fundamental criticisms. As Nickell (1978) demonstrates, there is a plethora of plausible alternative assumptions which could be included in a neoclassical model but the majority must be assumed away in order to make the model tractable. Apart from tradition, few guides exist for determining which assumptions to employ. As Bischoff (1971), Elliott (1973), and Clark (1979) demonstrate, current econometric approaches are unable to demonstrate the superiority of neoclassical and putty-clay models over the simple flexible accelerator or accelerator and cash-flow models. Either the additional complexity of the newer models is not an empirical improvement over the much simpler models, or the data have told us little about the appropriate specification of investment models. Finally, the macroeconomic application of these models, which are developed using a single-firm theory, is questionable (Fisher, 1971).

*An earlier version of this paper was presented at the Eastern Economic Association meetings, Pittsburgh, PA 1985. This research was funded by the Sarah Scaiffe Foundation and the Naval Postgraduate School Research Foundation. I would like to thank Richard M. Cyert, Otto A. Davis, Gregory Fischer, Steven Garber, and Herbert A. Simon for their assistance, and the corporations which participated in this study by their cooperation.

Many of the *ceteris paribus* assumptions used in the model derivations may make sense at the firm level but are unpleasant at the national level (e.g., that the price level of capital goods is independent of orders for capital goods).

Given these serious problems, an alternative to the conventional approaches to the investment question appears justified. The research reported here is based on the tradition of behavioral economics (Cyert and March, 1963).¹ Congruent with this approach, the focus of this study will be decidedly microeconomic. The question is, what can examination of the behavior of individual corporations' planning and investment processes tell us about the determinants of corporate expenditures on property, plant, and equipment?² The information gathered in this way can be thought of as either, following Simon (1984), an empirical approach to determining what behavioral assumptions should be included in optimizing models (addressing criticism one above), or an independent approach to the determinants of capital investment (perhaps assisting in the development of empirically superior models).

In order to provide a basic understanding of the processes and information flows relevant to the determination of corporate expenditures on property, plant, and equipment, in-depth interviews were conducted in four corporations. Econometric models were specified to explore some implications of the interviews, either checking the consistency of the numbers with the verbal reports or estimating the magnitude of the effects reported by interviewees. Three of the four corporations had the data necessary to estimate equations based on their interviews. Finally, a conceptual framework for the determinants of corporate capital investment is presented.

Using qualitative data to determine model structure is somewhat suspect in economic analysis. The approach here is not to ask managers what determines capital investment (which they may or may not know) but rather to ask questions about the standard process by which they plan and implement capital investments. Managers are far better qualified to say what information appears in an investment proposal, or who originates investment proposals, than they are to talk about aggregate effects on investment. The derivation of regression models based on the interview data and the estimation of these models allows both testing of some of the implications of the interviews and estimation of the size of some effects (where the interviews

¹This paper summarizes research reported in greater detail in Bromiley (1986).

²While most of the literature refers to corporate capital investment, the models are developed in ways that are more relevant to expenditures on property, plant, and equipment. The change in capital as a whole includes acquisitions and dispositions of corporations or parts thereof. The normal model development (sales expectations leading to purchases of equipment with a given capital intensity followed by lags in the implementation) clearly differs from the acquisition of a corporation where the acquiring firm 'purchases' expected sales and profits, plant, and debts as a single package. In this paper, the two terms will be used synonymously but will refer to expenditures on property, plant, and equipment.

were not clear concerning the magnitude of some effects). Thus the statistical results allow a check on the implications derived from the qualitative data.

2. Copperweld Corporation

The first firm examined, Copperweld Corporation, is a 'Pittsburgh-based manufacturer of welded and seamless tubing, bimetallic rod, wire, and strand, and specialty carbon and alloy steel bars' [Copperweld (1979, cover)] with annual sales around half a billion dollars. During 1979 and 1980, internal planning and control documents were examined and interviews conducted with Copperweld employees ranging from a shop floor supervisor to vice presidents. The division level descriptions refer to one of Copperweld divisions, the Copperweld Steel Corporation. Procedures in the other divisions of the corporation vary somewhat.³

Copperweld develops both a five year strategic plan and an annual profit plan (or budget). According to all accounts, the annual plan is more influential since it is used as a basis for managerial rewards and was believed to be more realistic than the five year plan. The description that follows focuses on the profit plan.

The planning process begins in the division with the forecasting of sales. Such forecasts are made under an assumption of 'competitive' prices. Two procedures for forecasting were mentioned: (i) forecasting total sales in the appropriate markets and then working back based on market share to the expected sales for Copperweld, and (ii) having sales agents ask their customers what they would buy in the next year. The marketing manager develops a forecast based on these inputs and presents it to the division management which may modify it prior to approval. Given an approved sales forecast, the industrial engineering department forecasts the amount of time each machine will be operated to produce the needed products and the consequent manpower, raw materials, and supplies needed. Adding price forecasts for labor, materials, supplies, and utilities provides a preliminary plan including a forecast of income. These figures are reviewed by the division management with requests for re-evaluation (particularly of sales forecasts) not being infrequent.

A separate process develops a set of proposed capital investments. Projects are proposed by mid-level managers based on their operating knowledge of the plant, and industrial engineers who scan breakdown reports to identify equipment that needs replacement, both groups being aware of current sales and production capabilities. These proposed projects (a 'wish list') are reviewed by a committee which includes engineers, industrial engineers, and a

³The qualitative data reported in this paper were collected in 1979 through 1981. The processes are described as they operated at that time which may differ from current practice.

capital analyst. Out of these analyses comes a set of projects which are submitted to division management for tentative approval.

A variety of factors are reported to influence the number of projects proposed. Engineering personnel are concerned with their ability to actually implement the projects which are mainly alterations of an operating plant. Projects that either support new sales capacity (business expansion) or reduce costs (cost reduction) have to pass a hurdle rate specified by corporate headquarters based on the corporation's cost of capital. The hurdle rate is adjusted infrequently (about every five years) by estimating the corporation's cost of capital and adding a little to compensate for projects which do not have to calculate return on investment. Other projects that are required to meet regulatory requirements or are essential to keeping the plant operating do not have to pass a hurdle rate on return. The total dollars allocated for investment is compared to the cash generated by the division with some rough equality being considered desirable.

All of the forecasts in the planning process depend on some extremely difficult and consequently unreliable basic assumptions concerning sales and the basic inputs' prices (e.g., energy costs, scrap iron costs, etc.). The final forecasts represent a combination of the originator's estimates and management's modifications. The various parties have incentives to bias their forecasts since their performance is often judged by reference to these forecasts. Some managers report consciously biasing such forecasts.

The key assumptions of the division plan are sent to corporate headquarters where they are reviewed and discussed again with division management. Following approval of the key assumptions, the division reformulates its plan to conform with the approved assumptions – often this implies increasing their targets. To this point, the plans are made largely division by division and the investment plans are largely independent of the income forecasts.

With the tentatively-approved division plans, the corporate planning staff derives a corporate forecast of investments, income, and other cash-flow and balance-sheet items. The corporate office often adjusts the division's plan for the purpose of corporate forecasting (usually being more conservative than the division). The corporate-level problem is structured by the cash-flow equation: cash available from operations minus capital needed for essential uses (e.g., inventories and accounts receivable), minus anticipated dividends and desired capital investments equals funds to be raised from increased debt. Corporate financial managers report that the corporate management looks at the following items in deciding if this change in debt is acceptable: balance-sheet ratios such as debt to equity and the ratio of net income before interest and income taxes to interest expenses, current interest rates in historical perspective, and the desirability of the investments. Desirability was defined in terms of both direct return on investment and the importance of the investment to key strategic thrusts. When management is unwilling to

incur the debt needed to finance the capital investments, it cuts back on proposed investments. The final set of plans is presented for approval to the corporate Board of Directors which normally approves them.

During the operating year, the firm implements the profit plan. Monthly reports are sent to headquarters comparing the performance achieved to the numbers in the profit plan. As the division develops the investment projects outlined in the plan, it submits them to the appropriate level for funding. Approval in the plan does not constitute project funding. Rather a separate application must be made for actual funding during the operating year. Differing dollar levels of investment require different levels of corporate approval including major projects that must be approved by the Board of Directors.

Project analysis at the corporate level considers two basic questions. First, is the project a good project in a business sense? This combines both financial and policy-based criteria of evaluation. Second, how does the project impact the corporation's cash position? As noted above, some projects must show internal rates of return equal to or above the corporation's specified cost of capital hurdle rate although others do not need to do so.

Cash-flow management is a major concern of the corporate office. Each quarter the corporate staff forecasts cash flow over the next twelve months essentially to see if the required funds will be available to cover the needed uses given the anticipated cash generation. Actual cash management is executed on a day to day basis.

A cash shortfall constitutes a serious problem. Managers reported vigorous efforts are undertaken to alleviate cash shortfall problems. The courses of action reported included hiring freezes, inventory and accounts receivable reductions, spending controls on things such as maintenance, supplies and staff, and finally, if everything else failed, cutting back on capital investments. They try to avoid cutting investments based on a shortage of funds. On the other hand, some projects are delayed due to changes in forecast sales. Times when funds are short are also likely to be times when sales fall below anticipated levels which reduces the need to expand the production capacity. Increasing debt was not mentioned as an option, perhaps because interest rates were perceived to be very high during the period when these data were collected.

The other side of forecasting errors, when income and sales exceed what was anticipated, is not seen as affecting investment within the operating year. 'When we start making more money than we anticipate it has probably no impact on capital expenditures. The reason being that the programs we have established in the previous year ... are such that we're spending money not only to our monetary constraints but also to our engineering constraints. And the capital budget we come up with pretty much uses our staff – if we

had double the money it wouldn't make much difference' (a corporate planner).

To summarize, the Copperweld interviews suggest that the investment process has two major stages, planning and implementation. Individual projects come in several categories, some of which must pass hurdle rates on internal rate of return (compared to cost of capital) but the hurdle rate was not updated on a routine basis.⁴ At the end of the planning process, the uses of cash are balanced against the sources of cash with the difference being the required external funding. It was reported that at some times the firm was not willing to take on the debt needed to fund the list of investment projects. On the implementation side, shortages of funds would in some cases influence investment as would changes in sales but excess funds would have little influence on investment.

3. Corporation Two

Corporation Two,⁵ a large (sales over one billion dollars per year), diversified corporation operates mainly in industrial commodity markets. While Corporation Two produces a ten-year strategic plan and a three-year plan, the emphasis was on the first year of the three-year plan. As a senior finance official said, '(w)e place a lot more emphasis on the first year than on the next two years. Subsequent years are far away and consequently hard to forecast. Also the divisions have incentive programs that are related to the one-year forecasts'. While for large projects the three-year plan is important, over half the expenditures in Corporation Two go into small projects for which the one-year plan is more important. By manipulating the approval and implementation of small projects and the speed of the construction of larger projects, managers argued they have a substantial degree of flexibility in capital investment outlays in a given year.

The division examined is highly centralized. The marketing, planning, purchasing, etc., departments are located in the division headquarters. Production facilities located around the country report to the headquarters, often relying on headquarters for services such as engineering.

The planning process begins in June or July. A corporate economist provides forecasts to the divisions which generate the basic planning documents. As in Copperweld, planning worked from sales forecasts to cost estimates and the rest of the income forecast. In the division examined, a

⁴The controller mentioned in an interview that he was considering writing an article explaining why frequent reevaluation of cost of capital hurdle rates was not a useful practice. Not reevaluating the cost of capital hurdle rates was a conscious corporate decision.

⁵Corporations Two, Three and Four agreed to provide internal data under an agreement that their identities would not be revealed. For each of these firms, the process is described as it existed in 1980 and 1981 when these data were collected.

planner said that no formal mechanism exists for communicating the sales forecasts to the plants for planning purposes – the plants project operating costs without knowing sales and then the sales and cost forecasts are coordinated by the division management.

Capital investments come from two sources: the plants provide requests to the division on replacement and other minor projects and the division management proposes investments related to new products, new plants, and other large projects. At the division level, a committee reviews the investment proposals and comes up with a recommended list which it submits to the division manager for approval. The division aims for a minimum of 25 percent undiscounted return on investment and a maximum payback period of five years. The 25 percent figure had been used for a number of years (greater than five) and is corporate policy.

The division managers work to achieve consensus on the plan. After approval by the top division manager, the plan is presented to the group management which reviews it and may send it back for revision. By mid-November the group managers submit their group budgets to the corporate office. Following corporate review of the plans, the divisions come in and discuss their budgets with the corporate management, and the division plans are approved.

Following approval of the division plans, the corporate financial staff consolidate the division plans to give, 'a first pass at the overall company program which is reviewed by the company policy committee and the Chairman of the Board' (a corporate planner). The corporate-level plans include an analysis of the cash-flow implications of the division plans and, in particular, the amount of outside funding that will be required. Financial staff plan to meet the funding requirements of the plan. Corporate policy limits debt to a maximum of 35 percent of the total capitalization. Both the return on investment and debt to total capital policies were set based on the professional judgment of the top corporate managers rather than formal analysis. After the complete plan with funding, operations, and investment forecasts is approved by the Policy Committee and the Chairman of the Board, it is presented for approval to the Board of Directors.

As in Copperweld, approval in the plan is not approval to undertake the projects. As the projects come due, managers prepare project proposals which, depending on the size of the project, may be approved at the division, group, or corporate level. For most projects, the policy on the debt limit is not a problem but for large projects the corporate Policy Committee questions whether other projects might be coming up that would run into the debt limit if they approved the current project. As one planner said, 'I've never been turned down on the basis of expected availability of funds,' but he reported some tightening of the approval criteria during downturns in sales and income.

A variety of reasons were provided for actual investment deviating from forecast investment. Most were operational problems. For example, finding better equipment than previously anticipated might require redesign of a project, or managers might delay capital improvements on an existing plant during high sales periods if the improvements would require stopping production. While explicit cutback policies on investment due to cash shortages were not reported, some managers reported a tightening of criteria for project approval during periods of cash shortages. Thus, while reductions from planned investment were reported for a variety of operating reasons, it was not clear how much effect periods of cash shortage had on investment.

4. Corporation Three

Corporation Three, a large manufacturing corporation (annual sales between one and five billion dollars) sells in industrial, construction, and retail markets using products that are relatively undifferentiated across manufacturers. Corporation Three managers refer to at least three corporate long range plans: the sum of the division plans (believed to be optimistic), the corporate strategic plan (believed to be most realistic), and the financial plan (believed to be very conservative). The long range plans cover a ten-year horizon and a profit plan covers a one-year horizon.⁶

Corporation Three planning begins with the corporate office developing a set of forecasts which are approved by the corporate management. In addition to forecasts of sales, cost of sales, depreciation, etc., these documents include a set of guidelines for capital investment. A senior corporate planner reported that the guidelines for investment come from an analysis of previous plans and strategies which yield forecasts of cash flows. Given the investment programs from previous plans, and the sales and profits figures from previous plans, a cash flow analysis is executed to 'help both us and the corporate management (management committee) get a feel for what the preliminary spending guidelines should be ...' (a senior corporate planner). While the projections are modified somewhat depending on current economic forecasts, the planning staff reported that they did not modify the internally approved economic forecasts to adapt to every new bit of information. They said that such modifications would seriously disturb the implementation of corporate strategy. All interviewees agreed that maintaining stability in strategy is extremely important so that the policies and programs outlined in previous plans would be largely maintained in the new plans.

Given these planning assumptions, the divisions start to develop their long range plans. The divisions must use the forecasts provided by the corporate

⁶The process as described here started in 1976. Prior to 1976, the corporation developed and approved division business strategies, and a corporate financial plan was developed, but no corporate strategic plan was made.

headquarters or provide justifications for deviations. Much of the long range planning is done on a financial basis at the division level. Division management sets growth and profit objectives and works back from these to forecasts of investment, cost of sales, etc., all within the context of the long range sales forecasts for current products. The emphasis is on producing a credible set of forecasts that meet profit, market share, and growth objectives over the ten-year horizon. Given such forecasts, the sales projections are compared to current plant capacities in order to determine where and when new plants will be needed. The division identifies major projects for the next five years and provides just a total for expenditures in years six to ten. While large projects are analyzed at the division, medium and small projects are projected simply as lump sums based on the annual depreciation of the appropriate facilities, their asset bases, and historical experience.

In the planning phase, the division management segregates investment projects into those which fall within the corporate guidelines and those which exceed the guidelines. Investment projects falling within the guidelines are examined and questioned less closely by the corporate office than projects the divisions wish to implement that exceed the corporate guidelines.

The division plan is approved at division level, group level, and finally corporate level based on analysis and presentation to the appropriate decision makers at each stage.

Corporate finance and strategic planning staffs analyze division plans in order to assist the corporate management in their review of the plans, and also to use the division plans as a major input to the corporate strategic and financial plans. The corporate strategic plan integrates two perspectives: the bottom-up development of the division plans and a top-down portfolio perspective as the corporate office determines appropriate allocations among the businesses of the corporation. According to a strategic planner, '(a) lot of our allocation of resources is tied to the ability to generate internally real cash flows and that has a big bearing on our capital expenditure guidelines ... Profits aren't as important to investment as distributable cash flows'.⁷

The corporate strategic planning staff uses a number of models to check the plausibility of division and corporate plans. These models include a number of standard heuristics, for example working capital ratios should be close to historical patterns, dividends should be near historical payout as a percentage of net earnings but should never be reduced, and the debt to equity ratio should be within a policy-defined range. After a number of iterations of plans and adjustments to plans, a corporate plan is approved.

Parallel to the corporate strategic plan, a financial plan is also developed

⁷Distributable cash flows refers to actual funds that are available for discretionary application. In estimating the cash available for allocation, depreciation must be added back in to profits while a number of non-discretionary uses of funds (standard inventories, accounts receivable, dividends, etc.) may be taken out.

and approved using a substantially more conservative set of assumptions. The finance plan is intended to be '90 percent assured', i.e., not to error on the cash shortage side more than one year in ten. This risk assessment is done intuitively. Corporate policy is to maintain corporate cash and securities at a reasonable level by incurring long term debt well before it is needed to fund actual operations. In addition to 'prefunding', corporate officials reported restricting their debt to levels which would not harm the corporation's bond rating. This was translated primarily into maintaining a predetermined debt-to-equity ratio but also included consideration of interest coverage and the other standard bond rating variables. Managers reported that shortages of funds had not constrained capital expenditure plans for operations but had come into play in plans for acquisitions.

Following the approval of the long range plan, the divisions develop profit plans which follow the implications of the long range plan into operational budgets. While the planning staff in the divisions handle the long range plan, the profit plans are handled by the comptroller's staff.

After approval of the corporate plan, the divisions develop capital investment proposals. Small and medium sized projects are approved at the division level while large projects are reviewed and approved at the corporate level. The corporate finance department, which reviews the investment proposals, checks a number of factors including whether the project was in the long range plan, and whether the assumptions underlying the projections are plausible given historical patterns in the field. Almost all the projects that have been in the plan will be approved when they are submitted. The main criterion for approval (in addition to having been in the appropriate plan and having plausible analysis) is that the projects pass a hurdle rate on internal rate of return. During the interview period, Corporation Three raised the hurdle to reflect high inflation rates. The hurdle rate is based on an estimate of the cost of capital with a percentage added to compensate for projects that did not have direct profit returns.⁸ The hurdle rate was modified in 1980 but had not been revised in the previous four years.

In contrast to managers at Copperweld and Corporation Two, Corporation Three managers insisted that the determination of investment is geared to long-term profitability and strategic concerns, not to short term variations. Although the capital investment program is normally not fully spent, short term variations in funds are said to be unimportant in determining project implementation. What short term variations exist are said to come from market timing considerations. In particular, corporate policy is to complete projects just after the bottom of a recession has passed so the new capacity is available as demand picks up. Interviewees reported that this policy implied,

⁸As in Copperweld and Corporation Two, some projects, for instance those required to comply with government regulations, do not have to pass the profitability hurdle.

rather than cutting back in recessions, the corporation would often speed projects to be ready for the recovery.

The data available in Corporation Three present a particular problem in that the strategic planning system as currently implemented has only been in operation since 1976 making a consistent set of long-range plans unavailable for estimation. Budget documents were used in lieu of the obviously more desirable strategic plans for the statistical analysis below. These data pose difficulties since they present an annual picture of decisions which according to the interviews are taking into account a multi-year perspective.

Corporation Three interviews identified several policy differences from Corporation Two and Copperweld. The differences included (i), counter-cyclical investment strategy – in order to bring plants on line on the upswing of the economy, Corporation Three managers reported increasing spending rates on projects during slow periods in sales, (ii) long range perspective on the generation of capital investment projects – gearing the investment program to long term objectives and having about 80 percent of investment expenditures in new plants and major projects, and (iii) prefunding capital needs – incurring long term debt well ahead of the need for the funds as opposed to incurring short term debt and then converting it into long term debt or incurring long term debt just when the funds are needed. As in Copperweld and Corporation Two, many managers freely admitted the figures they put in their plans were biased, i.e., not their best guess of future outcomes. The primary exception was the corporate strategic plan.

5. Corporation Four

Corporation Four is a large (sales greater than one billion dollars per year) diversified producer of commodities, services, and equipment all of which are sold to industrial customers. The corporation is heavily capital intensive, has grown rapidly, and sells in many markets where long-term contracts are the rule. The corporation's investments vary from those which are largely guaranteed by long-term contracts before any expenditure is made, to conventional plants which produce for a market which varies with economic conditions.

Unlike the other corporations studied, Corporation Four uses its strategic plan strictly as an information tool. As in the other corporations, the strategic planning process begins with corporate guidelines (but no guideline on total capital expenditures), and the plans work up from the business area manager (who was responsible for a set of products) to the division, group, and corporate level. Consistent with the 'information tool' approach to strategic planning, the corporate management does not approve or disapprove the group plans, but rather discusses them and gives some comments. In addition, inclusion in the corporate plan is not relevant to the approval of

a project when it is submitted during the operating year. Having considered the plans coming up from the lower levels, the corporate management discusses and approves a corporate strategic plan. A corporate financial plan is produced which parallels the strategic plan, essentially checking whether it is fundable. Based on the feedback obtained in discussions of their long-range plans, the business area managers develop their budgets.

During the operating year, projects are developed and the larger ones submitted to the corporate office. Projects have to pass a hurdle rate based on internal rate of return although this was reported to be a recent innovation. The previous chief executive officer had not liked discounted cash-flow measures and so had required the use of straight rate of return. Current practice is to informally adjust the hurdle rate depending on the risk characteristics of the particular business being invested in. The corporate rate had been set in 1975 and in 1980 a substantial amount of study was going into developing a new set of hurdle rates that formally adjusted for the risk characteristics of the corporation's businesses. Financial managers reported that they incurred short-term debt and then converted it into long-term debt, going to the market every year regardless of interest rates.

Overall, the investment and funding pattern in Corporation Four seems similar to that of Corporation Two with the following differences: (i) Corporation Four was the most capital intensive of the firms examined, (ii) whether more or less was spent than planned was not clear since planners reported that projects were often proposed and approved which had not appeared in the strategic plans.

6. Regressions equations

While the primary findings of this research are based on qualitative data which has been reported, the plans of the corporations examined will be analyzed statistically in order to address a number of issues. The primary objective of the statistical analysis is to provide some independent verification of some of the implications of the interviews. Checking those implications of the qualitative data that are testable with the quantitative data provides some additional support for both these observations and the other observations generated using the same methodology. The quantitative analysis also provides estimates of the magnitude of certain effects, not simply their direction. Let us consider the issues to be addressed and the models that will be used in addressing them.⁹ Variable definitions appear in table 1.

⁹Numerous equations based on the interview data presented in Bromiley (1986) are estimated there. The selection of equations here is designed to support a few specific observations about the set of firms examined. The intent at this point is not to test or develop a general model but rather to provide a second source of substantiation for some of the qualitative observations and to examine some issues that the qualitative data do not address in a useful manner.

Table 1
Variable definitions.

$AveInterest(t,t-2)$	Average of $Interest(t)$ and $Interest(t-2)$
$CI(t)$	Corporate expenditures on property, plant and equipment in year t
$FDeprec(t)$	Forecast accounting depreciation for year t
$FDiv(t)$	Forecast of dividends to be paid in year t
$FGNP(t+2)$	Forecast GNP for year $t+2$
$FIBT(t+1)$	Forecast income before taxes for year $t+1$
$FS(t+2)$	Forecast sales for year t
$FTaxes(t+1)$	Forecast corporate income taxes after investment tax credit, year $t+1$
$F\Delta WC(t+1)$	Forecast change in working capital years t to $t+1$
$GNP(t)$	Gross National Product in year t
$Gross\ Plant(t)$	Property, plant and equipment at cost in year t
$IBT(t)$	Income before taxes in year t
$Interest(t)$	Interest rate for new corporate debt issues in year t
$Net\ Plant(t)$	Property, plant and equipment at cost minus accumulated depreciation in year t
$S(t)$	Sales for the corporation in year t
t	Year in which planning occurs
$t+1$	Year in which implementation occurs

Three output variables are of primary interest: planned investment, planned changes in debt, and actual investment. Actual investment obviously is the variable of most importance to explain, and according to the interviews planned investment has an extremely large impact on actual investment. Changes in debt are examined because they constitute an interesting area in which the corporations differ.

Forecast capital investment appears to be influenced by a number of variables. In Copperweld Corporation, numerous factors were reported as influencing investment: sales which derives the need for business expansion investment, the need for cost reduction or business sustaining investment, rules on the percent of income to be reinvested and the willingness to increase debts to fund the projects. In Corporation Two, planned investment appears to be determined by the need for new capacity to meet increased sales and the need to reduce costs and maintain existing plants. The same factors appear to be dominant in Corporation Four. Interest rates (availability of funds) were reported to be a potential problem in both firms but had not been a problem in the time period for which data were available, and hurdle rates based on cost of capital were adjusted very infrequently. Sales will be used to pick up the need for business expansion investment and the ratio of plant minus accumulated depreciation over plant at cost will be used to pick up the need for cost reduction and business sustaining

investment.¹⁰ Consequently, the forecast investment equation for Corporations Two and Four will be

$$FCI(t+1) = \alpha_1 S(t) + \alpha_2 [Net\ Plant(t)/Gross\ Plant(t)] + \varepsilon_1.$$

Corporation Three planned on a longer horizon than the other firms, and managers strongly asserted that their investment was geared strictly to the long-run growth in sales with a timing adjustment which tried to bring plants on line on the upswing of the economy. Two variables will be used: (i) the average of sales in the previous year, the current year, and the forecast year, and (ii) the difference between current and forecast sales. The first measure attempts to represent the long-run sales pattern while the second attempts to pick up a timing effect. The equation is thus

$$FCI(t+1) = \beta_1 * 1/3 * [FS(t+1) + S(t) + S(t-1)] + \beta_2 [FS(t+1) - S(t)] + \varepsilon_2.$$

All the corporations but Corporation Three forecast changes in debt as the residual of a cash-flow planning exercise. Corporation Three planned changes in debt on a long-run basis rather than on a year-to-year basis. The forecast change in debt will be modelled as a function of forecast cash flows (forecast income before taxes plus forecast depreciation minus forecast change in working capital, forecast taxes, and forecast dividends), the forecast capital investment, and the difference between interest rates in the year in which the plans are produced and the average of interest rates from year t and two years earlier. The forecast capital investment term is entered separately from the other uses of cash in order to examine if it appears to be treated differently from the other uses, and the interest term attempts to represent inter-year timing of debt transactions. Thus, the forecast change in debt equation is¹¹

$$\begin{aligned} FDEBT(t+1) = & \lambda_1 [FIBT(t+1) + FDeprec(t+1) - F\Delta WC(t+1) \\ & - FTaxes(t+1) - Fdiv(t+1)] + \lambda_2 FCI(t+1) \\ & + \lambda_3 [Interest(t) - AveInterest(t, t-2)] + \varepsilon_3. \end{aligned}$$

¹⁰While some sales to capacity measure might be more desirable for the business expansion measure, aggregate capacity has very little meaning in firms with numerous different lines of business. None of the corporations examined mentioned aggregate capacity, a finding completely consistent with Eliasson's (1976) study on a larger sample.

¹¹A version of this equation is estimated in Bromiley (1986) where the FCI variable is included with the other capital uses, the interest term dropped, and the debt-to-equity ratio used. The results are substantially the same as those reported here.

Actual capital investment starts with the forecast capital investment and adjusts from there. The adjustment is based on the difference between forecast and actual results with the difference being a function of income before taxes in Corporation Two, and sales in Corporations Three and Four. Separate parameters are estimated when actual is above and when it is below forecast since the interviews indicated differing sensitivity to such factors. Finally, for Corporation Three, which is trying to bring plants on line on the upswing of the economy, the difference between forecast GNP in year $t+2$ and actual GNP in year $t+1$ is included to attempt to model these expectations.¹² Thus the basic actual capital investment equation is

$$CI(t+1) = \gamma_1 FCI(t+1) + \gamma_2 D_1 [IBT(t+1) - FIBT(t+1)] \\ + \gamma_3 D_2 [IBT(t+1) - FIBT(t+1)] + \epsilon_4,$$

where $D_1 = 1$ if $IBT(t+1) - FIBT(t+1) < 0$, otherwise 0, and $D_2 = 1$ if $IBT(t+1) - FIBT(t+1) > 0$, otherwise 0.

7. Data, estimation and results

All the forecasts used were taken from the documents recording the final agreements in the respective corporation's annual planning processes. Data on actual results were taken from the corporation's annual reports and forecasts of GNP were taken from *Business Forecasts* (Federal Reserve Bank of Virginia, various years). All the equations were estimated using ordinary least squares. Table 2 presents the results of these estimations.

In the forecast capital investment equations, sales clearly had a substantial effect as should be expected. As indicated by the interviews, Corporation Four appears substantially more capital intensive than the other firms (at least on the margin) investing almost twice as much as Corporation Two for an equivalent change in sales. The net-over-gross-plant variable appears to be largely unrelated to investment in Corporations Two and Four with both parameter estimates quite insignificant. Corporation Three had a significant positive parameter estimate on the average sales term and a significant negative parameter estimate on the difference between forecast and current sales. This suggests that holding the average sales term constant, forecasts of high growth in sales depresses investment forecasts and forecasts of low growth (or decreases) in sales spurs investment forecasts in Corporation Three. This is consistent with their policy to increase investment in order to have plants on line for the upswing of the economy.

¹²Corporation Three's sales are extremely closely related to changes in GNP. Regressing one on the other gave an R^2 of 0.99.

Table 2
Regression results.^a

Independent variable	Corporation Two	Corporation Three	Corporation Four
<i>Dependent variable: forecast capital investment</i>			
$S(t)$	0.150 (0.016)	—	0.290 (0.077)
$\frac{\text{Net Plant}(t)}{\text{Gross Plant}(t)}$	-179 (110)	—	613 (656)
$1/3[FS(t+1) + S(t) + S(t-1)]$	—	0.140 (0.017)	—
$FS(t+1) - S(t)$	—	-0.297 (0.124)	—
<i>Observations</i>	20	12	10
R^2	0.938	0.882	0.788
DW	1.79	2.09	1.01
<i>Dependent variable: forecast change in debt</i>			
$FIBI(t+1) + FDeprec(t+1) - F\Delta WC(t+1) - FDiv(t+1) - FTaxes(t+1)$	-0.653 (0.170)	-0.132 (0.272)	-1.20 (0.291)
$FCI(t+1)$	0.694 (0.122)	-0.031 (0.264)	0.904 (0.172)
$\frac{\text{Interest}(t) - \text{AveInterest}(t, t-2)}$	-14.8 (10.4)	-13.1 (17.5)	0.177 (0.075)
<i>Observations</i>	20	12	10
R^2	0.659	0.286	0.887
DW	1.78	1.85	1.52
<i>Dependent variable: actual capital investment</i>			
$FCI(t+1)$	0.894 (0.049)	0.715 (0.153)	1.07 (0.099)
$D_1[FIBI(t+1) - IBT(t)]$ (negative)	0.609 (0.258)	—	—
$D_2[FIBI(t+1) - IBT(t)]$ (positive)	0.434 (0.290)	—	—
$D_1[FS(t+1) - S(t)]$ (negative)	—	-0.460 (0.202)	1.04 (0.380)
$D_2[FS(t+1) - S(t)]$ (positive)	—	0.048 (0.144)	-0.487 (0.373)
$FGNP(t+2) - GNP(t+1)$	—	0.249 (0.201)	—
<i>Observations</i>	20	12	10
R^2	0.960	0.952	0.946
DW	2.24	2.16	1.27

^aStandard errors appear in parentheses. DW is the Durbin-Watson statistic.

In the forecast change-in-debt equations, substantial differences are visible across the three firms. In Corporation Two, a close tie is visible between cash needs and changes in debt, and forecasts of capital investment appear to be treated as just another cash need – the magnitude of the parameters on needed cash and forecast capital investment are very close with the appropriate sign reversal.¹³ An even closer tie appears in Corporation Four where the parameters (-1.20 with a standard error of 0.291 and 0.904 with a standard error of 0.172) suggest the firm plans to take on at least as much debt as is needed to balance current cash needs. That the Corporation Two parameters appear to be less than one suggests the firm uses its stocks of cash and securities to buffer the effect of cash needs on changes in debt, probably to a greater extent than Corporation Four. Corporation Four managers, as noted above, reported going to financial markets each year for the funds the firm needed, regardless of interest rates. On the other hand, in Corporation Three, which says it plans investment and funding on a multi-year horizon and prefunds its debt, the change-in-debt equation appears quite inappropriate – parameter estimates are small and insignificant. This supports Corporation Three's interview data since a firm which plans change in debt on a multi-year horizon and which prefunds should have a very slight or non-existent tie between current cash needs and current changes in debt.

In the actual capital-investment equation, both Corporations Two and Three appear to spend somewhat less than planned (as the interviews indicated), while it is possible that Corporation Four spends more than planned (parameter estimates of 0.894 , 0.715 , and 1.07 on the forecast capital-investment variable for Corporations Two, Three and Four respectively). Corporation Four interviews indicated the firm historically had approved and implemented projects that were not in the plan. In both Corporations Two and Four, as suggested by the interviews, the amount spent on investments reduces from what was forecast when business is slow (i.e., when sales or income are below what was forecast). When business is better than planned, no significant effect was found for either firm. Thus both firms appear to cut back from planned investment when business is below planned levels but do not speed up investment significantly when business is better than planned. Corporation Three reflected a different pattern where sales below forecast resulted in increased investment. This is consistent with their enunciated policy to complete plants just after the bottom of a recession. Sales above forecast appeared to have no effect. Finally for Corporation Three, the sign of the parameter estimate on the forecast GNP for year $t+2$ minus GNP in year $t+1$ is positive as expected but not significantly so.

¹³The $F(3, 17)$ statistic testing the joint hypothesis that cash and forecast capital investment parameters equal one and minus one respectively is insignificant at the 0.90 level, i.e., the hypothesis that the true parameters are one and minus one respectively cannot be rejected.

8. Summary of results

First, in all four firms, business expansion or cost reduction investment had to pass a hurdle rate on either discounted or undiscounted return on investment, but such hurdle rates did not change to conform to the latest economic conditions. It appears that these rates tended to remain in force for at least four years and often longer.

Second, interviewees agreed that the forecasts that were generated were biased in the statistical sense. It was common to assume that forecast investment was from five to ten percent above what would actually be spent. It was common to assume that forecasts of income would be conservative. It was also common to maintain several different sets of forecasts: optimistic ones to motivate lower level managers, 'accurate' ones for top management, and conservative ones for finance purposes.

Third, the results from the qualitative data and the regressions were consistent. Debt management and investment practices found in interviews were consistent with the quantitative data and such practices changed across corporations as the interviews suggested they would. This consistency between qualitative and quantitative data provides additional justification for belief in both the tested and untested inferences from the interviews, particularly since these models were generated without prior knowledge of statistical results on similar data.

Fourth, the investment problem as defined by managers in the four corporations contains two stages – the planning and the implementation stages. The importance management assigned to each stage varied across firms but within each firm the managers agreed where the emphasis was placed.

Fifth, the cash-flow equation (sources and uses of funds statement) is a fundamental consideration which periodically constrains corporate capital expenditures. The corporation has funds from operations and a variety of essential expenditures (changes in working capital, dividends, etc.). Management may face a choice between incurring the debt needed to fund desired investment or reducing investment below what it would otherwise be. The corporations differed in how they managed cash flow, but in all these corporations cash flow was critical to understanding the corporate view of investment.

Sixth, the primary influence on investment differed across corporations and over time. Some corporations responded to changes in sales, others to changes in profits. Decreases in sales spurred investment in one corporation while it lowered investment in another. Interviewees reported periods when profit levels were high enough that they had no problems financing their desired investments. At other times, shortages of cash slowed investments. Lack of manpower and ability to implement projects constrained investment when funds and good projects were available.

Seventh, the corporate managers perceived well-defined limits on their ability to incur debt. They defined the limits in terms of simple financial ratios. Managers expressed unwillingness to accept changes in debt that would risk lowering their corporation's bond rating by crossing a cutoff on variables the bond rating agencies are said to use. These target bond ratings were not determined by sophisticated analysis.

Eighth, the response of capital expenditures to deviations from expected income or sales differs depending on the sign of the deviation and the corporate strategy. For three of the firms, negative deviations (sales or income less than forecast) resulted in lower investment while positive deviations had little or no impact. For the fourth firm, negative deviations resulted in higher investment while positive deviations had little effect.

Finally, inter-corporation differences in corporate policy or strategy were apparent. Corporation Three prefunded its activities. Its statistical results on the debt equation differed substantially from the other corporations which did not prefund. Corporation Three also believed in a counter-cyclical investment strategy designed to bring plants on line on the up-swing of the economy. Again, the statistical results agreed: its adjustments of investment to deviations from planned sales had the opposite sign from adjustments in Corporations Two and Four (both of which were pro-cyclical). The appropriate variable to explain the adjustment also differed among Corporation Two (income – a finance based adjustment), Corporation Three (sales – an expected demand based adjustment) and Corporation Four (sales based). Finally, the importance of planning and the time frames over which planning occurred varied across corporations. In Copperweld and Corporation Two, the large proportion of investment that went into replacement gave management a substantial amount of flexibility in changing planned investment expenditures from year to year. In Corporation Three and Four, where most investment was in new plants, management did not perceive the same degree of flexibility.

9. Conceptual framework

This section presents a conceptual framework which attempts to summarize the perspective on corporate investment developed on the basis of the research presented above. The capital-investment process has two basic stages: planning and implementation. Furthermore, there are three main facets of the process: the desire or reason for capital investment, the ability to finance capital investment, and the ability to implement capital investment. Table 3 identifies the combinations of these possible factors and stages.

The most comprehensive overview of the capital-investment process usually occurs in the planning stage. In the planning stage desires for investment projects are reconciled with the ability of the organization to implement new

Table 3
A conceptual framework for the determinants of corporate capital investment.

Stage	Factor	Details
Planning	Desire for investment	Function of business sustaining needs, regulatory demands, cost reduction opportunities, business expansion possibilities, sales-capacity relations, hurdle rates for capital project approvals, and corporate strategy
	Ability to implement	Function of management practices, technology, kind of investment, and current implementation resources
	Financial constraints	Availability of cash to fund desired investments – forecast cash inflows minus essential investments with changes in debt and liquidity traded off against desires for investment
Implementation	Desire for investment	Adjusts from previous desire depending on current and expected market conditions and corporate policy
	Ability to implement	Usually able to implement less than planned amount of investment
	Financial constraints	Due to downturn in income, unanticipated acquisition, or other cash drain. Implement cost-cutting programs, reduce inventories, increase accounts payable, reduce receivables prior to cutting investment. Increasing short-term debt possible but undesirable alternative.

investment and the financial trade-offs possibly implied by such investments. Indeed, a primary function of capital-investment planning is to achieve this reconciliation in advance of actual commitments and operational pressures.

The first constraint on investment is the 'desire' for investment. One categorization of justifications for capital expenditures is: business expansion, cost reduction, business sustaining, and regulatory requirements. For the most part, business sustaining and regulatory requirement projects form an essential base over which the normal capital-investment decisions occur. Cost-reduction projects are associated with the supply of more efficient technologies and the condition of the current equipment. Business expansion is associated with the current and forecasted changes in sales compared to the capacity of current plants. Business expansion is a relatively volatile component of the desire for investment. Finally, all such justifications for investment are conditional on the corporate strategy and the financial criteria (hurdle rate) used for project evaluation.

The firm's ability to implement projects influences the planning stage as management screens the list of proposed projects to identify what can actually be accomplished within the planning period. It is hypothesized that

the ability of the corporation to implement planned investments is related to the current implementation resources (engineering staff, construction staff, etc.), management practices (e.g., Copperweld had a policy against substantial outside contracting), the technology (determining the extent to which new construction interferes with the ongoing production process), and the kind of investment (e.g., building a new plant in a new location will not interfere with current production).

Finally, the financial constraint is a function of the level of internal cash generation and liquidity, planned acquisitions, the desire for investment, and the ability and willingness to change debt levels. The level of internal cash generation and liquidity probably depend both on the specific condition of the corporation and its kind of business (e.g., the position of the business on the product life cycle may be related to the level of cash generated by that business). The desire for investment is detailed above. The willingness to incur debt varies with interest rates, bond rating variables, and corporate policies. In particular, a limit on finance is defined by the funds available from operations and the bond rating variables.

To a large extent, these three factors are not traded off against each other. Rather, the availability of cash or engineering capability will not cause a firm to undertake projects it does not want. Alternatively, if the firm cannot implement the expenditures, desire and funds will not suffice. Finally, financial constraints could be binding when both implementation resources and good projects are available. These can be thought of as constraints in the linear programming sense – planned investment will be less than or equal to each of the three factors and will be equal to one of the three.¹⁴

Given a planned level of capital investment, the corporation again faces these three sets of factors on the implementation side.

Changes in the desire for investment depend on current information deviating from previous expectations. Sometimes business downturns cause a revision of the corporate judgement on the appropriate time to bring a given plant on line or in revisions of corporate beliefs about the opportunities in a given market with consequent impacts on related projects. Alternatively, it is conceivable that substantial increases in sales and expected sales (for instance, as occurred during the Korean War) could cause firms to try to rush new investments.

The ability to implement projects is usually credited with causing some variation from the plan. It was often stated that the divisions cannot spend all the funds allocated to them. It seems that managers and engineering staff

¹⁴After writing this section, I became aware of the prescriptive work of Charnes, Cooper, and Weingartner, and others on budgeting for capital investments from an operations research perspective. Their general approach was to choose from a set of projects those which maximize profits subject to constraints such as payback period and liquidity. For an introduction to this literature see Bryne, Charnes, Cooper and Kortanek (1971) and Weingartner (1963).

tend to be overly optimistic about what can be accomplished in a given period of time.

Finally, the financial constraint can change from what was anticipated in the plan. Income can be below what was planned. An unanticipated major acquisition can drain a large amount of the corporation's cash. Normally, the corporation attempts to maintain the capital investment program by implementing cost savings programs and reducing inventory to generate funds. During implementation, the financial constraints are influential on the down side only – extra unanticipated funds normally will not spur investment.

In the multiple constraint process, different factors will be binding at different times and in different companies. While Copperweld interviews indicated that engineering time was a strong constraint on investment, this was not a serious concern in Corporations Three or Four. Alternatively, while Corporation Two and Corporation Four managers reported that in the past finance had not been a constraint because their firms generated sufficient cash to cover desired investments, both had either recently experienced cash shortages or anticipated such a shortage in the near future. Thus, the determinants of actual investment at a given time will be the constraints that are binding and such constraints will vary over time and across firms.

The variation across firms is particularly important in the annual adaptation to current business conditions. In Copperweld and Corporation Two, investment patterns followed sales and income patterns: low sales or income implied low investment. Thus the investment was pro-cyclical. This was seen both in the planning process and in the adjustment to actual outcomes. But in Corporation Three the corporate policy (corporate strategy) was strongly counter-cyclical. The aim was to bring projects on line on the upswing of the economy which implied increasing investment when sales were slow. This was supported by both the interviews and the regression analysis. In Corporation Four, the interviews indicated that different parts of the corporation have different sensitivities to current economic conditions but the statistical results indicated some pro-cyclical adjustments based on sales. Corporation Two and Four were sensitive to downturns but insensitive to upturns. While the interviews and data from all firms agreed that the basic level of investment over a moderate horizon would be strongly related to the 'permanent' sales level, sales or income being below expectations in any given year could have either positive or negative impacts on investments, depending on corporate strategy.

Thus, the multiple constraint view sees firms as constrained by one or more of the three alternative constraints. Furthermore, these constraints are in some cases a function of particular corporate beliefs and strategy (e.g., the counter-cyclical spending in Corporation Three, the refusal to use outside engineering in Copperweld, and the intuitive adjustment of the hurdle rate to

account for inter-group differences in risk in Corporation Four). However, firms that are similar in various ways might find the same constraint binding. Capital intensive firms in rapidly growing markets would be likely to find the financial constraint binding. Firms in mature (slowly growing, profitable) markets would be likely to have a shortage of new opportunities and so would find the desire for investment binding. Firms that prefund their investment would be relatively insensitive to short-term changes in interest rates. One would expect to find differences among groups of firms when the firms are grouped by position in the product life cycle for their major products, growth rate of sales, cash generation, size, diversification, and capital intensity.

10. Concluding remarks

The research presented in this paper provides an alternative perception of the determinants of corporate capital investment. Based on interview data, it specifies and estimates a number of equations related to planning and investment processes in four corporations and summarizes the implications of these studies in a conceptual framework.

The conceptual framework can be used in two distinct ways. First, from a behavioral perspective, testable hypotheses can be derived from the framework. These could then be tested on appropriate data. Thus, a simplification of the conceptual framework could develop into a competitor for the standard models of investment. On the other hand, many if not all of the behaviors described in the conceptual framework are consistent with neo-classical analysis if the appropriate set of transactions costs and simplifications are assumed. In a world with substantial under-pricing in equity markets (see Modigliani and Cohn, 1979) it would not be surprising to find that new equity is not a rational way to raise funds. Imperfections in the financial markets can justify a capital rationing approach and differential transactions costs on starting versus stopping may provide some of the asymmetries observed in implementation. Thus, the conceptual framework could be used as a guide to the selection of assumptions for model development under optimizing assumptions. In short, this research has attempted to provide an alternative to the conventional approaches to investment either as a model-building technique in itself (from the behavioral approach) or as a set of suggestions about the appropriate set of assumptions to be included in a neoclassical model for those working in that paradigm.

References

- Bischoff, Charles W., 1971, Business investment in the 1970's: A comparison of models, in: Arthur M. Okun and George L. Perry, eds., *Brookings Papers on Economic Activity* (The Brookings Institution, Washington, DC).

- Bromiley, Philip, 1986, *Corporate capital investment: A behavioral approach* (Cambridge University Press, New York).
- Bryne, R.F., A. Charnes, W.W. Cooper and K. Kortanek, 1971, A chance-constrained approach to capital budgeting with portfolio type payback and liquidity constraints and horizon posture controls, in: R.F. Bryne, A. Charnes, W.W. Cooper, O.A. Davis and Dorothy Gilford, eds., *Studies in budgeting* (North-Holland, Amsterdam).
- Clark, Peter K., 1979, Investment in the 1970's: Theory, performance, and prediction, in: Arthur M. Okun and George L. Perry, eds., *Brookings Papers on Economic Activity* (The Brookings Institution, Washington, DC).
- Copperweld Corporation, 1979, *Copperweld Corporation annual report and 10-K*, Pittsburgh, PA.
- Cyert, Richard M. and James G. March, 1963, *A behavioral theory of the firm* (Prentice-Hall, Englewood Cliffs, NJ).
- Eisner, R. and R.H. Strotz, 1963, Determinants of business investment behavior, in: Commission on Money and Credit, *Impact of monetary policy* (Prentice-Hall, Englewood Cliffs, NJ).
- Eliasson, Gunnar, 1976, *Business economic planning* (Wiley, New York).
- Elliott, J.W., 1973, Theories of corporate investment behavior revisited, *American Economic Review* 63, no. 1, 195-207.
- Federal Reserve Bank of Richmond, 1960 to 1979, *Business forecasts* (Federal Reserve Bank of Richmond, Richmond, VA).
- Fisher, Franklin M., 1971, Discussion, in: Gary Fromm, ed., *Tax incentives and capital spending* (The Brookings Institution, Washington, DC).
- Jorgenson, Dale W., 1971, Econometric studies of investment behavior: A survey, *Journal of Economic Literature* 9, no. 4, 1111-1147.
- Meyer, John R. and Edwin Kuh, 1959, *The investment decision* (Harvard University Press, Cambridge, MA).
- Modigliani, Franco and Richard A. Cohn, 1979, Inflation, rational valuation, and the stock market, *Financial Analysts Journal*, 24-44.
- Nickell, Stephen J., 1978, *The investment decisions of firms* (Cambridge University Press, Oxford).
- Simon, Herbert A., 1984, On behavioral and rational foundations of economic dynamics, *Journal of Economic Behavior and Organization* 5, 35-55.
- Weingartner, H. Martin, 1963, *Mathematical programming and the analysis of capital budgeting problems* (Prentice-Hall, Englewood Cliffs, NJ).