THE JOURNAL OF FINANCE • VOL. LIV, NO. 6 • DECEMBER 1999

The Corporate Cost of Capital and the Return on Corporate Investment

EUGENE F. FAMA and KENNETH R. FRENCH*

ABSTRACT

We estimate the internal rates of return earned by nonfinancial firms on (i) the initial market values of their securities and (ii) the cost of their investments. The return on value is an estimate of the overall corporate cost of capital. The estimate of the real cost of capital for 1950–96 is 5.95 percent. The real return on cost is larger, 7.38 percent, so on average corporate investment seems to be profitable. A by-product of calculating these returns is information about the history of corporate earnings, investment, and financing decisions that is perhaps more interesting than the returns.

WHAT IS THE OVERALL COST of capital for U.S. nonfinancial corporations? Does the rate of return on investment exceed this cost of capital? How do firms finance investment? We address these questions.

The standard textbook prescription calls for estimating a firm's cost of capital as a weighted average of the expected returns on its securities. Putting aside the difficult problem of estimating expected returns, this approach is straightforward for individual firms since the mix of securities in a firm's capital structure and the rates it pays on various forms of debt are known. But problems arise at the aggregate corporate level. For example, it is difficult to estimate aggregate quantities and returns for privately placed debt, and privately placed debt is a common form of corporate financing.

We take a different approach, less fraught with measurement problems. In effect, we treat the entire nonfinancial corporate sector as an investment project. The cost of capital for the nonfinancial sector is estimated as the internal rate of return (IRR) that equates the initial market values of firms with the present values of their post-entry net cash flows and their terminal market values, all of which are estimated accurately.

The IRR on value is a useful benchmark with many potential applications. For example, it is a starting point for cost of capital estimates for individual firms, which, of course, differ from the aggregate because of differences in

*Graduate School of Business, University of Chicago (Fama) and Sloan School of Management, MIT (French). Discussions with Steven Kaplan, S. P. Kothari, Mark Mitchell, David Scharfstein, and Jeremy Stein have been helpful. We also received valuable comments from René Stulz, a referee, and seminar participants at Harvard, MIT, and the University of Chicago.

risk and target capital structures. The IRR on value is also an estimate of what an investor would have earned during our sample period by passively investing in all corporate securities as they enter the sample. As such it is a good benchmark for judging the investment performance of institutions like pension funds and endowment funds.

To judge whether nonfinancial corporate investments on average generate value in excess of cost, we calculate another internal rate of return, on the cost of corporate investments. If this IRR on cost (the return delivered by the corporate sector) exceeds the IRR on value (the return required by investors), we infer that corporate investment on average adds value.

Our results suggest that on average corporate investment does produce returns that exceed the cost of capital. For the 1950–96 sample period, the real return on value (the real cost of capital) for nonfinancial firms is high, 5.95 percent. The real return on cost is higher, 7.38 percent, so on average investment seems to be profitable. For the shorter 1973–96 period, when our coverage of firms is more complete, the real IRR on cost, 7.52 percent, is again greater than the IRR on value, which is itself a hefty 5.57 percent.

The inference that the IRR on cost exceeds the IRR on value has problems, centering on the IRR on cost. We measure the components of the IRR on value (initial market values of firms, post-entry cash flows, and terminal market values) rather accurately, so our estimates of the IRR on value are accurate. In the IRR on cost, however, the assets firms hold when they enter the sample are measured at reported book value. There is no adjustment for the replacement cost of reported assets, and past investments in intangible assets are unreported. As a result, we understate the initial assets of entering firms and overstate the IRR on cost. If the correct initial asset values are about 40 percent higher than the reported book value, the conclusion that corporate investment on average generates value in excess of cost no longer holds.

Inferences about the value added from corporate investment are not, however, the main interest of this paper. Our most accurate and important numbers are the historical IRRs on value, which are estimates of the return on all corporate securities (purchased at initial market values), and as such have many uses. Moreover, the process of computing the IRRs produces interesting insights. For example, examining the inputs for the IRR on value shows how (i) the initial pricing of firms, (ii) post-entry investments, (iii) earnings on investments, and (iv) the terminal values produced by expected future net cash flows combine to produce the overall return on wealth invested in the nonfinancial corporate sector. And examining the details of cash inflows and outflows provides an interesting perspective on the financing of the corporate sector.

Section I discusses the logic underlying the IRRs. Section II summarizes the dynamics of corporate earnings, investment, and financing decisions, producing interesting background evidence for the IRRs. The IRRs are presented and dissected in Section III. Section IV discusses how the returns might be used and presents alternative estimates. Section V concludes.

I. Estimating the IRRs: Mechanics

The IRRs are discount rates that set the net present value of cash flows into and out of the corporate sector equal to zero. Algebraically, the IRRs on value and cost are the discount rates, r_v and r_c, that solve

$$IV_0 = \sum_{t=1}^{T(1996)} \frac{X_t - I_t}{(1+r_v)^t} + \sum_{t=1}^{T(1996)} \frac{FS_t - FBV_t}{(1+r_v)^t} + \frac{TV_{1996}}{(1+r_v)^T} \tag{1}$$

$$IC_0 = \sum_{t=1}^{T(1996)} \frac{X_t - I_t}{(1+r_c)^t} + \sum_{t=1}^{T(1996)} \frac{FS_t - FBC_t}{(1+r_c)^t} + \frac{TV_{1996}}{(1+r_c)^T}, \tag{2}$$

where (see the tables below for details)

IV_0 is the aggregate initial market value of firms that enter the sample at the beginning of the IRR estimation period (1950 or 1973);

IC_0 is their aggregate initial book value;

X_t is aggregate cash earnings (after taxes but before deduction of interest and depreciation) for year t for firms in the sample in year $t - 1$;

I_t is the aggregate gross investment (net investment plus depreciation) of these firms;

FS_t (firms sold during year t) is the terminal market value of firms that leave the sample in year t;

FBV_t (firms bought at value) is the initial market value of firms that enter the sample in year t;

FBC_t (firms bought at cost during year t) is their book value; and

TV_{1996} is the terminal market value of firms that exist at the end of the sample period (1996).

In the IRR on value, the initial investment in a firm is its market value when it enters the sample (IV_0 or FBV_t). In the IRR on cost, the initial investment in a firm is the cost of the assets it brings into the sample (IC_0 or FBC_t). Thereafter, the two IRRs use the same annual net cash flows ($X_t - I_t$) and the same terminal values for firms, either when they leave the sample (FS_t) or at the end of the sample period (TV_{1996}).

Except for FS_t, FBV_t, and FBC_t, equations (1) and (2) look like the standard expression that defines the IRR for an investment project. FS_t, FBV_t, and FBC_t appear in the equations because to estimate IRRs for the investment project represented by the entire nonfinancial corporate sector, we must account for entry and exit of firms.

A. *Interpreting the IRRs*

The rate of return on cost estimates the IRR delivered by firms on the cost of their investments. The more interesting IRR on value has three equivalent interpretations. (i) Most directly, it is the return to an investor who buys

firms at market value (IV_0 or FBV_t) when they enter the sample, receives or covers their subsequent net cash flows ($X_t - I_t$), and then sells them at market value (FS_t or TV_{1996}). (ii) The IRR on value is also an estimate of the overall cost of capital for nonfinancial firms. In effect, we apply the standard valuation equation to the whole nonfinancial corporate sector, and back out the corporate cost of capital. (iii) The IRR on value is the compound return on the initial market values of all the securities of nonfinancial firms, including the securities they issue after they enter the sample. To see this, note that since cash inflows (cash earnings, X_t, plus net new securities issued, NS_t) must equal cash outflows (investment, I_t, plus dividend and interest payments, $Div_t + Int_t$),

$$X_t + NS_t = I_t + Div_t + Int_t, \tag{3}$$

the net cash flow, $X_t - I_t$, is equal to payments to security holders less net new securities issued,

$$X_t - I_t = Div_t + Int_t - NS_t. \tag{4}$$

Substituting equation (4) into equation (1), we get

$$IV_0 = \sum_{t=1}^{T(1996)} \frac{Div_t + Int_t - NS_t}{(1 + r_v)^t} + \sum_{t=1}^{T(1996)} \frac{FS_t - FBV_t}{(1 + r_v)^t} + \frac{TV_{1996}}{(1 + r_v)^T}. \tag{5}$$

Equation (5) says that the IRR on value is the compound return on all the securities of nonfinancial firms outstanding during the IRR estimation period, with the securities purchased at market value when firms enter the sample (IV_0 or FBV_t) and when they later issue securities (NS_t) to finance cash outlays.

By way of contrast, the IRR on value is not the return from investing a dollar in the market portfolio at the beginning of the IRR estimation period, and then rolling the investment into the market portfolios available in subsequent years. This more traditional approach assumes that dividend and interest payments are reinvested in the market portfolio. And it simply reallocates the current value of invested wealth when new securities enter the market portfolio. Instead, capturing the actual history of wealth invested in the corporate sector, our IRR on value requires net new investment in any year when the sum of net cash flow from operations ($X_t - I_t$) and funds needed to cover the difference between the market values of exiting and entering firms ($FS_t - FBV_t$) is negative. Conversely, our approach reduces the value of invested wealth when the net flow from the corporate sector, $X_t - I_t + FS_t - FBV_t$, is positive. The net flow is positive in 28 years of the 1950–96 period and negative in 19 years (see Table VI, below).

Our IRR on value is a compound return. Under certain conditions, the appropriate return concept for the cost of capital is an expected one-period simple return (e.g., see Fama (1996)). This issue is complicated, however, by the fact that expected returns must be estimated and the estimates enter present value expressions in a nonlinear way. As a consequence, estimates of the cost of capital that produce unbiased estimates of present values are weighted averages of average simple and compound returns, with weights that depend on the maturity of the cash flow to be valued (Blume (1974), Cooper (1994)). Thus, when we later present estimates of the return on value, we show average annual simple returns on wealth invested in the corporate sector, along with the compound returns from equation (1).

B. Some Details

Our estimates of the capital stock of firms include only debt that pays explicit interest (COMPUSTAT's long-term debt plus short-term debt in current liabilities.) We exclude other obligations, like accounts payable, from market capital (IV_0, FBV_t, FS_t, and TV_{1996}) and book capital (IC_0 and FBC_t) for two reasons. First, measured cash earnings, X_t, are net of implicit interest payments. Including liabilities that do not pay explicit interest in market or book capital would thus bias our IRRs downward. Second, non-interest-paying liabilities are often the result of intercorporate financial intermediation. Including them in the market or book values of firms would overstate the market and book capital of the corporate sector. For the same reasons, we measure net investment (I_t less depreciation) as the change from year $t-1$ to year t in a firm's book capital (total assets minus non-interest-paying debt).

The terminal value in the IRR on cost includes the net present value of future investments. Including the value of future opportunities in the return on the cost of assets is legitimate if the opportunities are the result of past investments. For some purposes, however, the terminal value of assets in the IRR on cost should be limited to assets in place. This is, for example, the right approach for estimating the productivity of existing assets, as in Poterba (1997). (Future investment opportunities do not affect the expected value of the IRR on value because they are included in both the initial and terminal market values.)

Even if one were to conclude that the IRR on cost is too high because the terminal value includes future opportunities, this would not change the ordinal relation between the IRR on cost and the IRR on value. The IRR on cost is too high only if the market judges that future investments will create value in excess of cost. This seems unlikely unless past investments were also profitable. In other words, terminal values that are too high may cause us to overstate the spread between the IRR on cost and the IRR on value, but inferences about whether investment generates value added should not be affected.

Mergers, on the other hand, can cause us to understate the IRRs on cost. We measure investment for year t as the aggregate change in book capital for firms in the sample in years $t-1$ and t. Under the purchase method of

accounting for mergers (the predominant choice after 1970 (Baker, Lembke, and King (1996))), the market value of acquisitions by firms in the sample shows up in investment, which is an outflow in equations (1) and (2). But the market value of firms acquired during year t also adds to FS_t (firms sold during year t), which is an inflow in equations (1) and (2). Thus, mergers in which both firms are on COMPUSTAT wash out of the IRR calculations. The result is different if the acquired firm is not on COMPUSTAT. In this case, the merger has the effect of adding the acquired firm to the sample, and its assets enter the IRR on value and the IRR on cost at the same value (typically market value). If their market value exceeds their cost, adding the assets of these acquired firms at market value biases the IRR on cost down.

There is a minor problem in our estimates of terminal value for firms that leave the sample before 1996. We estimate FS_t for these firms using book debt and the market value of common stock on the date of their last available fiscal year end. As a result, when firms exit because of bankruptcy, we overstate the value of their debt. We also overstate the market value of their equity if the last available fiscal year end precedes the date when the full effects of bankruptcy are known. Since firms dropped from COMPUSTAT because of bankruptcy are typically small, this bias should not have a big effect on our IRRs on value and cost, which are effectively size weighted.

Finally, there is some double-counting in the IRRs. When COMPUSTAT firms invest in the securities of other firms, the market value of the securities appears in I_t in the IRRs on both value and cost. We would prefer to wash this double counting of corporate assets out of the IRRs, but there is no way to do this that properly accounts for the contribution of intercorporate investment to cash earnings, X_t. Double-counting is particularly important for financial firms, since many of their assets are claims on other firms. Thus, we do not include financial firms in the tests.

C. *Estimation Periods*

We calculate IRRs for two periods, 1950–96 and 1973–96. The longer period is attractive for two reasons. First, we use realized returns to draw inferences about expected returns. A long estimation period provides more reliable estimates of expected returns. Second, to estimate the return on cost, we measure a firm's initial cost (in IC_0 or FBC_t) by the book value of its assets (less non-interest-paying liabilities), rather than by replacement cost. We do not adjust for inflation or for differences between past economic and book depreciation. Such adjustments would be arbitrary, since we have no information about the types of assets firms bring into the sample, or about when the assets were acquired. We also make no adjustment for pre-entry investments in intangible assets (R&D, advertising, and human capital), which are expensed and do not show up in book assets. The use of historical rather than replacement cost produces a downward bias in our estimates of initial cost and an upward bias in the IRR on cost. In contrast, annual net cash flows, $X_t - I_t$, are measured accurately and include expenditures on

intangible assets. Thus, the longer 1950–96 estimation period is attractive because measurement error in estimates of initial cost is offset by more years of accurate net cash flows.

The downside of the longer 1950–96 period is that the IRRs are more subject to survivor bias. The data are from the historical COMPUSTAT file maintained by the Center for Research in Security Prices (CRSP). The COMPUSTAT file begins in 1950. Since the first version was not built until the mid 1960s, we know COMPUSTAT backfilled the data for earlier years. The early sample is also biased toward large successful firms. As a clear indication that the result is a survivor bias, no firms disappear from the sample until 1966. Chan, Jegadeesh, and Lakonishok (1995) find that COMPUSTAT's coverage of listed firms becomes rather complete by 1973. The IRRs for 1973–96 are thus less subject to survivor bias than the estimates for 1950–96 and so provide a useful check on the results for the longer period.

D. Some Perspective on the Sample

Table I shows how the COMPUSTAT sample of nonfinancial firms evolves through time. The number of firms grows from an average of 319 per year in 1951–56 to 4,442 in 1992–96. The combined book capital of the firms in the sample also grows steadily. Measured in December 1996 dollars, total book capital averages 357.0 billion dollars in 1951–56 and 3.589 trillion dollars in 1992–96.

Table I also summarizes the entry and exit of firms from the sample. The number of firms in the sample grows by more than 11 percent per year before 1972, and by six to nine percent per year thereafter. As COMPUSTAT's coverage of listed firms becomes more complete, the firms that are added are smaller, and they account for a small fraction of total book capital. New firms added each year are around eight percent of the total book capital of the sample in 1951–61, but they are 2.22 percent or less thereafter.

The proportion of firms dropping out of the sample provides clear evidence of backfilling in the COMPUSTAT database. We lose no firms until 1966. But after 1973 (when COMPUSTAT's coverage is essentially complete) an average of 5.20 percent of existing firms leave the sample each year. As one would expect, the attrition rate is much lower if we measure by book capital rather than by firms. The average annual rate for book capital in 1974–96, 1.41 percent, is about one-fourth the rate for firms. In other words, the firms that leave the sample (including firms acquired by other sample firms) are typically small and they account for a small fraction of aggregate assets.

We combine several accounting variables to measure annual net cash flow, $X_t - I_t$ (see Tables III and IV, below). Income before extraordinary items and the change in assets are the critical determinants of $X_t - I_t$. If either is missing from COMPUSTAT, we set the firm's net cash flow for the year to zero. To have the broadest possible coverage, we do not set the cash flow to zero if other variables, such as income from extraordinary items or deferred

Table I

Number of Firms and Total Assets in the Sample of Nonfinancial Firms, 1951–96

The sample includes all publicly traded, nonfinancial firms (all SIC codes except 6000–6999) in the historical COMPUSTAT database that are incorporated in the United States and have data on the market and book value of capital for any two years between 1950 and 1996. A firm enters the portfolio at the end of the first fiscal year for which we have market and book value data, and it leaves at the end of the last fiscal year for which we have market and book value data.

Firms is the number of firms in the sample at the beginning of each year. Book Capital is the total end-of-year book value of long-term debt, short-term debt, and equity (in billions of December 1996 dollars) for firms in the sample. Long-term debt is COMPUSTAT data item (9). We measure short-term debt as debt in current liabilities (34) if it is available. If not, we use current liabilities (5). Book equity is total assets (6) minus total liabilities (181) plus balance sheet deferred taxes and investment tax credit (35, if available). (If total liabilities is unavailable before 1974, we replace it with the sum of long-term debt, current liabilities, other liabilities (75), balance sheet minority interest (38), and balance sheet deferred taxes and investment tax credit.) Percent of Firms is the number of firms (i) entering the portfolio, (ii) leaving the portfolio, or (iii) missing either income before extraordinary items or the change in assets, each divided by the number of firms in the sample at the beginning of the year. Percent of Book Capital is the comparable ratio of the total book capital of the firms in a category divided by the total book capital of the firms in the sample. The table shows averages of these variables for various periods.

		Percent of Firms			Book	Percent of Book Capital		
	Firms	Entering	Leaving	Missing	Capital	Entering	Leaving	Missing
1951–56	319	11.74	0.00	0.04	357.0	8.01	0.00	0.00
1957–61	574	17.00	0.00	0.07	737.9	7.79	0.00	0.00
1962–66	1337	11.72	0.11	0.14	1402.7	2.22	0.09	0.01
1967–71	2111	11.30	2.05	0.07	2094.3	1.29	0.62	0.00
1972–76	2942	6.62	3.46	0.12	2508.2	0.59	0.76	0.02
1977–81	3024	6.07	5.80	0.26	2643.7	0.26	1.38	0.08
1982–86	3247	9.06	7.14	0.47	2725.5	1.74	2.23	0.21
1987–91	3590	7.34	5.27	0.72	3362.2	0.86	1.07	0.05
1992–96	4442	8.98	3.57	0.37	3589.4	1.21	1.26	0.04
1951–96	2353	10.02	2.98	0.25	2118.7	2.78	0.81	0.04
1974–96	3508	7.58	5.20	0.42	3009.9	0.94	1.41	0.09

taxes, are unavailable. Instead, we set the values of the missing items to zero in estimating $X_t - I_t$. Table I shows that only a tiny fraction of firms is missing the critical change in assets or income before extraordinary items. For 1950–96, we are forced to set the annual cash flow to zero for only 0.25 percent of the firms on average, and these firms account for only 0.04 percent of the book capital of firms in the sample. The averages for 1973–96 are 0.42 percent of the firms and 0.09 percent of book capital.

II. Capital Structures and Financing Decisions

In the terminal market values of firms used to calculate the IRRs on value and cost, only common stock is measured at market. We measure other liabilities (short-term debt, long-term debt, and preferred stock) at book value.

Likewise, in the estimates of initial market value in the IRR on value, only common stock is measured at market. In this section, we use aggregate corporate capital structures to argue that measuring debt and preferred stock at book value does not create serious biases in the IRRs. The more interesting output of the exercise, however, is information about the evolution of the overall corporate capital structure in response to earnings, investment, and distributions to security holders.

A. Capital Structures: Summary Results

Table II describes aggregate capital structures for (i) all firms in the sample during the current and previous year (All Firms), (ii) firms that enter the sample during the year (Initial Year), and (iii) firms that exit (Final Year). Averaging over the annual estimates for 1974 to 1996, when COMPUSTAT's coverage of listed firms is essentially complete, 65.84 percent of the combined market capital (total market value) of firms in the sample is common equity, 2.64 percent is preferred stock, 24.99 percent is long-term debt, and 6.53 percent is short-term debt.

Common equity's share of market capital is larger before 1972 (73.74 percent in 1967–71 and more than 80 percent in 1951–66). Part of the decline in equity's share is picked up by long-term debt, which increases from 9.46 percent of aggregate market capital in 1951–56 to around 25 percent after 1971. The changes in the relative importance of common equity and long-term debt after 1971 may be due in part to COMPUSTAT's initial bias toward large successful firms. But a similar increase in leverage in the 1970s is observed in earlier studies that use Federal Reserve Flow of Funds data, which are not limited to firms on COMPUSTAT (e.g., Taggart (1985)). The general conclusion from the earlier work is that corporate leverage is unusually low after World War II, and the increase in leverage in the 1970s may just be a return to normal levels. Consistent with this view, after 1971, common equity's share of market capital is rather stable, at around 65 percent. Long-term debt's share is also rather stable at around 25 percent. These results suggest that, at least in aggregate, firms adjust their capital structures to maintain relatively constant proportions of common stock and debt. It remains to be seen, however, whether the increase in common equity's share of market capital during the last five years (1992–96) of strong stock returns, and the corresponding decrease in the share of long-term debt, is reversed in the future.

Preferred stock is the least important source of financing. It is always less than five percent of the aggregate market capital of nonfinancial firms, and it falls below two percent during the last 10 years (1987 to 1996) of the sample period, perhaps as a result of the decreasing importance of utilities (the major issuers of preferred stock). There is also a modest increase (two to three percent) in short-term debt's share of aggregate value after 1971. This may be a result of the increasing importance of service firms.

The capital structures of firms leaving the sample are similar to those of all firms during the 1974-96 period of relatively full COMPUSTAT coverage. Common equity's 1974-96 average share of market capital for exiting firms,

Table II
Nonfinancial Corporate Capital Structures

The table shows the average shares of different classes of liabilities, expressed as percentages of total market or book capital, for (i) all firms in the sample at the beginning of the year (All Firms), (ii) firms entering the sample during the year (Initial Year), and (iii) firms leaving the sample (Final Year). A firm's market capital is the sum of the market value of its common stock plus the book value of its long-term debt, short-term debt, and preferred stock. A firm's book capital is the total end-of-year book value of its long-term debt, short-term debt, and equity (see Table 1). The market value of common stock is the stock price (COMPUSTAT data item 199) times shares outstanding (25) at the end of the fiscal year.

	Common Stock	Preferred Stock	Long-Term Debt	Short-Term Debt		Common Stock	Preferred Stock	Long-Term Debt	Short-Term Debt
Panel A: Components of Market Capital for All Firms					Panel B: Components of Book Capital for All Firms				
1951–56	83.02	3.34	9.46	4.18	1951–56	74.91	4.89	14.21	5.99
1957–61	84.61	1.80	11.64	1.95	1957–61	73.69	3.07	19.94	3.30
1962–66	80.56	2.12	14.91	2.40	1962–66	66.95	3.60	25.38	4.07
1967–71	73.74	3.43	18.67	4.15	1967–71	58.56	5.40	29.50	6.54
1972–76	65.19	4.07	25.53	5.21	1972–76	57.98	4.96	30.85	6.20
1977–81	62.72	3.53	28.32	5.43	1977–81	61.19	3.67	29.49	5.66
1982–86	67.09	2.69	25.44	4.78	1982–86	61.54	3.13	29.73	5.60
1987–91	64.76	1.85	24.43	8.96	1987–91	51.65	2.54	33.48	12.33
1992–96	71.42	1.51	19.76	7.31	1992–96	50.59	2.59	34.20	12.62
1951–96	72.80	2.72	19.57	4.92	1951–96	62.18	3.78	27.13	6.90
1974–96	65.84	2.64	24.99	6.53	1974–96	56.50	3.20	31.60	8.69
Panel C: Components of Market Capital in Initial Year					Panel D: Components of Market Capital in Final Year				
1950–55	78.97	3.61	12.93	4.49					
1956–60	79.19	2.49	14.87	3.45					
1961–65	67.27	2.58	23.87	6.28	1966–71	63.66	2.23	20.79	13.32
1966–70	73.85	3.98	17.25	4.92	1972–76	57.29	1.50	29.28	11.93
1971–75	69.11	1.52	21.36	8.01	1977–81	64.26	1.90	27.96	5.88
1976–80	67.87	2.23	22.33	7.57	1982–86	68.58	1.72	23.43	6.28
1981–85	80.15	0.58	16.34	2.93	1987–91	64.01	2.53	24.09	9.38
1986–90	74.40	1.60	20.87	3.13	1992–96	72.23	1.46	22.03	4.29
1991–95	80.90	0.96	16.15	1.99	1996–96	75.70	1.05	17.31	5.94
1950–95	74.73	2.20	18.32	4.75	1966–96	64.96	1.90	24.47	8.67
1974–95	74.35	1.39	19.64	4.61	1974–96	65.96	1.76	24.96	7.32

65.96 percent, is close to the average for all firms, 65.84 percent. The proportions of total value in preferred stock, long-term debt, and short-term debt are also similar for all firms and exiting firms. At least in terms of capital structure there is nothing special about firms that leave the sample.

Most firms leaving the sample are driven out by distress or are acquired in mergers. Since distressed firms have low market values, mergers probably account for much of the value of exiting firms. Table II then says that on average the capital structures of acquired firms are similar to those of all firms.

There are more interesting differences between the capital structures of all firms and firms entering the sample. New firms have a larger fraction of their market value in common stock. Focusing again on 1974-96, common equity averages 74.35 percent of the market capital of entering firms, versus 65.84 percent for all firms. The reduction in equity's share as firms mature is absorbed by long-term and short-term debt, which increase by 5.35 percent and 1.92 percent. This shift is consistent with the argument that debt is a relatively more efficient form of financing for mature firms with established track records (Myers (1977)).

The internal rate of return on corporate value requires estimates of each firm's initial market value, and the IRRs on value and cost require terminal market values. Table II says that the market value of common equity, which we measure with little or no error, is about 75 percent of initial value and 65 percent of terminal value. We use book value to proxy for the market value of preferred stock, long-term debt, and short-term debt. There is probably little difference between book and market values for short-term debt, which accounts for 4.61 percent of initial firm value and 7.32 percent of terminal value. In short, Table II suggests that measurement error is not an issue for about 80 percent of the initial market values and 73 percent of the terminal values of the firms in the sample.

Measurement error is also probably not much of an issue for the initial market values of preferred stock and long-term debt. Firms entering the sample are unlikely to be in default on their debt or preferred stock, so on average the book value of these securities is probably an unbiased estimate of their market value. Thus, measurement error probably is not much of an issue in the initial market values of firms. Similarly, book value is probably an unbiased estimate of the market value of debt and preferred stock for firms acquired in mergers. In the end, the only real problem arises for firms that exit because of distress, where book value overestimates the market value of debt and preferred stock. Again, however, firms that leave because of distress are typically small, so any upward bias in estimates of their terminal values is probably not a serious problem in the IRRs.

In sum, at least for the aggregates of interest here, our estimates of the initial and terminal market values of firms are probably accurate. Since we estimate cash flows accurately, the estimates of the return on value have sampling error due to the peculiarities of the sample period, but other sources

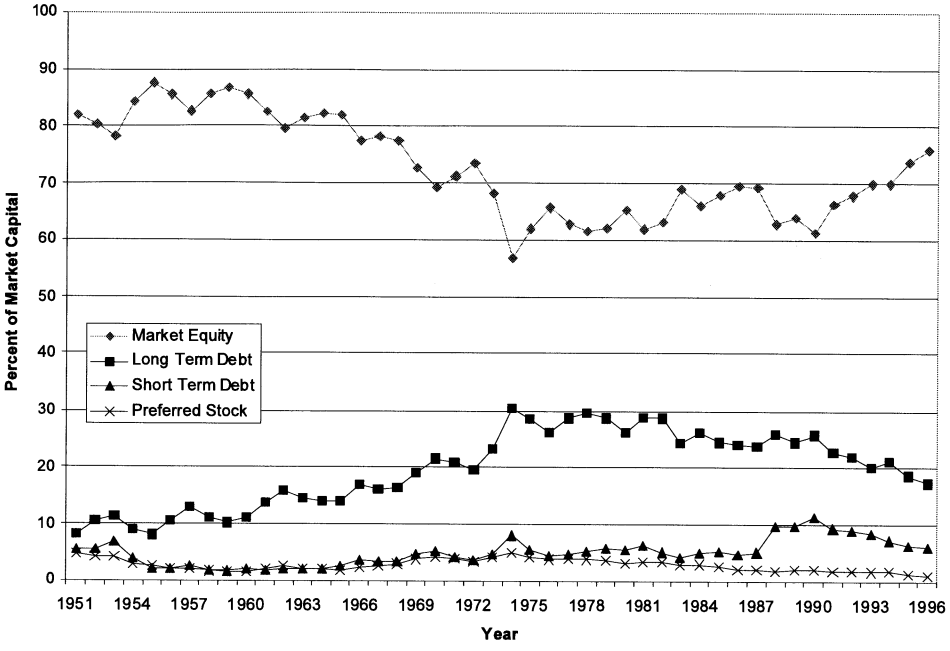

Figure 1. The nonfinancial corporate capital structure: Market value, 1951–96.

of measurement error are probably negligible. In the IRRs on cost, however, the estimates of the cost of the assets of new firms are less accurate. We discuss this problem later.

B. Capital Structures: Year-by-Year

In the late 1980s there was much concern about the level of corporate debt (e.g., Bernanke and Campbell (1988) and Bernanke, Campbell, and Whited (1990)). The perceived problem was not that leverage increased in the late 1980s, but that, despite sustained good times after the 1980-82 recession, leverage failed to return to the lower levels of the 1950s and 1960s.

This pattern in leverage is apparent in Figure 1, which shows the year-by-year components of market capital, and is basically an updated version of Bernanke and Campbell (1988). Common equity's share of market capital declines rather steadily after 1955, reaching a low in 1974. Although common stock is more important after 1974, its share of market capital remains much below the levels of the 1950s and 1960s throughout the 1980s. After the recession of 1990, however, there is a steady increase in equity's share of market capital, and by 1996 market leverage has returned to the levels of the late 1960s.

Finally, an open question in finance is whether firms target leverage to the market value or the book value of capital. Comparing Figures 1 and 2 provides suggestive evidence. Figure 2 plots the components of the aggregate corporate capital structure as shares of book capital. Common stock's

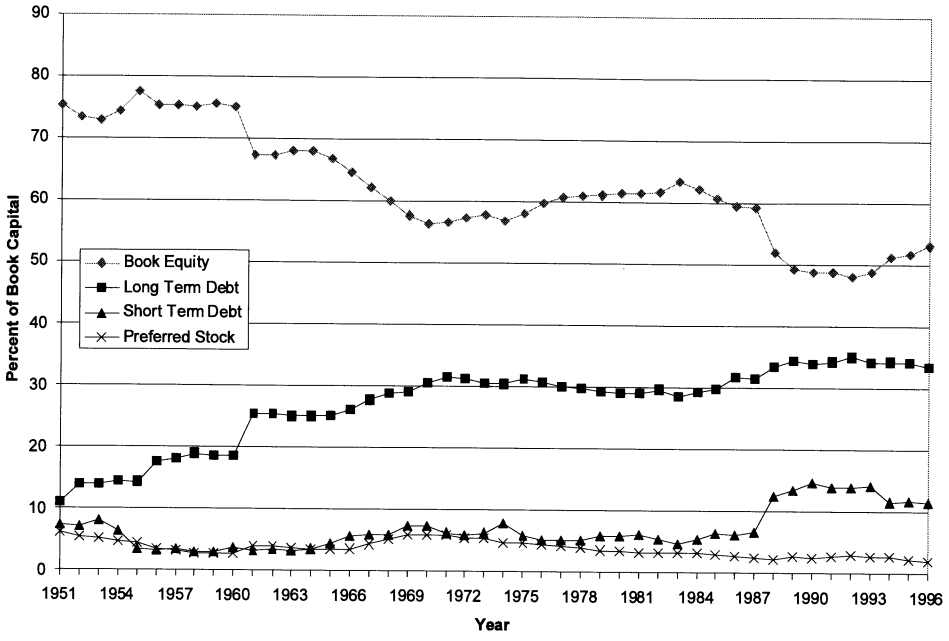

Figure 2. The nonfinancial corporate capital structure: Book value, 1951–96.

share of book capital declines rather steadily during the 1950s and 1960s. For the 20 years from 1968 to 1987, however, common equity's share of book capital is steady at around 60 percent. This is in contrast to the jagged path followed by common equity's share of market capital in Figure 1, which we can infer is due to variation in stock prices. Moreover, the large increase in book leverage in 1988 is probably due to a change in accounting rules. Starting in 1988, firms must consolidate their accounts with those of their (highly levered) financing subsidiaries. If the change in leverage in 1988 is indeed due to this change in accounting rules, common equity's share of book capital is rather constant throughout the post-1968 period.

Since book leverage is more stable than market leverage, it is tempting to conclude that the leverage targets of firms are typically a function of book capital, not market capital. This can then be read as support for theories in which debt is issued with relatively low contracting costs when it is backed by tangible assets. But debt is not efficient for financing intangible monopoly rents and unrealized future growth opportunities because of the agency problems and asymmetric information problems associated with these assets (Myers (1977)).

C. Cash Flows and Financing Decisions

The capital structures in Table II and Figures 1 and 2 are the result of the way firms respond to the period-by-period constraint that cash outflows must be met by inflows. By examining the components of cash inflows and out-

Table III

Aggregate Annual Cash Inflows and Outflows as Percentages of Aggregate Beginning of Year Book Capital, 1951–96

$$Y_t + Dp_t + dS_t + dLTD_t + dSTD_t = I_t + Div_t + Int_t.$$

Y_t is the sum of income before extraordinary items (COMPUSTAT data item 18), extraordinary items and discontinued operations (48), interest expense (15), and income statement deferred taxes (50). Dp_t is depreciation expense (14). $dLTD_t$ is the change in the book value of long-term debt (9) from year $t-1$ to t. $dSTD_t$ is the change in the book value of short-term debt, measured by debt in current liabilities (34), if available, or current liabilities (5). Investment, I_t, is the change in book capital (the book value of long-term debt, short-term debt, and equity) from $t-1$ to t, plus depreciation. Int_t is interest expense (15). Div_t is the sum of dividends paid on common (21) and preferred stock (19). The net flow from the sale and repurchase of stock, $dS_t = I_t + Div_t + Int_t - Y_t - Dp_t - dSTD_t - dLTD_t$, balances the cash flow identity.

	Firms	Y_t	Dp_t	dS_t	$dLTD_t$	$dSTD_t$	I_t	Div_t	Int_t
1951–56	336	10.52	5.17	1.44	1.71	0.57	13.50	5.39	0.51
1957–61	643	8.76	5.50	1.47	1.36	0.28	12.00	4.59	0.77
1962–66	1380	9.31	5.16	0.90	1.98	0.62	12.45	4.28	1.25
1967–71	2250	8.60	5.22	1.93	3.76	0.89	14.97	3.50	1.93
1972–76	3061	10.21	5.31	1.22	2.56	0.33	13.98	2.98	2.67
1977–81	3146	12.05	5.70	1.43	2.74	0.78	16.12	3.31	3.28
1982–86	3471	10.73	6.36	−0.51	2.06	0.37	11.90	3.32	3.80
1987–91	3755	9.43	6.09	0.04	3.14	2.39	13.76	3.05	4.28
1992–96	4603	8.22	6.55	1.57	1.59	0.22	11.96	2.82	3.36
1951–96	2422	9.57	5.54	1.04	2.26	0.70	13.12	3.65	2.34

flows, we can get an additional perspective on how firms are financed. Table III summarizes the components of aggregate annual inflows and outflows,

$$Y_t + Dp_t + dS_t + dLTD_t + dSTD_t = I_t + Int_t + Div_t. \tag{6}$$

The inflows are cash earnings (earnings before interest but after taxes, Y_t, plus depreciation, Dp_t), the net flow from issuing and repurchasing common and preferred stock (dS_t), and the net flows from issuing and redeeming long-term debt ($dLTD_t$) and short-term debt ($dSTD_t$). The outflows are gross investment (I_t), dividends (Div_t), and interest expense (Int_t). The flows are expressed as proportions of the aggregate beginning of year book capital (book assets less non-interest-paying debt) of the firms in the sample.

Table III shows that, on average, internally generated funds exceed investment outlays. Gross investment by existing firms (I_t, the change in book capital plus depreciation) averages 13.12 percent of book capital, while cash earnings ($X_t = Y_t + Dp_t$) are 15.11 percent of capital. Firms, however, make substantial payments to security holders. Annual dividend and interest payments average 3.65 percent and 2.34 percent of aggregate book capital. Al-

Table IV

Aggregate Investment and Forms of Financing as Percentages of Aggregate Beginning of Year Book Capital, 1951–96

$$I_t = RCE_t + dS_t + dLTD_t + dSTD_t$$

Investment, I_t, is the change in book capital (the book value of long-term debt, short-term debt, and equity) from $t - 1$ to t, plus depreciation (COMPUSTAT data item 14). Retained cash earnings, RCE_t, is the sum of income before extraordinary items (18), extraordinary items and discontinued operations (48), depreciation expense, and income statement deferred taxes (50), minus dividends paid on common (21) and preferred stock (19). $dLTD_t$ is the change in the book value of long-term debt (9) from year $t - 1$ to t. $dSTD_t$ is the change in the book value of short-term debt, measured by debt in current liabilities (34) or current liabilities (5). The net flow from the sale and repurchase of stock, $dS_t = I_t - RCE_t - dSTD_t - dLTD_t$, balances the cash flow identity.

	Firms	I_t	RCE_t	dS_t	$dLTD_t$	$dSTD_t$
1951–56	336	13.50	9.79	1.44	1.71	0.57
1957–61	643	12.00	8.90	1.47	1.36	0.28
1962–66	1380	12.45	8.95	0.90	1.98	0.62
1967–71	2250	14.97	8.39	1.93	3.76	0.89
1972–76	3061	13.98	9.87	1.22	2.56	0.33
1977–81	3146	16.12	11.16	1.43	2.74	0.78
1982–86	3471	11.90	9.97	−0.51	2.06	0.37
1987–91	3755	13.76	8.19	0.04	3.14	2.39
1992–96	4603	11.96	8.59	1.57	1.59	0.22
1951–96	2422	13.12	9.12	1.04	2.26	0.70

ternatively, dividend and interest payments together consume about 40 percent of cash earnings, X_t. As a result, the nonfinancial corporate sector regularly makes substantial net new issues of securities.

More precisely, during the 1951–96 period, the cash outflow, $I_t + Div_t + Int_t$, of nonfinancial firms averages 19.11 percent of book capital. Cash earnings, $X_t = Y_t + Dp_t$, average 15.11 percent of book capital, so average annual net inflow from new securities is four percent of book capital. Net new issues of common and preferred stock average 1.04 percent of capital, or about 26 percent of the shortfall of cash earnings over investment outlays and payments to security holders. More outside financing comes from net new long-term debt, which averages 2.26 percent of capital and 57 percent of net new financing. The remainder is covered by net new short-term debt, which averages 0.7 percent of book capital and 17 percent of new financing.

Table IV focuses more directly on how firms finance investment. The table splits the financing of investment (I_t) among internal funds (retained cash earnings, $RCE_t = Y_t + Dp_t - Int_t - Div_t$) and external financing, that is, net new issues of stock (dS_t), long-term debt ($dLTD_t$), and short-term debt ($dSTD_t$),

$$I_t = RCE_t + dS_t + dLTD_t + dSTD_t. \tag{7}$$

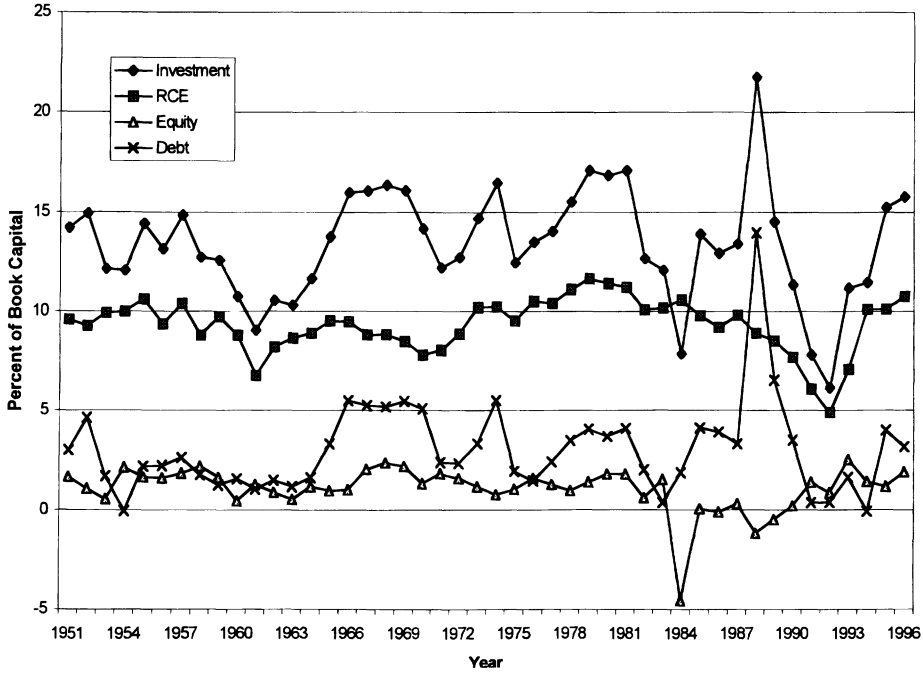

Figure 3. Investment and its financing.

Investment averages 13.12 percent of book capital in 1951–96, and retained cash earnings are about 9.12 percent. Thus, after paying out dividends and interest, internally generated funds cover about 69.5 percent of investment. New issues of stock (net of share repurchases) finance about 7.9 percent of investment, 17.2 percent comes from long-term debt, and 5.3 percent comes from short-term debt.

Figure 3 shows investment and its financing year by year. The figure suggests that net new issues of stock do not move closely with investment. In fact, when the variables are measured relative to book capital as in Table IV and Figure 3, the correlation of investment, I_t, and net new issues of stock, dS_t, is only 0.19. A possible explanation is that new stock is often used to finance mergers, and merger activity is not highly correlated with other forms of investment (Andrade and Stafford (1997)). Figure 3 suggests that retained cash earnings move more closely with investment. The correlation between I_t and RCE_t is indeed higher, 0.56, but far from perfect. The source of financing most correlated with investment is long-term debt. The correlation between I_t and $dLTD_t$ is 0.79. The correlation between I_t and net new short-term debt is lower, 0.60, but nontrivial. These correlations confirm the impression from Figure 3 that debt plays a key role in accommodating year-by-year variation in investment. (See also Fama and French (1999).)

Table V

Rates of Return on Value and Cost (in Percent) for Nonfinancial Firms, 1950–96 and 1973–96

Panel A shows the internal rates of return on value and cost of equations (1) and (2). The IRR on value estimates the return on corporate investments under the assumption that firms are acquired at market value when they enter the sample, and then sold at market value, either when they leave the sample or when we liquidate the sample in 1996. The IRR on cost assumes the assets of entering firms are acquired at book rather than market value. To compute real IRRs, we divide each year's nominal cash flow by the end-of-year Consumer Price Index.

Panel B shows simple and compound returns on value for the subsample of the firms in Panel A that have market value data at the beginning and end of a given year, as well as for their first and last years on COMPUSTAT. The simple return for a year is $R_t = [(X_t - I_t) + (V_t - V_{t-1})]/V_{t-1}$, where V_{t-1} and V_t are the aggregate values of firms that have value data at the beginning and end of year t and $X_t - I_t$ is their aggregate net cash flow. IRR on Value is the IRR defined by equation (1) for the subsample of firms in Panel B.

Panel A: IRRs for Basic Sample of Firms

1950–96				1973–96			
IRR on Value		IRR on Cost		IRR on Value		IRR on Cost	
Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
10.72	5.95	12.11	7.38	11.78	5.57	13.97	7.52

Panel B: Simple and Compound Returns for Firms with Yearly Value Data

	Average of Simple Annual Returns		Geometric Mean of Simple Annual Returns		IRR on Value from Equation (1)		Standard Deviation of Simple Annual Returns	
	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
1950–96	12.12	7.81	11.51	7.09	10.76	6.00	11.67	12.55
1973–96	12.68	6.90	12.25	6.35	11.83	5.60	9.73	10.62

III. The IRRs

Panel A of Table V reports real and nominal internal rates of return on the initial market values of the securities of nonfinancial firms (r_v in equation (1)) and on the cost of their investments (r_c in equation (2)). The annual values of the cash flows that generate the real IRRs for 1950–96 are in Table VI.

A technical point. The aggregate corporate cash flow, $(X_t - I_t) + (FS_t - FBV_t)$ or $(X_t - I_t) + (FS_t - FBC_t)$, changes sign several times between 1950 and 1996 (Table VI). Until the sample is sold in 1996, however, the sum of the undiscounted net cash flows (including the initial outlay, IV_0 or IC_0) is always negative. Given this result, it is easy to show that at any positive interest rate, the present value of the stream of net cash flows up to any year before 1996 is negative. As a result, we never face the problem of multiple IRRs; there is only one positive IRR for each set of cash flows for 1950–96 and for 1973–96.

Table VI

Components of Net Cash Flows for 1950–96, in Billions of 1996 Dollars

The sample includes all publicly traded nonfinancial firms (all SIC codes except 6000–6999) in the historical COMPUSTAT database that are incorporated in the United States and have data on the market and book value of capital for any two years between 1950 and 1996. A firm enters the portfolio at the end of the first fiscal year we have market and book value data, and it leaves at the end of the last fiscal year we have market and book value data.

A firm's net cash flow from operations, $X_t - I_t$, is included in aggregate net cash flow beginning in the year after the firm enters the portfolio through the year it leaves the portfolio. X_t, the cash inflow from operations, is income before interest expense (Y_t of Table III) plus depreciation (Dp_t). As in Table III, Investment I_t is the change in book capital (the book value of long-term debt, short-term debt, and equity) from $t - 1$ to t, plus Dp_t.

FBC_t is the cost of new firms bought at the book value of capital (Cost) in year t. FBV_t is the cost of firms bought at the market value of capital (the market value of common stock plus the book value of long-term debt, short-term debt, and preferred stock) in year t. FS_t is the market value of capital of firms sold when they leave the sample or at the end of the sample period, 1996. When firms that enter the sample are bought at cost, Net Flow, the total net cash flow for year t, is $(X_t - I_t) + (FS_t - FBC_t)$, that is, the net cash flow from operations plus the net flow generated by exit and entry of firms. When entering firms are bought at value, Net Flow is $(X_t - I_t) + (FS_t - FBV_t)$. Firms is the number of firms in the sample at the beginning of the year. The real IRRs in Table V are the discount rates that set the present values of the streams of Net Flows equal to zero.

		New Firms at Book Value		New Firms at Market Value							
	Firms	Net Flow	FBC_t	Net Flow	FBV_t	FS_t	$X_t - I_t$	X_t	I_t	Dp_t	$I_t - Dp_t$
1950	262	−254.2	254.2	−321.4	321.4	0.0	0.0	0.0	0.0	0.0	0.0
1951	289	−11.4	15.6	−20.2	24.4	0.0	4.2	44.3	40.1	13.0	27.1
1952	296	−0.4	2.0	−1.0	2.6	0.0	1.6	47.5	45.9	15.3	30.6
1953	306	9.6	2.9	10.0	2.5	0.0	12.5	53.4	40.8	18.0	22.8
1954	311	7.3	7.5	−2.8	17.5	0.0	14.8	58.8	44.0	20.4	23.7
1955	449	−48.3	57.9	−76.2	85.7	0.0	9.5	74.2	64.7	24.1	40.5
1956	485	−107.6	116.1	−128.7	137.2	0.0	8.5	88.1	79.6	30.2	49.4
1957	509	4.9	4.5	3.6	5.9	0.0	9.4	105.8	96.4	39.2	57.2
1958	522	0.2	10.9	−8.4	19.6	0.0	11.1	99.1	88.0	40.4	47.6
1959	540	12.6	6.8	3.5	16.0	0.0	19.4	113.6	94.1	42.8	51.3
1960	809	−17.9	44.8	−43.5	70.4	0.0	26.9	114.7	87.8	44.2	43.5
1961	1005	−233.9	257.7	−375.5	399.3	0.0	23.8	124.5	100.7	49.3	51.4
1962	1224	−14.3	53.0	−26.9	65.6	0.0	38.7	168.4	129.7	61.8	67.9

1963	1383	32.1	17.4	27.6	22.0	0.0	49.5	183.7	134.2	67.1	67.1
1964	1486	−8.2	47.1	−16.4	55.3	0.0	38.9	204.5	165.6	72.1	93.5
1965	1578	10.0	10.9	4.6	16.3	0.0	20.9	232.4	211.6	80.7	130.8
1966	1734	−24.6	18.3	−30.5	24.2	8.6	−14.9	252.6	267.5	87.7	179.8
1967	1829	−32.4	21.5	−41.0	30.0	22.8	−33.7	264.7	298.4	97.5	200.9
1968	2207	−71.5	36.8	−112.4	77.8	7.6	−42.2	286.2	328.4	102.7	225.7
1969	2417	−50.0	29.9	−87.3	67.2	24.0	−44.0	306.0	350.0	114.5	235.5
1970	2531	−30.9	26.5	−35.1	30.7	14.8	−19.2	299.8	319.0	119.0	200.1
1971	2721	24.7	18.4	4.2	38.9	14.3	28.8	314.9	286.1	124.4	161.7
1972	2961	29.6	21.7	3.9	47.3	16.6	34.7	347.3	312.6	129.9	182.7
1973	3016	17.0	19.5	12.2	24.3	12.3	24.2	392.2	368.0	132.3	235.7
1974	3215	−14.2	17.1	−12.5	15.5	13.5	−10.6	406.3	416.9	130.9	286.0
1975	3199	91.1	9.8	88.7	12.2	26.5	74.4	389.7	315.3	136.0	179.2
1976	3236	92.4	5.7	90.4	7.6	23.7	74.3	425.7	351.4	139.6	211.8
1977	3217	93.6	5.0	92.8	5.8	34.2	64.4	435.9	371.5	144.5	227.0
1978	3163	77.6	4.4	76.0	6.1	34.9	47.2	462.2	415.0	150.5	264.5
1979	3124	54.4	5.2	50.3	9.4	30.8	28.9	480.2	451.3	150.2	301.1
1980	3152	98.2	7.0	86.9	18.4	66.4	38.9	479.1	440.3	152.4	287.9
1981	3320	54.7	13.3	43.0	25.0	28.9	39.1	490.7	451.6	155.3	296.3
1982	3335	157.6	5.3	149.4	13.5	34.4	128.5	465.4	336.9	164.4	172.5
1983	3464	214.9	26.5	186.1	55.3	98.6	142.8	471.7	328.9	174.0	154.9
1984	3583	199.2	139.3	213.7	124.8	78.2	260.4	475.3	214.9	163.1	51.8
1985	3552	134.3	21.3	122.2	33.5	74.2	81.4	470.9	389.4	182.0	207.4
1986	3678	133.1	39.7	101.6	71.2	74.0	98.8	476.7	378.0	194.8	183.1
1987	3833	128.4	45.5	103.7	70.2	69.5	104.4	505.4	401.0	195.8	205.2
1988	3817	−125.9	28.9	−146.8	49.8	87.2	−184.2	557.0	741.1	204.7	536.5
1989	3761	84.7	21.1	69.0	36.8	55.9	50.0	568.3	518.3	207.4	311.0
1990	3772	136.6	21.6	123.8	34.4	27.4	130.7	529.0	398.2	206.5	191.7
1991	3913	187.5	24.6	154.0	58.1	25.9	186.3	457.5	271.3	213.8	57.5
1992	4211	196.0	41.0	140.7	96.2	43.6	193.3	389.2	195.9	222.6	−26.7
1993	4643	111.8	55.0	37.6	129.1	93.2	73.5	458.3	384.8	221.8	162.9
1994	4956	275.6	43.4	230.6	88.3	155.2	163.8	571.9	408.2	234.1	174.1
1995	5217	63.1	72.8	−33.6	169.5	102.8	33.0	613.1	580.1	249.1	330.9
1996	4979	7709.0	0.0	7709.0	0.0	7685.8	23.3	655.9	632.6	258.8	373.9

Table VII

Cumulated Components of Net Cash Flow for 1950–96 and 1973–96 as a Percentage of 1996 Terminal Value

The table reports the 1996 value of the annual components of net cash flow cumulated at the real or nominal IRR on value or cost (Table V) and expressed as a percentage of the terminal market value of capital of the firms in the sample in 1996. FB_t is the cost of new firms added to the sample at book value (Cost) or market value (Value). FS_t is the market value of firms sold from the sample before 1996. $X_t - I_t$, the net cash flow from operations for firms in the sample, is the cash flow from operations, X_t, minus investment, I_t. Dp_t is the depreciation for firms in the sample, and $I_t - Dp_t$ is the change in book capital. The components of net cash flow are defined in more detail in Tables III and IV. Since the IRR equates the cumulated cost of the sample to the terminal value, $FB_t - FS_t - (X_t - I_t) = 100$ percent.

	FB_t	FS_t	$X_t - I_t$	X_t	I_t	Dp_t	$I_t - Dp_t$
Nominal cash flows, 1950–96							
Cost	236.91	44.20	92.72	777.95	685.23	281.06	404.17
Value	208.05	37.18	70.87	579.38	508.51	210.48	298.03
Real cash flows, 1950–96							
Cost	239.05	45.51	93.54	851.87	758.33	307.93	450.40
Value	206.92	37.37	69.55	616.86	547.31	224.06	323.25
Nominal cash flows, 1973–96							
Cost	211.00	44.02	66.97	428.90	361.92	153.57	208.35
Value	187.91	35.08	52.83	331.39	278.56	120.12	158.43
Real cash flows, 1973–96							
Cost	189.30	35.61	53.70	348.57	294.88	125.40	169.48
Value	171.86	28.85	43.02	273.78	230.76	99.71	131.05

The nominal internal rate of return on the initial market values of the securities of nonfinancial firms is 10.72 percent for 1950–96. The nominal IRR on value for 1973–96 is 11.78 percent. Both estimates are above the stereotypical textbook cost of capital, 10 percent. Adjusting for inflation lowers the IRRs on value and brings them closer together, 5.95 percent for 1950–96 and 5.57 percent for 1973–96. The nominal IRRs on cost are 12.11 percent for 1950–96 and 13.97 percent for 1973–96. The real IRRs on cost are again more similar, 7.38 percent (1950–96) and 7.52 percent (1973–96).

The IRRs on the cost of corporate investment are 1.39 percent to 2.19 percent greater than the corresponding IRRs on value (the cost of capital estimates). Thus corporate investment on average seems to be profitable. We shall, however, revisit this conclusion, after examining the nuts and bolts of the IRRs.

A. Dissecting the IRRs

Table VII summarizes the way initial assets, earnings, investment outlays, and terminal values combine to produce the IRRs on value and cost. To determine the contributions of the various inflows and outflows, we cumulate them to 1996 at each of the four IRRs (nominal or real, on value or cost) and express them as a percent of TV_{1996}, the terminal value of firms that exist at the end of the sample period.

Table VII confirms the evidence in Table VI that firms make substantial investments after they enter the sample. Capitalized post-entry investment is about 2.5 times the capitalized cost of the assets firms bring into the sample. Capitalized at the nominal IRR on cost for 1950–96, for example, the cumulative value of annual post-entry investment, I_t, is 6.85 times TV_{1996}, the terminal value of firms that exist in 1996, and the cumulative value of initial costs, FB_t, is only 2.37 times TV_{1996}. Post-entry cash earnings are also large. Capitalized at the nominal IRR on cost for 1950–96, cash earnings, X_t, are 7.78 times the 1996 terminal value. But because investment is so large relative to earnings, the capitalized value of the stream of net cash flows, $X_t - I_t$, is always less than TV_{1996}. In other words, the terminal values of firms that exist in 1996 contribute more to the IRRs than the 46-year (1951–96) stream of net cash flows, $X_t - I_t$.

Because of the way we treat mergers, our $X_t - I_t$ estimates understate total corporate net cash flows. A merger in which both firms are on COMPUSTAT does not increase aggregate cash earnings, X_t. The merger does, however, erroneously increase our estimate of aggregate investment, I_t, causing us to understate the net cash flow, $X_t - I_t$. (This error has little effect on the IRRs themselves because there is an offsetting increase in the value of firms sold, FS_t, in equations (1) and (2).) Since mergers between COMPUSTAT firms increase investment, I_t, and the value of firms sold, FS_t, by about the same amount, we can partially fix the overstatement of investment by measuring net cash flow as $X_t - I_t + FS_t$. Obviously, not all firms that leave the sample merge with firms on COMPUSTAT, so this estimate is an upper bound for the net cash flow.

Table VII says that the augmented flow $X_t - I_t + FS_t$ contributes only about as much as the terminal value TV_{1996} to the IRRs on value for 1950–96. In the IRRs on value for 1973–96, $X_t - I_t + FS_t$ contributes much less than TV_{1996}. $X_t - I_t + FS_t$ contributes about 30 percent more than TV_{1996} to the IRRs on cost for 1950–96, but $X_t - I_t + FS_t$ and TV_{1996} are about equally important in the IRRs on cost for 1973–96.

In short, Table VII produces an interesting message: Because the investments of nonfinancial firms are so large relative to their cash earnings, the terminal values of firms are a major factor in the IRRs on value and cost, even for a period almost a half century long.

B. The Initial Cost Problem

Since the IRRs on cost (the returns on corporate investment) in Table V systematically exceed the corresponding IRRs on value (our estimates of the cost of capital), on average corporate investment seems to be profitable. But there is a problem.

Equations (1) and (2) say that differences between the IRRs on cost and value are due entirely to differences between the market and book values of firms when they enter the sample. In the return on value, we add firms to the sample at their initial market values (IV_0 or FBV_t). In the return on cost, we add firms at their initial book values (IC_0 or FBC_t). Both IRRs then use

the same net cash flows ($X_t - I_t$) and the same final market values when firms exit the sample (FS_t) or when we sell them at the end of the sample period (TV_{1996}). The market value of firms entering the sample exceeds the book value in all but three years (1953, 1974, and 1984) of the 46-year 1950–95 period (Table VI). These positive differences between the market and book values of entering firms are the reason the IRRs on cost exceed the IRRs on value.

There is measurement error in our estimates of the cost of the assets firms bring into the sample. As noted earlier, to estimate IC_0 or FBC_t, we use the initial book value of assets (minus non-interest paying liabilities), rather than replacement cost. Moreover, pre-entry investments in intangible assets (R&D, advertising, and human capital) are missed entirely since they are expensed and do not show up in book assets. This downward bias in our estimates of initial assets creates upward bias in the IRRs on cost.

Once firms enter the sample, however, their net cash flows are measured accurately. For example, post-entry investments in R&D, advertising, and human capital show up as lower cash earnings, X_t, rather than as investment outlays, I_t, but they produce the appropriate reductions in net cash flow from operations, $X_t - I_t$. Adjusting the post-entry cashflows for inflation is also not much of a problem. We know when each cash flow occurs so, to estimate real IRRs, we simply convert post-entry cash flows to real (inflation-adjusted) dollars.

Substantial measurement error in initial cost is needed to overturn the conclusion that the return on the cost of corporate investment exceeds the corporate cost of capital. The true IRRs on value and cost for 1950–96 are equal if the book value of entering assets understates replacement cost by about 42 percent. The true IRRs on value and cost for 1973–96 are equal if we understate the cost of entering firms by about 35 percent.

How badly does historical cost understate the replacement cost of assets? The Federal Reserve Flow of Funds accounts show estimates of historical cost and replacement cost for the tangible assets of the nonfinancial corporate sector. For 1950–97 and 1973–97, the annual ratios of replacement cost to historical cost average about 1.6, more than enough to reverse our conclusion that the investments of firms are on average profitable. But the Flow of Funds data are for the entire nonfinancial corporate capital stock. We are using historical cost to estimate replacement cost only for the assets firms bring into our sample. The initial assets of entering firms are likely to be much younger than the average age of the nonfinancial capital stock, and the historical cost of initial assets is likely to be closer to replacement cost. Thus, Flow of Funds replacement cost data may not be relevant to our initial cost problem.

C. *Additional Perspectives*

Though largely circumstantial, other evidence suggests that corporate investment is on average profitable. Suppose that, on the contrary, corporate investment is worth less than it costs. The market values of entering firms

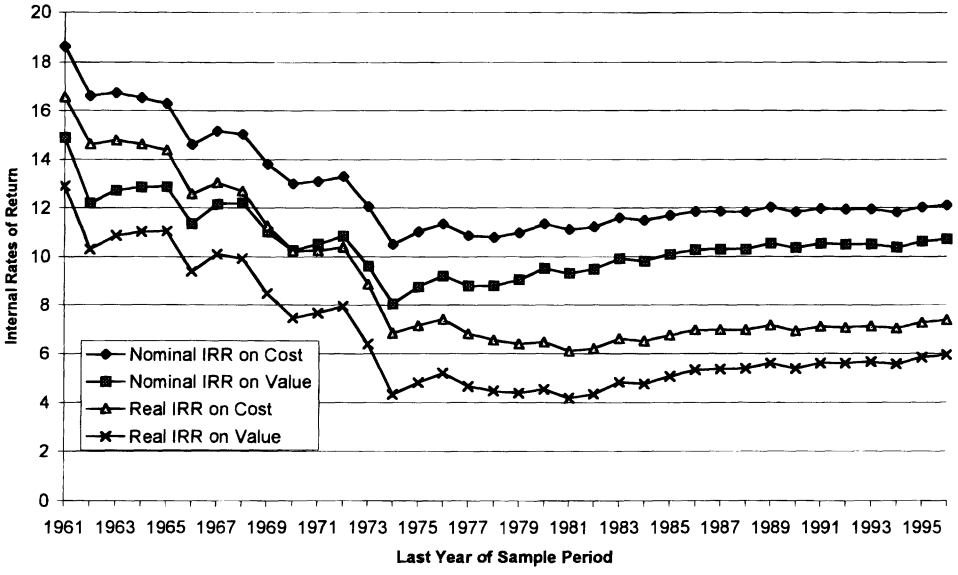

Figure 4. Internal rates of return (in percent) for sample periods beginning in 1950 and ending in 1961 to 1996.

should then be low to reflect expected losses on future investments. This should be especially true later in the sample period when there is a long history of evidence that firms make massive investments after they enter the sample. Again, however, Table VI shows that the spread of value over cost for entering firms is almost always positive, and it does not decline through time. The market seems to believe that, on average, corporate investment is profitable.

One might argue that investor overconfidence about new firms is incurable, and firms enter at values in excess of cost despite evidence that post-entry investments are likely to be large and unprofitable. A clue to such chronic overvaluation of entering firms would be low rates of return on value; high initial values should produce low IRRs. But the nominal IRRs on value for 1950–96 and 1973–96, 10.72 percent and 11.78 percent, are high. Indeed, returns like these produce the familiar conclusion that common stock returns are too high to be explained by standard consumption-based asset pricing models (Mehra and Prescott (1985)).

Finally, one might suspect that the high returns on value for 1950–96 and 1973–96 are the result of a burst of investor optimism at the end of the sample period that pushes 1996 terminal values so high they overwhelm initial values that are also too high. Figure 4 puts this hypothesis cleanly to rest. The figure shows estimates of IRRs on value and cost for each year from 1961 to 1996. The start date for each estimate is 1950, so the estimates illustrate how the IRRs vary as the estimation period for net cash flows and the date for terminal values are extended. The IRRs decline from 1961 to 1974. This may be a result of the initial bias of the COMPUSTAT sample

toward large successful firms. After 1975, the IRRs are quite stable. In short, the IRRs are not sensitive to the date used to measure terminal values, so unusually high terminal values for 1996 do not explain the high returns on value for 1950–96 and 1973–96.

IV. The Returns: Uses and Alternative Estimates

The IRRs on value in Panel A of Table V are estimates of the nonfinancial corporate cost of capital. How should they be used? Are real or nominal returns more relevant? The IRRs on value are compound returns. How do they compare with simple annual returns on value that, in some circumstances, are relevant estimates of the cost of capital? What is the relation between our returns on value and the typical textbook weighted average cost of capital (WACC)? How do our estimates of the return on cost from COMPUSTAT data compare to estimates from Flow of Funds data? We address these questions next.

Real Versus Nominal Returns on Value. The expected nominal IRR on value surely varies with expected inflation, and there is much variation in inflation during our sample period. As a result, the overall nominal IRR on value may not be a good estimate of the nominal cost of capital at any specific time, including the present. Since the real IRR on value nets out variation in inflation, we are more comfortable with its estimates of the real cost of capital. And we take some comfort from the fact that the real IRRs on value for 1950–96 and 1973–96, 5.95 and 5.57 percent, are more similar than the nominal IRRs, 10.72 and 11.78 percent.

Of course, the real IRRs on value for the nonfinancial sector are not likely to be relevant for any individual firm or investment project. Estimates of the cost of capital for firms and projects will differ from the aggregate cost of capital because of differences in risk and variation through time in expected real returns. (Taking account of differences in risk and variation in expected returns is, however, a nontrivial task, fraught with measurement error. See, for example, Fama and French (1996).) In short, our real IRRs on value are best regarded as benchmarks or starting points for cost of capital estimates for firms and projects.

Simple Versus Compound Returns. The IRRs on value in Panel A of Table V are compound returns. Under certain conditions, the appropriate cost of capital is an expected one-period simple return (e.g., Fama (1996)). This issue is, however, complicated by the fact that expected returns must be estimated and the estimates enter present value expressions nonlinearly. As a result, cost of capital estimates that produce unbiased estimates of present values are weighted averages of average simple and compound returns, where the weights depend on the maturity of the cash flow to be valued (Blume (1974), Cooper (1994)).

Panel B of Table V shows estimates of the average simple return on wealth invested in the nonfinancial corporate sector. Using equation (4), the simple return for year t is,

$$R_t = [(X_t - I_t) + (V_t - V_{t-1})]/V_{t-1} = [Div_t + Int_t + (V_t - NS_t - V_{t-1})]/V_{t-1}. \quad (7)$$

V_{t-1} and V_t are the aggregate values of firms that have market value data for the end of both year $t - 1$ and year t. NS_t is the value of net new securities issued by these firms during year t. $V_t - NS_t - V_{t-1}$ is an estimate of the aggregate capital gain from $t - 1$ to t on the market value of their securities outstanding at $t - 1$. And $X_t - I_t$, Div_t, and Int_t are their aggregate net cash flows, dividends, and interest payments.

R_t is an estimate of the simple return for year t on the market value of wealth invested in the nonfinancial corporate sector at the end of year $t - 1$. Equivalently, it is an estimate of the return from $t - 1$ to t on the market portfolio of nonfinancial corporate securities outstanding at $t - 1$. The expected value of R_t is the year t WACC for the nonfinancial corporate sector in a world where market values are obtained by discounting cash flows at expected simple returns on value. This is the world envisioned by most corporate finance textbooks, such as Brealey and Myers (1996).

The analysis in Blume (1974) and Cooper (1994) suggests that the appropriate estimate of the real cost of capital is a weighted average of the average and the geometric mean of the simple annual returns, with weights that depend on the maturity of the cash flow. The geometric mean returns (also shown in Panel B of Table V) are, of course, less than the average simple returns. The average annual simple real returns for 1950–96 and 1973–96 are 7.81 and 6.90 percent. The geometric means are 7.09 and 6.35 percent.

There are large differences between the IRRs on value in Panel A of Table V and the geometric means of the simple returns in Panel B. For example, the geometric means of the simple real returns for 1950–96 and 1973–96, 7.09 and 6.35 percent, are much larger than the IRRs from equation (1), 5.95 and 5.57 percent. Why do these two methods for estimating the compound return on value produce such different results?

A small part of the difference occurs because some of the firms in the IRRs in Panel A of Table V are not included in the returns in Panel B. The estimates in Panel B can include only firms that have the market value data for years $t - 1$ and t needed to calculate the simple return for year t. In contrast, the IRRs on value from equation (1) require only that firms have value data for their first and last years in the sample. But the additional data requirement in Panel B has a trivial effect on the returns. The IRRs on value from equation (1), computed with just the firms used in Panel B, are within 0.05 percent of the IRRs in Panel A. This is not surprising. All of our returns are effectively size weighted and only tiny firms are likely to be missing intermediate value data.

Most of the difference between the IRRs on value from equation (1) and the geometric means of the simple returns arises because the two approaches weight annual returns differently. The geometric mean puts the same weight on each annual return (more precisely, on the continuously compounded annual return). In contrast, it is easy to show that the IRR on value is an average of the annual simple returns, where the weight for the year t return is nonfinancial invested wealth at the beginning of the year, discounted to the beginning of the sample period at the IRR on value. Thus, later years tend to get more weight because invested wealth is higher, but the discounting of invested wealth tends to give later years less weight. Without showing the details, the end result is that the middle years of the 1950–96 sample period, which include most of the negative simple annual returns, tend to get more weight in the IRRs. This pushes the IRRs on value below the geometric means of the simple returns.

Which is the better estimate of the compound return on value? Because it allows for the net new investment required to finance the growth of the nonfinancial sector, the IRR on value is clearly a more accurate estimate of the realized return on the wealth allocated to the nonfinancial corporate sector than the geometric mean of the simple returns. But if we want to use a compound return on value to estimate a forward-looking cost of capital, the geometric mean of the simple returns, which treats all years the same, is probably the better choice.

Standard Deviations of Annual Simple Returns. All of our returns are subject to sampling error. We do not have estimates of sampling error variances for the various compound returns, but we can get some perspective on the likely size of the problem from the standard errors of the average simple returns. The standard deviations of the annual simple returns (Panel B of Table V) range from 9.73 to 12.55 percent. The implied standard errors of the average simple returns range from 1.67 to 2.21 percent. These rather large standard errors are actually downward biased. Since we measure long-term debt and preferred stock (about 28 percent of the nonfinancial corporate capital structure) at book value, we miss variation in long-term debt and preferred stock returns due to variation in interest rates. In short, there is substantial uncertainty about the true values of the IRRs on cost and value, and about the cost of capital for the nonfinancial sector, however estimated. (Fama and French (1996) emphasize the same conclusion for estimates of industry costs of capital.)

Flow of Funds Estimates of the Return on Cost. Many papers use Federal Reserve Flow of Funds data to estimate the return on cost for the nonfinancial corporate sector (Nordhaus (1974), Feldstein and Summers (1977), Holland and Myers (1979), Feldstein, Dicks-Mireaux, and Poterba (1996)). The usual estimate is the average, for a sample period, of the ratio of nonfinancial corporate earnings for year t to the replacement value of the nonfinancial capital stock at the end of year $t - 1$.

The most recent and thus most up-to-date paper in this tradition is Poterba (1997). His estimate of the average nonfinancial return on cost for 1959-96 is 5.1 percent, which he interprets as an average real return. Our real IRRs on cost for 1950–96 and 1973–96 are a lot higher, 7.38 and 7.52 percent.

Our higher returns on cost are due in part to the fact that we measure the assets of entering firms at historical cost rather than replacement cost, which (again) biases our returns upward. On the other hand, the nonfinancial capital stock grows through time, so the returns on cost from the Flow of Funds are biased downward if it takes more than a year for new assets to reach their earning potential. Our IRRs on cost avoid this problem because they include the future earnings generated by assets either directly or in the market values of firms when they leave the sample.

We can use COMPUSTAT to produce a return on cost conceptually similar to Poterba's (1997) estimate from the Flow of Funds. For COMPUSTAT firms and Poterba's 1959–96 period, the average ratio of aggregate earnings for year t to aggregate book capital at the end of year $t - 1$ is 9.68 percent. If we divide this return by 1.6 (the average ratio of replacement cost to historical cost for nonfinancial tangible assets in the Flow of Funds), our return drops to 6.05 percent. This is almost one percent above the 5.10 percent return reported by Poterba. It seems, then, that the listed firms on COMPUSTAT are more profitable than the full sample of listed and privately held nonfinancial firms in the Flow of Funds. Differences in the way variables are measured on COMPUSTAT and the Flow of Funds may also be a factor.

V. Conclusions

We estimate an internal rate of return (IRR) that equates the initial market values of nonfinancial firms with the present values of their year-by-year post-entry net cash flows and their terminal market values. This return is a simple and direct estimate of the IRR on the initial market values of all the nonfinancial corporate securities outstanding during the IRR estimation period. The return on value is also an estimate of the nonfinancial corporate cost of capital, in circumstances where the cost of capital is taken to be an expected compound return (e.g., as in Copeland, Koller, and Murrin (1990)).

The IRR on value is high. The nominal return for 1950–96 is 10.72 percent. The estimate for 1973–96, when our coverage of firms is essentially complete, is 11.78 percent. Adjusting for inflation lowers the returns, and brings them closer together, 5.95 percent for 1950–96 and 5.57 percent for 1973–96.

The IRRs on value from equation (1) incorporate the net transfers of wealth into and out of the corporate sector that occur each year. The IRRs thus provide good estimates of the compound return on wealth allocated to the nonfinancial sector. An alternative concept is the compound return to a dollar invested in the nonfinancial sector at the beginning of the return estimation period—that is, the return obtained by compounding annual simple returns. This alternative compound return is less accurate than the IRR

from equation (1) as an estimate of the return on wealth allocated to the nonfinancial sector, but it is probably more appropriate as an estimate of the nonfinancial cost of capital. During our estimation periods the compound returns from a reinvested dollar are 0.47 to 1.14 percent higher than the IRRs from equation (1).

Even when the cost of capital is an expected simple return, the appropriate estimate of the cost of capital is typically a weighted average of average simple and compound returns on value (Blume (1974), Cooper (1994)). The average annual simple returns produced by our COMPUSTAT sample are, of course, higher than the compound returns. The average simple nominal returns for 1951–96 and 1974–96 are 12.12 and 12.68 percent; the average simple real returns are 7.81 and 6.90 percent.

We also estimate the internal rates of returns delivered by the nonfinancial corporate sector on the cost of its investments. These estimates of the return on cost always exceed our estimates of the cost of capital. Thus, on average, corporate investment seems to be profitable. This conclusion is, however, clouded by the fact that in the IRRs on cost, we measure the assets firms bring into the sample at book value rather than replacement cost. If the book value of entering assets understates replacement cost by about 40 percent, the conclusion that investment is on average profitable is overturned.

A byproduct of our IRR calculations is detailed evidence on cash flows into and out of the nonfinancial sector, and thus on the way firms finance themselves. We find that the investments firms make after they enter the sample dwarf their initial assets and their terminal values. Cash earnings are also large, and firms could in principle finance their investments entirely with retained earnings. Firms, however, make substantial dividend and interest payments. As a result, on average about 70 percent of gross investment is financed with internally generated funds (retained earnings and depreciation) with the remainder covered by net new issues of securities, primarily debt. The result of all this investment and financing activity is an overall corporate capital structure that is a rather stable mix of debt and equity after about 1970, especially when the capital structure and its components are measured at book value.

REFERENCES

Andrade, Gregor, and Erik Stafford, 1997, Investigating the characteristics of mergers and other forms of investment, Working paper, University of Chicago.

Baker, Richard E, Valdean C. Lembke, and Thomas E. King, 1996, *Advanced Financial Accounting* (McGraw-Hill, New York).

Bernanke, Ben S., and John Y. Campbell, 1988, Is there a corporate debt crisis?, *Brookings Papers on Economic Activity* 1, 83–125.

Bernanke, Ben S., John Y. Campbell, and Toni M. Whited, 1990, U.S. corporate leverage: Developments in 1987 and 1988, *Brookings Papers on Economic Activity* 1, 255–278.

Blume, Marshall E., 1974, Unbiased estimators of long-run expected rates of return, *Journal of the American Statistical Association* 69, 634–638.

Brealey, Richard A., and Stewart C. Myers, 1996. *Principles of Corporate Finance* (McGraw-Hill, New York).

Chan, Louis K.C., Narasimhan Jegadeesh, and Josef Lakonishok, 1995, Evaluating the performance of value versus glamour stocks: The impact of selection bias, *Journal of Financial Economics* 38, 269–296.

Cooper, Ian, 1994, Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting, Working paper, London Business School.

Copeland, Tom, Tim Koller, and Jack Murrin, 1990. *Valuation: Measuring and Managing the Value of Companies* (John Wiley and Sons, New York).

Fama, Eugene F., 1996, Discounting under uncertainty, *Journal of Business* 69, 415–428.

Fama, Eugene F., and Kenneth R. French, 1996, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Fama, Eugene F., and Kenneth R. French, 1999, Testing tradeoff and pecking order predictions about dividends and debt, Working paper, University of Chicago.

Feldstein, Martin, Louis Dicks-Mireaux, and James Poterba, 1996, The effective tax rate and the pretax rate of return, *Journal of Public Economics* 21, 129–158.

Feldstein, Martin, and Lawrence Summers, 1977, Is the rate of profit falling?, *Brookings Papers on Economic Activity* 1, 211–227.

Holland, Daniel, and Stewart Myers, 1979, Trends in corporate profitability and capital costs, in R. Lindsay ed.: *The Nation's Capital Needs: Three Studies* (Committee on Economic Development, Washington, D.C.).

Mehra, Rajnish, and Edward C. Prescott, 1985, The equity premium: A puzzle, *Journal of Monetary Economics* 15, 145–161.

Myers, Stewart C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

Nordhaus, William D., The falling share of profits, 1974, *Brookings Papers on Economic Activity* 1, 169–208.

Poterba, James M., 1997, The rate of return to corporate capital and factor shares: New estimates using revised national income accounts and capital stock data, Manuscript, MIT.

Taggart, Robert A., 1985, Secular patterns in the financing of U.S. corporations, in Benjamin M. Friedman, ed.: *Corporate Capital Structures in the United States* (NBER Conference Volume).