Volume Title: Asymmetric Information, Corporate Finance, and Investment

Volume Author/Editor: R. Glenn Hubbard, editor

Volume Publisher: University of Chicago Press, 1990

Volume ISBN: 0-226-35585-3

Volume URL: http://www.nber.org/books/glen90-1

Conference Date: May 5, 1989

Publication Date: January 1990

Chapter Title: Sustaining Investment, Discretionary Investment, and Valuation: A Residual Funds Study of the Paper Industry

Chapter Author: John S. Strong, John R. Meyer

Chapter URL: http://www.nber.org/chapters/c11470

Chapter pages in book: (p. 127 - 148)

5 Sustaining Investment, Discretionary Investment, and Valuation: A Residual Funds Study of the Paper Industry

John S. Strong and John R. Meyer

The agency theory of corporate takeovers and restructurings argues that neoclassical approaches to investment decision making fail to capture the incentive and monitoring problems related to cash flow. In particular, Jensen (1986) and Griffin (1988) have argued that managers have substantial control over the allocation of corporate cash flows and incentives to reinvest these flows in unnecessary or wasteful projects. These uneconomic investments, it is argued, lead to poor performance and lower valuation. To a crude (ceteris paribus) first approximation therefore, a negative relationship should be observable between the relative extent of "free" cash flow for a firm and the rate of change in its market valuations.

Unfortunately, empirical testing of this hypothesis is complicated by the possibility (increasingly recognized in economic theory and long recognized empirically) that for some firms there may exist a hierarchical ordering to the costs of different sources of financing (as induced say, by information, tax or other asymmetries).[1] Typically, internal cash flow would be among the cheapest sources that is at the base of this hierarchy. In such circumstances, a firm's investment may be limited by the availability of internal cash flow. This, in turn, could limit the growth and general performance of the firm. In short, internal cash flow can be a source for not only financing permissive managerial extravagances but, in a world of information and tax asymmetries and other financial market imperfections, can also be a means for a firm achieving higher growth rates and equity valuations than might otherwise be possible.

John S. Strong is an assistant professor of finance at the School of Business Administration, College of William and Mary, and a research fellow of the Center for Business and Government, Harvard University. John R. Meyer is the Harpel Professor of Capital Formation and Economic Growth, Center for Business and Government, Harvard University.

The authors would like to thank Steven Fazzari, R. Glenn Hubbard, Larry Pulley, and Kim Smith for helpful comments and Susan Swartz for research assistance.

Accordingly, while the agency theory of corporate restructurings is appealing, empirical verification has proceeded slowly. In particular, empirical testing has focused only on small parts of the model. What is required is an examination of the relation between cash flows and investment, and then between those investments and longer-term financial performance. First, do firms with larger "free" cash flows exhibit different investment behavior? Second, do these differences in investment behavior lead to poorer or better financial performance and, more precisely, under what circumstances?

5.1. A Review of the Agency Model

Agency theory emphasizes the conflicts that arise between management and stockholders.[2] This approach holds that increased cash flows reduce shareholder incentives for monitoring performance while increasing managerial discretion. Managers are believed to take advantage of this discretion by directing cash flows to projects over which they retain supervision. Since this control cannot be achieved by dividend or share repurchase policies, managers choose to emphasize capital expenditures. These capital projects are believed to be uneconomic at the margin in many cases, thereby producing the consequences of the agency problem.

This argument depends on a number of critical assumptions. For example, as already noted, if a firm faces a pronounced hierarchy in its financing possibilities, preference for capital investment may increase value if the set of investment opportunities is attractive (Fazzari, Hubbard, and Petersen 1988). However, previous research (Griffin 1988; Jensen 1986) on the agency theory of restructurings has studied situations in which economic rents on older assets were present and investment opportunities were unattractive. In contrast to this research, McConnell and Muscarella (1985) found that corporate capital expenditure announcements are associated with significant positive increases in share values, consistent with a view that managers seek to maximize the value of the firm when making investment decisions.[3]

Similarly, corporate debt that reduces the agency problem by reducing cash flows available to managers may concomitantly reduce financial capacity, thereby limiting the firm's ability to undertake positive net present value (NPV) projects if they present themselves. The agency model implicitly assumes that the costs of managerial discretion in allocating cash flows outweigh the benefits of reserve financial capacity.[4] Donaldson (1984) points out the difficulty in sorting out this trade-off. He finds that managers of large firms were not oriented toward maximization of the value of the firm, but rather by "the aggregate purchasing power available to management for strategic purposes during any given planning period."[5] The difficulty, emphasized in agency theory, is whether this strategic resource flexibility is used to increase the value of the firm over the longer term.[6]

Furthermore, the market for corporate control may fail to serve as a foil for

reducing managerial cash-flow discretion. Rather than that market acting as a discipline for cash-rich firms, managers may choose acquisitions as an alternative to capital investment projects. For example, if conditions of information asymmetry lead managers to know of their excess cash flows before potential acquirers, these cash flows might lead to dubious acquisitions that enhance or create agency problems, rather than being the solution to them.[7] This relation was found by Bruner (1988) in a study of mergers in which firms with excess cash and debt capacity were more likely to be bidders for companies with less liquidity and debt capacity.

5.2 An Alternative Model: The Residual Funds Approach

The agency model is not very precise in its definitions of cash flows and capital investment, nor does it spell out the decision-making and funds-allocation processes within the firm. As an alternative, we believe that a residual funds model better captures the behavioral dimensions of corporate capital budgeting and related resource allocations. The residual funds approach first was presented by Meyer and Kuh (1957) and extended by Kuh (1963), Meyer and Glauber (1964), and Dhrymes and Kurz (1967). More recently, the notion of a hierarchy of financing choices has been extended to capital structure analysis by Myers (1984) and to the interaction of investment and financing decisions by Myers and Majluf (1984), Petersen (1988), Fazzari, Hubbard and Petersen (1988), Bernstein and Nadiri (1986), and McDonald and Soderstrom (1986).

The residual funds approach argues that the amount and financing of capital investment by firms is in part a function of the "residual funds" available after proceeding down a hierarchy of prior claims on corporate cash flow. The starting point is the total cash flow generated by the firm, which provides the base amount for distribution to various claimants and investment opportunities. The first priority is for servicing established levels of debt, incorporating both interest payments and associated principal obligations (either at maturity or via sinking funds requirements). The established level of debt will presumably reflect a firm's evaluation of what constitutes its best mix of debt and equity financing, trading off tax aspects and other features, and (where applicable) expected allowance for growth in core lines of business.

The funds available after debt service are then used to pay preferred dividends. The next claimants on the funds, following Dobrovolsky (1951) and Lintner (1956), and as amplified by more recent signaling concepts (Ross 1977; Bhattacharya 1979; Hakansson 1982; Bernheim 1988; Crockett and Friend 1988), are the common shareholders, who receive dividends at a previously established "regular" *pattern* of payments per share.[8] This pattern includes established or expected growth in dividends and, for some firms, where nonrecurring dividends have become a characteristic feature of cyclical upturns, these "extra" payments as well. Following common dividends, the

residual funds are then available for capital investment of several types. First, mandated investments, such as safety needs or pollution control equipment are put in place. Second, investment aimed at replacing or improving the efficiency of established productive capacity is implemented. Third, new investments for capacity expansion of established product lines are undertaken, followed by capital needed for expansion into closely related products. Finally, capital investment outside the existing lines of business will be considered, but generally only if some internal funds remain after meeting prior claims in the hierarchy.

To see that the residual funds approach can produce outcomes consistent with those of the agency model of free cash flow, it is useful to consider both the determinants of capital investment and the dual position of common stockholders in the funds-distribution process. To start, capital investment is only partially a search for positive net present value projects, in which prior investments are continually reevaluated and potential new investments analyzed in a neoclassical profitability framework.[9] Rather, when the level of capital investment is conditioned by the amount of residual cash flows, an important distinction arises concerning *types* of capital investment. If we assume that the baseline financial commitments of debt and dividends were founded on an extrapolation of current product mix, scale and market trends, and so on, then capital investment may be classified into two types. First comes *sustaining investment*, that amount which is necessary to provide a level of funds commensurate with existing financial and core business requirements. In general, this should approximate replacement investment, although short-term fluctuations in economic rents and longer-term changes in productivity relationships may make this correspondence less than one-to-one. Next comes *discretionary investment*, defined as that which is *not* required to sustain the firm's core business at its current level and trend of operations.

Preference for "cheap" internal finance will cause a firm to use residual funds to pay for sustaining investment whenever possible. By contrast, discretionary investments are more likely to be undertaken when a pool of residual funds remains available after sustaining investments have been made. In the event the available funds are absorbed by prior claims, discretionary investments are less probable, a result consistent with both agency and residual funds hypotheses. Thus, sustaining investment will tend to be more related to existing capital stocks and neoclassical profitability approaches, while discretionary capital expenditures will depend on the existence of residual funds. Resort to external financing also could be described as residually derived, since it depends on the relationship between internal cash flows, prior financial claims, and sustaining investment requirements. The cyclical asymmetry observed by Meyer and Kuh (1957) between accelerator and cash-flow effects on investment could be similarly explained; the dominance they observed of the accelerator during cyclical upswings might be expected to correspond with periods when sustaining investment exceeded the available pool of residual

funds. In short, discretionary investment serves as a buffer, tending toward zero when no residual funds are available and competing with nonroutine shareholder distributions when a surfeit of internal funds exists.

Indeed, if at all possible, all necessary projects will be financed internally. If, as in many cases, this is not possible, the residual funds will be used as the basis for establishing the amount of required external financing. Because of tax considerations (at least in the United States) debt will usually be the lowest-cost source of external finance and will be used, especially if it can be accommodated within accepted capital structure targets.[10] These targets will incorporate information on ability to pay debt service from cash flow without jeopardizing other established claimants, especially prior debt servicing requirements, preferred dividends, and the preexisting pattern of common dividends. New equity becomes attractive only under highly specialized conditions; for example, at very high antidilutive price/earnings ratios or where additional debt bears a high-risk premium. If, on the other hand, any internal funds remain after "established" financial and investment claims have been met, then these funds can be distributed to shareholders, used to replenish liquidity positions on the balance sheet, or to finance "discretionary" investment. It is at this point that the agency problem comes to the fore. There are obviously many "slippages" and possible alternatives, further complicated by the fact that hierarchical considerations enter on *both* the financial and real side. Nevertheless, the residual funds approach will often provide a good approximation to the real world of corporate capital budgeting. The approach also helps explain why cash-flow variables consistently do well in empirical models of investment even though not specified by theories assuming perfect financial markets.

An interesting issue arises at this point concerning major acquisitions, a special case of discretionary investment. Here, widespread use of debt finance and the frequency of postmerger leveraged recapitalizations might seem at odds with the residual funds model. However, such acquisitions are likely to change the scale, mix, and trend of the firm's "core business," thus modifying sustaining investment requirements. At the same time, associated changes in asset ownership and operations will induce a rethinking of the financial structure of the combined entity. In particular, major acquisitions are likely to reorient firms away from internal growth of core businesses.[11] If this occurs, a reordering of cash flows toward financial claimants is probable. Of course, restructurings generally include assumption of the prior debt obligations of the acquired firm, but these claims, along with dividend policies, may be substantially changed following a restructuring. Thus, the preference for internal finance in the residual funds model is conditioned by mergers and acquisitions, which introduce changes in the hierarchies of both investment and financing and require adjustment to a new residual funds regime.

The second principal feature of the residual funds approach is that common shareholders occupy two places in the hierarchy of funds distribution. The

two positions correspond to the two sources of retum—dividends and capital appreciation through retention. The dual position of the common stockholder enhances his monitoring ability, for example, by separating the signals produced by the regular pattem of dividends from those created by increases in the dividends, or by the use of extemal finance. To illustrate, the behavior of ongoing dividends provides information as to the value of the existing businesses, while incremental distributions through repurchases or extraordinary dividends may convey negative information about investment opportunities.[12] Under the residual funds approach, *changes* in the pattem of dividends, and what such changes signal, are most important; as a corollary, financing constraints are perhaps as well identified by changes in dividend policy as by payout levels.[13]

Compared with the agency model, the residual funds approach posits a relationship not between total cash flow and investment, but between a quite restrictive notion of residual cash flow and discretionary investment. Again, the relevant residual cash flow involves cash available *after* established debt service, dividends, and sustaining investments have been made. Empirically, this means that "free" cash flow in a residual funds model might well be periodically negative even for otherwise very successful enterprises. Indeed, for the very successful firm participating in a strong growth sector, free cash flow might be persistently negative. Financial policies that serve to make such cash flows even more persistently negative by additional debt or dividends, as recommended by some applications of agency theory, could therefore be questioned in some circumstances.

5.3 Data

Time-series data from 1971–86 for the paper and allied products industry are used to test the residual funds approach. The paper industry was selected for study for several reasons. To start, it experienced two important factor price shocks, in 1973–74 and in 1979, due to energy prices. Also, the production technology of the industry is well defined and relatively homogeneous. The industry is about average in cyclical sensitivity but has experienced substantial fluctuations in operating performance over the period studied.[14] Over that study period, the retums to paper industry shareholders have neither consistently outperformed nor lagged behind the stock market as a whole, as shown in figure 5.1. The range of company total retums encompasses overall market retums, suggesting that the paper industry provides a better test of the relationship between cash flows, investment, and performance than industries in which most firms have performed persistently above (or below) the economy as a whole.

Compared to the petroleum industry studied by Griffin (1988), the paper industry has experienced sizable sustaining investment requirements due to factor price changes, though in recent years it has not required much addi-

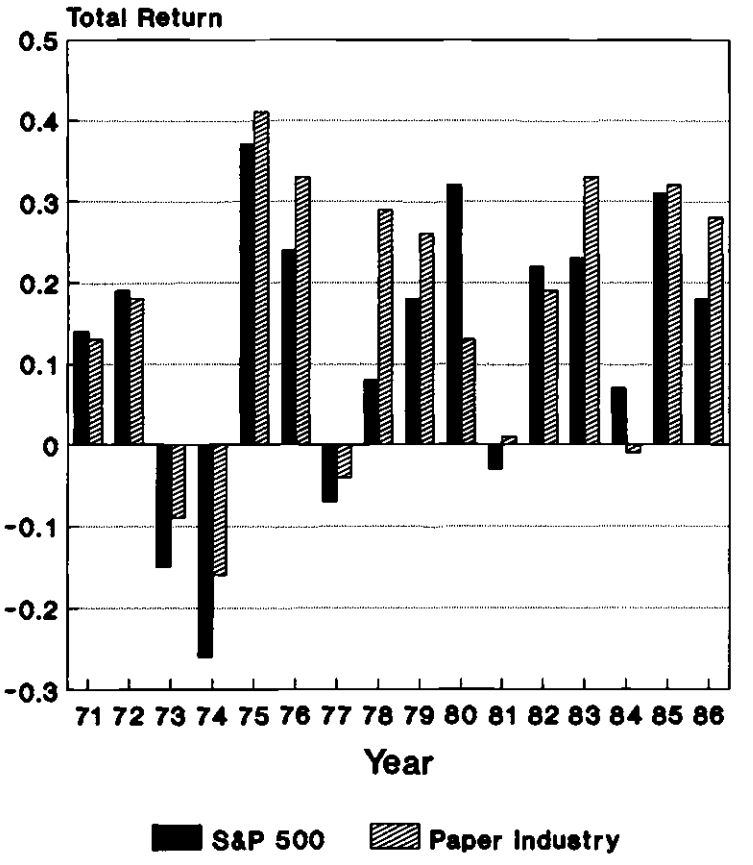

Fig. 5.1 Total return to shareholders: paper industry and S&P 500

tional capacity investment. Thus, the investment opportunity set may have shifted from the sustaining class in the 1970s to being more discretionary in nature in the 1980s. In addition, the cash flows generated by the firms in the paper industry have not been driven by huge swings in product prices, so that capital investment in response to nonrecurring economic rents are not so dramatic as in petroleum. Finally, the industry has undergone considerable restructuring, principally taking the form of industry consolidation of assets, rather than diversifying mergers or acquisitions. This activity provides an opportunity to examine the degree to which those firms with larger residual cash flows sought to acquire those companies whose cash flows impaired their ability to make sustaining investments.

Thirty-four firms constitute the data set. Annual balance sheet, income statement, and funds flow data were obtained from COMPUSTAT tapes, while monthly financial series were constructed from the COMPUSTAT PDE

files. While most of the variables are self-explanatory, the investment and cash-flow series require additional discussion.

Total capital investment was compiled from the funds flow statements for each firm for each year. The variable was defined as the sum of reported capital expenditures, acquisitions, and investments (principally securities held for purposes other than liquidity). Share repurchases were not included. Acquisitions and longer-term security investments were defined directly as discretionary investment.[15]

The separation of capital expenditures into sustaining and discretionary investment components was done by using accounting data on replacement depreciation, with adjustments for real sales growth, as described below. With the advent of Statement 33 from the Financial Accounting Standards Board (FASB), current replacement cost data began to be available in the early 1970s. Each firm's quarterly 10-Q report was reviewed for information as to the age, estimated life and remaining value of its plant and equipment. When this information was not explicitly provided, Internal Revenue Service guidelines on asset class lines and depreciation were used to supplement the company's quarterly disclosures. The result is a constructed series of "replacement" capital investment for each firm, based on accounting information.[16] These amounts were then combined with adjustments to reflect the required amount of inventory investment. These inventory requirements are not automatically captured by the cost of goods sold on the income statement. Cost of goods sold and related inventory accounts exhibited wide variations in the degree of last-in-first-out (LIFO) versus first-in-first-out (FIFO) accounting.[17] In addition, adjustments were necessary for those firms that dipped into lower cost LIFO layers on their income statements during the late 1970s and early 1980s. The inventory adjustments involved the use of current-cost inventory data when possible and information from the most recent quarterly financial report on LIFO cost of goods sold and changes in the LIFO reserve. The effect of these calculations is to reflect more accurately the sustaining expenditures on physical assets required for ongoing operation at prior or established levels of activity.

However, such a series does not incorporate those capital investments required to maintain established growth patterns or trends. To do this, further adjustments were necessary to distinguish the growth-related component of sustaining investment from discretionary expenditures. To incorporate this effect, each firm's real sales growth was calculated, and this growth factor applied to the required replacement investment calculated above.[18] When added together, the result is an estimate of sustaining investment for each year.[19] The difference between total capital expenditures and sustaining investment provides our estimate of discretionary investment.[20]

Residual cash flow was estimated by indirect construction. Reported net income (before extraordinary items) was combined with noncash expenses (principally depreciation, amortization, and the change in deferred taxes) to

generate a total cash-flow measure. Construction of the residual cash-flow measure began with net operating income before interest and taxes. Consistent with the hierarchical model, interest payments on existing debt and taxes were then subtracted.[21] The subsequent set of cash distributions involve provisions of returns to financial claimants *at previously established levels*, for example, net debt issuance, sinking fund requirements, preferred dividends, and common dividends at the same level as the previous year.[22] Following these distributions, sustaining investment (as described above) was subtracted. The amount of funds available after this entire series of distributions was defined as the residual cash flow.

5.4 Empirical Tests of Cash Flow–Investment Relationships

Summary statistical information for the paper industry is presented in table 5.1 for the entire 1971–86 period, and the 1971–80 and 1981–86 subperiods. The 1971–80 subperiod reflects the years of large energy and capital shocks, while the 1981–86 period covers years of stable or falling energy costs and a different investment environment. In particular, while capital expenditures as a percentage of total assets has remained stable, there was more acquisition

Table 5.1 Summary of Cash Flow and Investment Data, Paper Industry

Variable	1971–86	1971–80	1981–86
Return on assets	4.316	4.79	3.804
	(1.839)	(1.91)	(2.057)
Residual cash flow as % total cash flow	.499	.644	.311
	(.512)	(.737)	(.533)
Residual cash flow as % of common equity (book value)	.120	.131	.092
	(.068)	(.084)	(.078)
Capital expenditures as % of total assets (annual average)	.102	.119	.097
	(.023)	(.039)	(.038)
Dividend payout ratio (average)	.202	.165	.201
	(.201)	(.227)	(.246)
Debt/asset ratio	.449	.425	.477
	(.069)	(.146)	(.135)
Total share repurchases as % beginning equity	.151	.055	.106
	(.173)	(.069)	(.127)
Discretionary investment as % of total capital investment	.287	.320	.252
	(.354)	(.382)	(.114)
Residual cash flow as % of capital expenditures (% internal financing)	.682	.763	.576
	(.365)	(.400)	(.452)
Acquisitions and investments as % of beginning common equity	.503	.271	.469
	(.633)	(.179)	(.491)
Average total return to shareholders	.155	.168	.175
	(.095)	(.077)	(.187)

Note: Mean is given for each category with SD in parentheses below.

activity and less nontakeover discretionary investment in the 1980s. Consistent with the free cash-flow hypothesis and our residual funds model, this decline in nontakeover discretionary investment occurred at the same time as increases in leverage and dividend payout. Within the possible discretionary uses of residual funds, the main change has been the importance of share repurchases, which doubled (on average) between the two periods.

Traditional investment analysis assigns a large role to profitability (net present value) as a determinant of investment behavior. A difficulty arises in distinguishing between the profitability of investment opportunities at the margin as distinct from the overall profitability of the firm (returns from the flow of new projects relative to returns from the stock of prior investments). As proxies, our model employs a set of return on assets (ROA) variables and a measure of Tobin's q, the ratio of the market value of the firm to the replacement cost of assets.[23] The first of our ROA variables is the firm's ROA for the previous year, to reflect the "best" historical information that managers might have on recent performance. The second variable is the ROA that actually occurred for the current and succeeding year, which is intended to serve as a proxy for reasonably perfect foresight about investment returns. The third measure is the overall industry average ROA for the prior year, current year, and following year. This measure also incorporates foresight, intending to measure the general industry outlook at the time the investment was made. While the effect of including both past and future (perfect foresight) ROA measures might be expected to overstate the strength of the profitability-investment link, it does provide a more stringent test of incremental influences of cash flow on sustaining and discretionary investment.

Three altemative cash-flow measures are employed: total cash flows, residual cash flows, and residual cash flows net of ROA effects. The last of these measures was constructed by regressing residual cash flows as a percentage of common equity on the firm's ROA, and defining the regression errors as residual cash flows net of ROA effects. This measure embodies a rigorous test of the independent effect of cash flow on investment, since arguably it could be claimed that ROA or other profit measures incorporate cash-flow financial considerations.

In pooling the cross section time-series data set, we used both standard ordinary least squares (OLS) estimation with a single intercept and a fixed-effects model utilizing separate dummy intercepts for each firm. The former model depends on inter- as well as intrafirm variation, whereas the fixed-effects model depends solely on interfirm variation. Generally, the fixed-effect model is preferred because of the asymptotic efficiency of its estimators. The fixed-effects model has the further advantage of controlling for omitted firm-specific effects. Consequently, the cash-flow parameter estimates in the fixed-effects model are more likely to reflect their hypothesized influences rather than merely serve as a proxy for omitted neoclassical profit-related variables.

Table 5.2 presents results for the determinants of sustaining investment,

Table 5.2 **Dependent Variable: ln(Sustaining Investment)**

Equation	Constant	ln(ROA) − 1	ln(IND ROA) (−1, 0, +1)	ln(*q*)	ln(EXP ROA) ln(ROA 0, +1)	ln(TCF)	ln(RCF)	ln(RCF Net of ROA Effect)	R^2	*F*	Durbin-Watson Statistic
(1)	.832	.292	.147	.026	.258	.255			.623	288.3	1.72
	(2.63)	(3.47)	(2.78)	(1.37)	(2.05)	(3.64)					
(2)	.684	.238	.124	.025	.192		.248		.656	240.3	1.67
	(2.23)	(2.64)	(1.75)	(1.38)	(1.96)		(3.41)				
(3)	.955	.215	.209	.014	.265			.285	.651	235.3	1.62
	(3.48)	(2.88)	(1.68)	(1.18)	(2.33)			(3.03)			
(4)		.192	.304	.303	.284	.390			.739	271.2	1.93
		(2.82)	(2.94)	(2.34)	(2.71)	(2.36)					
(5)		.196	.196	.256	.273		.434		.712	287.1	1.61
		(3.54)	(2.33)	(1.85)	(3.03)		(2.72)				
(6)		.387	.121	.298	.392			.417	.741	212.4	1.74
		(4.21)	(2.26)	(2.19)	(2.44)			(2.03)			

Note: t-statistics are in parentheses. ROA = returns on assets; IND ROA = industry returns on assets; EXP ROA = expected returns on assets; ln = natural log; TCF = total cash flow; RCF = residual cash flow.

expressed in log transformations. Equations (1), (2), and (3) are OLS estimates for each of the different cash flow measures, while equations (4), (5), and (6) are the corresponding fixed-effects estimates. Of the profitability measures, the firm's recent ROA and its expected ROA (in a perfect foresight framework) are relatively consistent and significant. In addition, industry average ROA exerts a positive, albeit smaller, effect on sustaining investment. The q variable is small and insignificant in the OLS equations, but larger and more significant in the fixed-effects models. The magnitude of the q coefficients is consistent with the estimates of Salinger (1984), Summers (1981), Hayashi (1982), and Schaller (1988). The added significance of q in the fixed-effects regressions suggests that q models should carefully control for firm-specific effects. This may help to better control for interfirm differences in market power or other product market imperfections.

The cash-flow variables in table 5.2 are significant and roughly the same magnitude as the individual profitability variables. However, the profitability effects taken together are still larger than the cash-flow influences. Also, the significance of the residual cash-flow variable drops when it is measured net of ROA collinearity.

The residual funds hypothesis asserts that residual cash flows, while having some effect on total capital expenditures, should be of greater importance in determining discretionary investment. In table 5.3, fixed-effects estimates of discretionary investment equations are shown. The first three regressions in table 5.3 introduce the three altemate cash-flow measures and are estimated using the entire pooled sample, including those observaitons where residual cash flows are negative. However, a "strong form" of the residual funds model would argue that, since discretionary investment cannot fall below zero, the residual cash flow–discretionary investment relationship might differ in those situations where residual cash flows are negative. To evaluate this, equation (4) of table 5.3 estimates the fixed-effects model without those observations in which residual cash flows were below zero. Negative residual cash flows occurred in at least one year for 19 of the 34 firms, but accounted for only 16% of the total observations. As equation (4) shows, the coefficient estimates are relatively uninfluenced by this change, suggesting that the logarithmic structure of the model is reasonable.[24]

The lagged ROA effect is always negative, with marginal significance. Expected ROA does have the hypothesized positive effect and is somewhat significant. Both industry ROA and q effects are insignificant and negatively associated with discretionary investment. By contrast, the cash-flow estimates are positive and significant in all equations. Furthermore, residual cash flows are both larger and more significant than total cash flows as determinants of discretionary investment. The residual cash-flow measures apparently incorporate few profitability effects, as there are only slight differences in the estimated coefficients (and significance) for the "raw" residual cash-flow measure and for the same variable purged of ROA effects.

Table 5.3 **Dependent Variable: ln(Discretionary Investment)**

Equation	ln(ROA) (−1)	ln(*q*)	ln(IND ROA) (−1, 0, +1)	ln(EXP ROA) ln(ROA 0, +1)	ln(TCF)	ln(RCF)	ln(RCF Net of ROA Effect)	R^2	*F*	Durbin-Watson Statistic
(1)	−.311	.002	−.216	.306	.471			.582	291	1.84
	(1.94)	(.38)	(1.54)	(1.48)	(2.92)					
(2)	−.227	−.002	−.163	.226		.570		.511	259	1.89
	(2.09)	(.20)	(1.35)	(2.10)		(3.43)				
(3)	−.217	.001	−.126	.183			.524	.493	254	2.15
	(1.84)	(.23)	(.82)	(1.66)			(2.14)			
(4)	−.189	.003	−.171	.199		.539		.498	237	1.96
	(1.99)	(.47)	(1.49)	(2.03)		(2.86)				

Note: *t*-statistics are in parentheses. ROA = returns on assets; IND ROA = industry returns on assets; EXP ROA = expected returns on assets; ln = natural log; TCF = total cash flow; RCF = residual cash flow. Discretionary investment measured as actual capital expenditure minus replacement cost depreciation of physical assets adjusted for real sales growth.

Comparing tables 5.2 and 5.3, the profitability variables' coefficients are larger for sustaining investment than for discretionary expenditures, while the cash-flow measures are substantially more important for discretionary investment. In most of the equations, ROA is negatively related to discretionary investment, yet positively associated with sustaining expenditures. Since the ROA variables reflect returns on existing assets, they would be expected to exert a more direct and pronounced influence on sustaining than on discretionary investment. Lower profitability also may signal an orientation toward discretionary expenditures outside of the firm's current operations.

Table 5.4 presents fixed effects estimates of the determinants of merger and acquisition activity (within the industry).[25] Resources used for within-industry acquisitions or similar investments can be thought of as a particular class of discretionary investment. In this case the profitability variables are negatively related to acquisition activity, although with only marginal significance. The major negative relation is with expected ROA, which suggests that poorer prospects may induce consolidations and outside acquisition activity. In all three equations, cash-flow measures are significant and positive. Moreover, the residual cash-flow coefficients dominate those for the total cash flows in magnitude and are roughly equal or better in significance, again supporting the link between residual cash flow and discretionary investment.

5.5 Residual Cash Flows, Discretionary Investment, and Financial Performance

The agency model of the market for corporate control contends that free cash flows create incentives for wasteful capital expenditures, which then hurt financial performance and reduce the value of firms. The previous sections found considerable evidence of a link between residual cash flows and the level of discretionary investment. It remains to be determined whether these discretionary investments harm financial performance. To analyze this, shareholder returns must be examined. Since most investments are multiyear in nature, a long-term review is needed; we chose to measure shareholder returns as the price relative of common stock for the 1971–80 and the 1981–86 periods. The price-relative measure cumulates the price and dividend components of shareholder returns. It is superior to the average total return because it takes into account wealth positions reinvested on an ongoing basis, rather than only short-term trading returns.

The results for the 1971–80 and 1981–86 subperiods are presented in table 5.5. Most of the estimated coefficients are similar for both periods; however, the sustaining investment and dividend payout ratio variables have statistically significant coefficient changes. Capital expenditure on sustaining investment was associated with higher returns in the 1970s than in the 1980s. This may reflect a high marginal return on replacement of existing assets in the wake of two major energy price shocks during the earlier period. Conversely, sustain-

Table 5.4 **Dependent Variable: ln(Acquisitions and Investments)**

Equation	ln(ROA) (−1)	ln(*q*)	ln(IND ROA) (−1, 0, +1)	ln(EXP ROA) ln(ROA 0, +1)	ln(TCF)	ln(RCF)	ln(RCF Net of ROA Effect)	R^2	*F*	Durbin-Watson Statistic
(1)	−.163	.531	−1.440	−.103	.463			.477	5.46	1.64
	(1.88)	(2.08)	(1.54)	(2.69)	(2.82)					
(2)	−.199	.302	−.644	−.118		.658		.503	8.38	1.72
	(1.44)	(1.84)	(1.25)	(2.47)		(3.31)				
(3)	−.167	.325	−.694	−.141			.577	.485	5.97	1.62
	(1.58)	(2.24)	(1.32)	(2.99)			(2.58)			

Note: t-statistics are in parentheses. ROA = returns on assets; IND ROA = industry returns on assets; EXP ROA = expected returns on assets; ln = natural log; TCF = total cash flow; RCF = residual cash flow.

Table 5.5 **Dependent Variable: Price Relative of Common Stock (Total Return to Shareholders over Entire Period)**

Variable	1971–80	1981–86
Constant	1.831	.827
	(.72)	(.94)
Sustaining investment as % of total assets	2.381	.944
	(2.63)	(1.90)
Discretionary capital investment as % of total assets	−1.417	−1.612
	(−3.12)	(−3.20)
Cumulative ROA	.834	.938
	(2.66)	(3.14)
Orthogonalized residual cash flow as % of total assets	.886	.964
	(−2.19)	(2.52)
Dividend payout ratio	.402	.652
	(−1.56)	(1.76)
Share repurchases as % of equity	−1.441	1.718
	(−1.46)	(3.15)
Acquisitions and investments as % of common equity	2.781	2.182
	(2.41)	(3.18)
(Sales + inventory change as % of total assets) × (sustaining investment as % of total assets)	.545	.304
	(2.84)	(2.46)
$\bar{R}^2$	.568	.558
F-statistic	3.39*	2.74*

Note: t-statistics are in parentheses.
*$p = .01$.

ing investment in the 1980s was done in an environment largely characterized by excess industry capacity, so that maintenance of the existing asset base may have resulted in lower returns.

In considering the possible influence of sustaining investment on returns, the interaction of capacity utilization and investment requirements must be considered. Specifically, the closer a firm is to full capacity, the more likely growth in sustaining investment will be required. Since firm-specific capacity utilization measures are not available, a proxy was constructed as (sales + change in inventories) divided by total assets.[26] This variable then was multiplied by (sustaining investment/total assets) to create an interactive variable. The coefficient of this measure is positive and significant in both periods, although much larger in the 1970s. One reason for this change may be that capacity utilization in the earlier period was much higher; in the 1980s, many plants did not achieve 80% utilization until late 1985. This result also suggests that sustaining investment may be quite stable during periods of excess capacity, but that nonlinearities are introduced once capacity utilization passes some threshold.[27]

In both periods, a larger share of discretionary capital expenditure was significantly negatively associated with stock price relatives, lending strong credence to at least the major tenets of the Jensen agency hypothesis. However,

acquisition activity (a component of discretionary investment) was positively and significantly associated with higher shareholder gains. At least for the paper industry, distinguishing between sustaining and discretionary investment may not go far enough; the positive effects of acquisition activity suggests that discretionary investment classification should be further disaggregated.[28]

The availability of residual cash-flow financing is positively related to shareholder wealth in both periods, even after orthogonalizing for profitability effects. One possible explanation is the value of such residual cash flows as reserve financial capacity, akin to Donaldson's (1984) and Myers and Majluf's (1984) concept of financial slack. Thus, residual cash flows may provide financial flexibility to undertake positive net present value projects if they appear; however, the negative relation between discretionary investment and shareholder returns suggests that the key component in the agency model of corporate control lies not in residual cash flows as much as in the uses to which those funds are committed.

5.6 Summary

This paper develops two distinctions in evaluating the linkages between cash flows, investment, and financial performance. The first is the difference between sustaining and discretionary investment. Sustaining investment is aimed at maintaining the productive capacity of the firm's existing assets. Discretionary investment reflects capital expenditures that are not required for core business purposes, yet are undertaken in lieu of dividend increases, share repurchases, or other stockholder distributions. A major contention of this paper is that the determinants of these two types of corporate investment are quite different. In fact, the logic of the residual funds approach is that it is inherently a misspecification to use total capital expenditures as a dependent variable in analysis of investment, since total capital expenditure comprises at least two different components.

At the same time, a distinction was made between total cash flow and residual cash flow. The total cash-flow measure is more closely tied to profitability, while residual cash flows takes into account a hypothesized hierarchy of claims, only some of which embody legally established priority obligations. Residual cash flows were defined as funds that remain after debt service, taxes, sustaining investment, and "established" dividends were paid. This set of payments to financial claimants, in conjunction with sustaining investment, is a vital means of signaling information as to the value of the firm's existing assets. Once this is done, residual cash flows, discretionary investment, and changes in dividend policies provide information concerning a firm's prospects and investment opportunities.

The disaggregation of investment and cash-flow data is important in empirical analysis of both agency and asymmetric information models. The ob-

served relationship between residual cash flows, discretionary investment, and financial performance is consistent with agency hypotheses. Discretionary expenditures are negatively related to shareholder returns, but acquisitions (mostly related to core business activities) are positively associated with shareholder wealth. This strongly suggests that further disaggregation and specification of the different constituent parts of both corporate cash flow and capital budgets would be worthwhile. Some important nonlinear relationships also may be present and need to be explored.[29] Finally, this paper examined only one industry; any substantial generalization awaits a broader investigation into other industries, locales, and time periods.

Of particular interest would be investigations of other industries at different stages of product maturity and with different cash-flow characteristics. For example, the behavior of reputedly "mature" industries such as railroads, steel, and tires might be contrasted with those industries based on relatively new technologies, such as electronics and some pharmaceuticals. Natural resource-based industries subject to product price volatility also would provide a different body of experience for investigation.

In each of these cases, of course, difficult data and definitional problems are present. However, such problems also are endemic when attempting to adapt accounting information to measure other economic concepts (as, say, when attempting to measure q). Furthermore, if the paper industry results are not too atypical, then efforts to define and measure discretionary investment and residual funds are valuable, at least by the empirical standard of better identifying underlying behavioral regularities in investment and financial decisions.

Notes

1. The theoretical base in this area has been developed over a 20-year period in a series of papers by Joseph Stiglitz (1969, 1973, 1974, 1982, 1988). See also B. Greenwald, J. Stiglitz, and A. Weiss (1984), J. Stiglitz and A. Weiss (1981), Stephen Ross (1977), and Hayne Leland and David Pyle (1977). An excellent review of these issues is found in Auerbach (1983).

2. For a review of these issues, see Amir Barnea, Robert A. Haugen, and Lemma W. Senbet (1986); also, Michael C. Jensen and Clifford W. Smith, Jr. (1985).

3. However, the study only analyzes stock price effects of the announcement of capital spending plans, so that the longer-term valuation effects of actual capital expenditures are not considered.

4. Early discussions of debt capacity include John R. Meyer and Edwin Kuh (1957) and Gordon Donaldson (1961). Recently, Stewart Myers's (1984) notion of "financial slack" is quite similar.

5. Gordon Donaldson (1984, 3).

6. Much of the empirical work in support of agency perspectives on corporate control and the problem of managerial discretion relies heavily on stock price event stud-

ies, which typically cover only a short period, most commmonly 60 days surrounding the event.

7. Information asymmetry arguments must be carefully drawn in the context of acquisitions outside of core businesses. In those cases, the acquiring firm's managers may have no information advantage or, possibly, an information disadvantage. This may explain (in part) the lack of gains to shareholders of acquiring firms during merger activity.

8. A review of signaling aspects of altemative financing is presented in P. Asquith and D. Mullins (1986). See also J. Crockett and I. Friend (1988).

9. K. Smith (1989) finds little evidence of a relation between the sophistication of investment review and control systems and financial performance.

10. See Alan J. Auerbach (1984).

11. This has been true in the natural resource industries and in financial institutions, where growth has occurred through acquisition rather than intemal expansion. This reorientation may also account for critiques of such restructurings, which raise concems about diversion from long-term to short-term goals.

12. In a recent paper, Bemheim shows that dividends and repurchases can serve different signaling functions analogous to the distinction between sustaining and discretionary activities. See B. Douglas Bemheim (1988). See also Kose John and Joseph Williams (1985).

13. This contrasts with Fazzari, Hubbard, and Petersen (1988), who separate firms on the basis of payout levels in their analysis of investment decisions.

14. The average equity beta for the sample of paper companies is 1.17; the asset-weighted average beta is 1.04.

15. The discretionary nature of such activities depends in part on the degree to which acquisitions involve operations related to core business, as distinct from unrelated diversification. The COMPUSTAT and DISCLOSURE data only provide aggregate dollar amounts of each firm's acquisitions and investments. A search of *the Wall Street Journal Index* and *the New York Times Index* identified corporate acquisitions and a few acquisitions of plants or divisions, but for these asset purchases terms typically were not disclosed.

16. Use of replacement depreciation as a proxy for sustaining investment may overstate actual sustaining investment, to the extent that such replacement is unwarranted. This might be true, e.g., in declining industries, or where technological change has increased the flow of capital services from a given stock of capital assets.

17. This information was gathered from the footnotes of each firm's financial statements for each year.

18. These adjustments were made using the Consumer Price Index.

19. An altemative measure of sustaining and discretionary investment was constructed using a distributed lag model for each company. The model was used to construct a baseline "expected" level of capital expenditures for each firm for each year. While the two measures of sustaining investment had a correlation of .74, the estimate of sustaining investment from the distributed lag model is consistently higher than that employing adjusted accounting data. This result might be expected, since any "average" level of capital expenditures is likely to include some discretionary component.

20. Although we do present a model of total gross capital expenditures below, our focus is on the relation between cash flow and discretionary investment, which should be largely unrelated to capital stock per se. Since our construction is based on replacement depreciation from financial statements, capital stock effects thereby are incorporated. In the total investment model, Goldfeld-Quandt tests for heteroscedasticity were rejected. Given reasonably homoscedastic residuals, Kuh and Meyer (1955) argue that deflating by assets may introduce spurious correlation in the ratios.

21. This subtraction introduces a degree of measurement error becasuse taxes payable for financial reporting purposes may differ from the actual amount of taxes paid.

22. Net debt issuance is included here as a means by which companies can maintain target capital structures.

23. In our regressions, our measure of q is unadjusted for taxes and reflects the market and asset values at the beginning of each year. While a more detailed construction of q could change our reported results, Fazzari, Hubbard, and Petersen (1988) find little difference in their results using adjusted or unadjusted measures of q. Schaller (1988), however, finds the estimates of the effects of q on investment to be quite sensitive to measurement issues.

24. The model's fit is enhanced slightly, due to the nonlinearity of discretionary investment-residual funds relationship around zero.

25. The partitioning of total expenditures into sustaining and discretionary components is always open to criticism. However, the clear discretionary nature of acquisitions and investments provides a good test of the residual funds approach.

26. Since the valuation equations are cross-sectional, industry capacity utilization for each subperiod does not capture intrafirm differences very well. While the (sales + inventory change)/total assets measure does suffer from flow-stock incongruity, it does measure asset-use intensity. To check the relation with capacity utilization, the constructed (sales + inventory change)/total assets variables were combined into an asset-weighted average for each year. The correlation of this measure within the time series of paper industry capacity utilization was .71.

27. Further analysis of this point introduces measurement problems as well, since a reliance on historically based accounting or investment relations may be unreliable as a guide to future sustaining investment needs.

28. Given that most of the paper industry merger and acquisition activity involved consolidation rather than diversification, the positive valuation effects of acquisitions support well-established business policy views on the value of "sticking to one's knitting" in seeking mergers and acquisitions within the core business or in closely related activities. See M. E. Porter (1987).

29. Dhrymes and Kurz (1967) contend that study of investment and financial policies generally requires use of simultaneous-equations methodology, given the prevailing endogeneity; they gave particular emphasis to the problem of dividend payout and retention. This approach, while worthy of exploration, may not apply as directly to the residual funds model, in that the strict accounting and financial identities are not present in our hierarchical model of financial and investment allocation.

References

Asquith, P., and D. Mullins. 1986. Signalling with dividends, stock repurchases, and equity issues. *Financial Management* 15:27–44.

Auerbach, A. 1983. Taxation, corporate finance, and the cost of capital. *Journal of Economic Literature* 21:905–40.

———. 1984. Taxes, firm financial policy and the cost of capital: An empirical analysis. *Journal of Public Economics* 23:27–57.

Barnea, A., R. Haugen, and L. Senbet. 1986. *Agency problems and financial contracting*. Englewood Cliffs: Prentice-Hall.

Bernheim, B. D. 1988. Dividends versus share repurchases as signals of profitability. Unpublished manuscript. Northwestern University, Kellogg School of Management.

Bernstein, J., and M. I. Nadiri. 1986. Published in Peston, M. and Quandt, R., editors, *Prices, competition, and equilibrium*. London: Philip Allan/Barnes and Noble.

Bhattacharya, S. 1979. Imperfect information, dividend policy, and the "bird in the hand" fallacy. *Bell Journal of Economics* 10:259–70.

Bruner, R. 1988. The use of excess cash and debt capacity as a motive for merger. *Journal of Financial and Quantitative Analysis* 23:199–217.

Crockett, J., and I. Friend. 1988. Dividend policy in perspective: Can theory explain behavior? *The Review of Economics and Statistics* 70:603–13.

Dhrymes, P., and M. Kurz. 1967. Investment, dividend, and external finance behavior of firms. In *Determinants of investment behavior*, ed. R. Ferber. New York: Columbia University Press.

Dobrovolsky, S. 1951. *Corporate income retention*. New York: NBER.

Donaldson, G. 1961. *Corporate debt capacity: A study of corporate debt policy and the determination of corporate debt capacity*. Boston: Harvard University, Graduate School of Business Administration, Division of Research.

———. G. 1984. *Managing corporate wealth*. New York: Praeger.

Fazzari, S., R. G. Hubbard, and B. Petersen. 1988. Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, no. 1, pp. 141–95.

Greenwald, B., J. Stiglitz, and A. Weiss. 1984. Information imperfections in the capital market and macroeconomic fluctuations. *American Economic Review* 74:194–99.

Griffin, J. 1988. A test of the free cash flow hypothesis: Results from the petroleum industry. *Review of Economics and Statistics* 70:76–82.

Hakansson, N. 1982. To pay or not to pay dividends. *Journal of Finance* 37:415–28.

Hayashi, F. 1982. Tobin's marginal q and average q: A neoclassical interpretation. *Econometrica* 50: 213–24.

Jensen, M. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76:323–29.

Jensen, M., and C. Smith. 1985. Stockholder, manager, and creditor interests: Applications of agency theory. In *Recent advances in corporate finance*, ed. E. Altman and M. Subrahmanyam, pp. 93–136. Homewood, Ill.: Irwin.

John, K., and J. Williams. 1985. Dividends, dilution, and taxes. *Journal of Finance* 40:1053–70.

Kuh, E. 1963. *Capital stock growth: A microeconometric approach*. Amsterdam: Elsevier.

Kuh, E., and J. R. Meyer. 1955. Correlation and regression estimates when the data are ratios. *Econometrica* 23:400–416.

Leland, H., and D. Pyle. 1977. Information asymmetries, financial structure, and financial intermediation. *Journal of Finance* 32:371–87.

Lintner, J. 1956. Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review* 46 (May): 97–113.

McConnell, J., and C. Muscarella. 1985. Corporate capital expenditure decisions and the market value of the firm. *Journal of Financial Economics* 14:399–422.

McDonald, R., and N. Soderstrom. 1986. Dividend and share changes: Is there a financing hierarchy? NBER Working Paper no. 2029.

Meyer, J. R., and R. Glauber. 1964. *Investment decisions, economic forecasting, and public policy*. Boston: Harvard University, Graduate School of Business Administration, Division of Research.

Meyer, J. R., and E. Kuh. 1957. *The investment decision*. Cambridge, Mass.: Harvard University Press.

Myers, S. 1984. The capital structure puzzle. *Journal of Finance* 39:575–92.

Myers, S., and N. Majluf. 1984. Corporate financing decisions when firms have in-

vestment information that investors do not have. *Journal of Financial Economics* 13:187–221.

Petersen, B. 1988. Capital markets imperfections and investment fluctuations. *Economic Perspectives*, 12:3–12. Chicago: Federal Reserve Bank.

Porter, M. 1987. From competitive advantage to corporate strategy. *Harvard Business Review* 65:43–60.

Salinger, M. 1984. Tobin's q, unionization, and the concentration-profits relationship. *Rand Journal of Economics* 15:159–70.

Ross, S. A. 1977. The determination of financial structure: the incentive-signalling approach. *Bell Journal of Economics* 8:23–40.

Schaller, H. 1988. Why doesn't Q investment theory work? Evidence from U.S. firm data. Typescript, Department of Economics, MIT.

Smith, K. 1989. Effects of investment control systems. Ph.D. diss., University of Maryland.

Stiglitz, J. 1969. A re-examination of the Miller-Modigliani Theorem. *American Economic Review* 59:784–93.

———. 1973. Corporate financial policy and the cost of capital. *Journal of Public Economics* 2:1–34.

———. 1974. On the irrelevance of corporate financial policy. *American Economic Review* 64:851–66.

———. 1982. Information and capital markets. In *Financial economics: Essays in honor of Paul Cootner*, ed. C. Cootner and W. Sharpe, pp. 118–58. Englewood Cliffs, N.J.: Prentice-Hall.

———. 1988. Why financial structure matters. *Journal of Economic Perspectives* 2:121–26.

Stiglitz, J., and A. Weiss. 1981. Credit rationing in markets with imperfect information. *American Economic Review* 71:393–410.

Summers, L. 1981. Taxation and corporate investment: a q-theory approach. *Brookings Papers on Economic Activity*, no. 1, pp. 67–127.