Rates of Return on Corporate Investment*

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In the last two decades productivity has lagged in the United States, markets have been lost to foreign competition, real income per capita has grown slowly. This experience has led to considerable discussion of possible causes [7]. One possible cause often mentioned is the quality of managerial investment decisions. Managers have been accused of overinvesting in obsolete technologies, of underinvesting in risky projects with long run payoffs, of undertaking unprofitable mergers, and of overall poor judgment in their investment policies [39]. This paper presents evidence on the returns on investment over the 1970–88 period for a sample of 699 large corporations that is consistent with this view.

Although criticisms of management investment policies have focussed on the most recent two decades, evidence of low returns on investment was presented as early as 1970. Baumol, Heim, Malkiel and Quandt [2] (hereafter BHMQ) estimated returns on reinvested cash flows by large corporations ranging from 3.0 to 4.6 percent. These were significantly less than their estimates of the returns on newly issued debt and equity, and less than the 13 to 18 percent returns corporate shareholders were able to earn on the market portfolio over the same time period [9]. Their results seemed to support the hypothesis that managers overinvested in pursuing the growth of their firm, and that the discretion to do so increased with available cash flows [24; 30; 31].

The BHMQ findings were soon challenged [10] and a debate ensued with additional papers claiming either to contradict [6; 25] or to support [3; 45; 46; 12] the original BHMQ results.

Given the inconclusive nature of the earlier debate and the importance of the issue, we think the topic deserves another look. A second justification for our study is that we use a methodology to calculate returns on investment that we believe is an improvement on the one used in the earlier studies. This methodology is described in the following section. In section II we present some examples to illustrate the methodology's properties. Estimates of rates of return on investment for our 699 firm sample are given in section III. Separate returns on investment are measured for different sources and uses of investment funds in section IV. Alternative interpretations of the results are discussed in section V. A brief set of conclusions are in the final section.

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I. Methodology

BHMQ estimated rates of return on investment by regressing changes in profits over one time period onto the amounts invested in an earlier period. There are two objections one might raise to this procedure. First, the use of accounting profits data to measure economic profits has been challenged, and these criticisms cast doubt on estimates of returns on investment made from accounting profits data [8; 4]. Second, a degree of arbitrariness is introduced into the calculations through the choice of time periods over which both investment and profit changes are measured, and the lag asumed between investment and the resulting change in profits. The methodology we adopt avoids both of these difficulties.

Following other recent studies in industrial organization,[1] we seek to avoid some of the problems inherent in the use of accounting data by using changes in the market value of the firm to estimate returns on investment. To the extent that a change in the market value of a firm today reflects the market's expectation of all future changes in profits, market value data avoid the question of the proper time interval and lag structure.

The methodology is as follows: A firm's investment I_t in period t generates real cash flows $C_{t+j}, j = 1, \infty$ with present value PV_t:

$$PV_t = \sum_{j=1}^{\infty} C_{t+j}/(1 + i_t)^j. \tag{1}$$

With the same real discount rate i_t, the investment I_t would have the same present value PV_t, if it earned the return r_t in perpetuity.

$$PV_t = I_t r_t / i_t \tag{2}$$

Since the firm could always increase shareholder wealth by I_t by using these funds to repurchase its shares or paying them as a dividend, shareholder wealth maximization requires that $PV_t \geq I_t$, and thus that $r_t \geq i_t$.

The market value of the firm at the end of period t can be defined as the market value of the firm at the end of $t - 1(M_{t-1})$, plus the present value of the investment made in t, PV_t, minus the depreciation in the firm's total capital over the period $(\delta_t M_{t-1})$ plus any error the market makes in evaluating the present value of the firm's total capital at the end of period t, μ_t.

$$M_t \equiv M_{t-1} + PV_t - \delta_t M_{t-1} + \mu_t \tag{3}$$

Using (3) to replace the first right hand term in successive periods yields

$$M_{t+n} = M_{t-1} + \sum_{i=0}^{n} PV_{t+i} - \sum_{i=0}^{n-1} \delta_{t+i} M_{t+i} + \sum_{i=0}^{n} \mu_{t+i}. \tag{4}$$

Let us call

$$c_t = r_t / i_t. \tag{5}$$

1. See, for example, Lindenberg and Ross [20]; Smirlock, Gilligan, and Marshall [43].

Then, c, a weighted average of the c_{t+i}'s over the $n + 1$ periods, with the I_{t+i}'s as weights becomes

$$c = \sum_{i=0}^{n} c_{t+i}I_{t+i} / \sum_{i=0}^{n} I_{t+i} = \sum_{i=0}^{n} PV_{t+i} / \sum_{i=0}^{n} I_{t+i} \tag{6}$$

which from (4) can be rewritten as

$$c = (M_{t+n} - M_{t-1}) / \sum_{i=0}^{n} I_{t+i} + \sum_{i=0}^{n} \delta_{t+i}M_{t+i-1} / \sum_{i=0}^{n} I_{t+i} - \sum_{i=0}^{n} \mu_{t+i} / \sum_{i=0}^{n} I_{t+i}. \tag{7}$$

In any period the market's error in evaluating M_t could be large. The efficient market assumption implies that $E(\mu_t) = 0$, however, and thus that $E(\sum_{i=0}^{n} \mu_{t+1}) = 0$. As n grows large, the last term in (7) becomes approximately zero.

Recall that the objective is to evaluate the firm's return on investment relative to its cost of capital. If management is investing at a rate of return at least as great as their cost of capital, then c will be no less than one. If depreciation were zero, equation (7) implies that the weighted average c would be 1.0 if the increase in the market value of the firm over the n time periods equaled the cumulative investment over that period. If shareholders perceive the rate of return on investment to equal their own opportunity cost of not receiving those funds directly, then market value will rise by an amount equal to the investment made. The middle term on the right hand side of (7) adjusts the calculation for the depreciation in firm capital that takes place over the time interval. Some of gross investment offsets the decline in the market value of the company that would otherwise occur from the normal erosion of a firm's assets.

The methodology encapsulated in (7) avoids the difficulties inherent in previous techniques for measuring returns. The assumption of capital market efficiency allows us to finesse all issues relating to lags and time patterns of returns, and measure investment performance by examining the relationship between current investment and changes in market value. We discuss the market efficiency question below.

A firm's c can be calculated over any time interval. Basic balance sheet and income statement data can be used to calculate the market value of the firm in each year and the total funds used for investment over the period. Equation (7) also requires some estimate of the rate at which the entire market value of the firm depreciates in every year. A firm's market value can be broken down into the value of its separate components: its physical capital, KK_t, any intangible capital it has as a result of past advertising, AK_t, or R&D, RK_t, and any goodwill capital it has, GK_t, i.e. intangible capital that is not the result of past outlays on physical capital, advertising or R&D.

$$M_t \equiv KK_t + AK_t + RK_t + GK_t \tag{8}$$

Estimates of depreciation rates on plant and equipment fall over a fairly narrow range around 0.10 [16]. Estimates of depreciation on advertising generally exceed 0.10, but some scholars have come up with even lower figures [5; 1]. Depreciation on R&D is typically found to be much smaller than for advertising [14] and is probably reasonably approximated by a 0.10 figure.[2]

2. The highest depreciation estimates are by Pakes and Schankerman [34]. They estimate patent stocks to depreciate at a 0.25 rate, and a lag between R and D outlays and the time when they generate revenue of about two years. Their

Included in goodwill capital are all of the first and second mover advantages that result in some firms earning persistently higher *average* returns and market values [40; 33]. In some cases (e.g., Coca Cola, Kelloggs, Kodak), these advantages become associated with company brand names and seem to last indefinitely. On average, goodwill capital probably depreciates at less than 10 percent per year.

To calculate c's for individual companies we shall assume a constant δ of 0.10 over the 1970–88 time period. The preceding discussion suggests that this is a reasonable figure for physical and R&D capital, too low for advertising and too high for goodwill capital. In section IV we use our data to estimate both returns on investment and depreciation rates.

Since the market value of a firm reflects the present value of the profit streams stemming from *all* of its assets, we wish a similarly inclusive definition of investment. We thus define investment in year t as

$$I_t \equiv \pi_t + Dep_t - Div_t + \Delta E_t + \Delta D_t + A_t + RD_t, \tag{9}$$

where π is profits after interest and taxes, Dep is depreciation, Div is common and preferred dividends, ΔE is changes in the market value of outstanding equity, ΔD is changes in debt, A is advertising, and RD is research and development outlays. The first three terms in (9) are retained cash flow. To these we add the funds raised by issuing new equity and debt. These first five terms on the right hand side of (9) yield the amount of funds available for plant construction, the purchase of capital equipment, and for the acquisition of other companies either in part or in toto.

Both advertising and R&D are expensed for accounting purposes, and profits are thus measured *net* of these outlays. To obtain a measure of investment that includes these two forms of investment, we add both back in.

The only remaining variables in equation (7) needed to calculate c are the market values of the firm at the beginning and end of the time period. The market value of a firm is defined as the sum of the market values of its ownership claims—common stock equity, preferred stock equity and debt—and is calculated following standard procedures in the literature. The details of these and the other calculations are given in an appendix, which is available from the authors. Market value and investment figures are deflated by the consumers' price index, so that all calculations are in constant 1982 dollars.[3]

The procedure we use to calculate rates of return (equation (7)) is considerably simpler than those used by others. Complicated formulae involving tax rates and depreciation are not involved, and dividend payments are not required in the calculations. Some readers of earlier drafts of this paper have questioned whether these omissions may not account for the results we obtain. In the following section we therefore present some examples to illustrate how these issues are handled by our procedure.

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results would thus imply weighting R and D expenditures by $(1 + i_t)^2$, and then depreciating them at $\delta = .25$. This would give an effective δ of less than 0.25, but greater than our .10 figure. Most studies that estimate R and D capital find an inverted V pattern of weights fits the data best with the maximum impact of R and D on revenue occurring several years after expenditure. See Hirschey [14], Ravenscraft and Scherer [37], and Megna and Mueller [26].

3. The consumers' price index is the relevant deflator here because returns are measured in terms of the purchasing power of shareholders.

II. Some Examples of How the Procedure Works

Consider Example 1 of Table I. K is the capital stock of the firm. In this scenario it earns a 10 percent return and depreciates at 10 percent, which is also the accounting depreciation rate. The firm is assumed to have only equity outstanding and pays its \$10 in profits as dividends. The market value of the firm is \$100 reflecting the present value of the dividend stream discounted at 0.10. The c obtained from equation 7 is 1.0 as long as nothing changes, as can be seen from the numbers in the four far right columns, which calculate c for five periods.

Example 2 is identical to Example 1 except that the return on capital, profits and dividends are all double those of Example 1. With a \$20 annual dividend the market value of the firm is \$200. Equation (7) correctly calculates the ratio of r to i for the first five periods as indicated in the four far right columns. These two examples illustrate that our calculated returns on investment are quite different from the returns to common shares. In both examples the return on common shares is 10 percent, which is also the cost of capital of the firm, and this is always the case as long as shareholders correctly anticipate future dividends, regardless of whether the return on investment is above or below the firm's cost of capital.

In Example 3 the figures for the end of period 0 and period 1 are identical to those in Example 1. In period 2, however, the firm is assumed to be able to invest at an $r = .20$, perhaps because of technological change embodied in the new capital, or because of accelerated depreciation or tax credits attached to the new capital. The market correctly perceives the increase in return on investment and values the \$10 invested in period 2 at \$20. The market value of the firm rises to \$110 (row M, ignore rows M' and $\delta M'$ temporarily), and it continues to rise until eventually all of the old capital (K_0) that earns $r = .10$ is replaced by new capital (K_N) earning .20, and the steady state of Example 2 obtains. The upper figures in the four right hand columns present the figures used in calculating c for the first five periods. In these periods the firm invested \$10 at a 10 percent return and \$40 at a 20 percent return for a weighted average r of .18. Our procedure gives the correct c of 1.8 given that $i = .10$.

The figures in row M are those one would obtain if the stock market valued a firm at the end of any period t under the assumption that next period's profits and dividends will persist indefinitely. In effect, the market is continually surprised as each period's return on investment exceeds the average return on capital until the two converge in the steady state. The last two rows of Example 3 present market value (M') and calculated depreciation thereof ($\delta M'$) under the assumption that the market correctly anticipated the future returns on all investments and all future profits and dividends, i.e. M'_t is the present discounted value of all future dividends at each t. The market value of the firm is higher in both period 0 and period 5, with the net effect of the correct anticipation of future returns being that the $(M_5 - M_0)$ term in c is reduced. However, the higher values for initial Ms also raise the δMs and these more than offset the decline in $(M_5 - M_0)$, so that the net effect of the market's correct anticipation of a future increase in returns on investment would be to bias our calculated returns upward. Whether this will always be the case depends on the pattern of returns *changes,* the timing of the market's anticipation of these changes and the relative magnitudes of δ and i.[4] Since the effects of anticipated future changes in r on $(M_{t+n} - M_0)$ and $\sum \delta M$ are of opposite sign, we do not expect biases caused by these an-

4. Let the return on investment change from r to r' in period t. If this change is fully anticipated at time 0, the change in M_0 is $\sum_{j=0}^{\infty}(r' - r)I/(1 + i)^{t+j}$. The change in M_0 is greater the smaller i and t are. The change in the $\sum \delta M_{t-1}$ will, of course, be greater the greater δ is.

Table I. Example Calculations of Rates of Return

Time	0	1	2	3	4	5 . . . ∞		$M_5 - M_0$	$\Sigma_{t=1}^{5} \delta M_t$	$\Sigma_{t=1}^{5} I_t$	c
Example 1: Constant $r = .10$											
K	100	100	100	100	100	100	100	0	50	50	1.0
Dep		10	10	10	10	10	10				
r		.10	.10	.10	.10	.10	.10				
π		10	10	10	10	10	10				
Div		10	10	10	10	10	10				
M	100	100	100	100	100	100	100				
δM		10	10	10	10	10	10				
I		10	10	10	10	10	10				
Example 2: Constant $r = .20$											
K	100	100	100	100	100	100	100	0	100	50	2.0
Dep		10	10	10	10	10	10				
r		.20	.20	.20	.20	.20	.20				
π		20	20	20	20	20	20				
Div		20	20	20	20	20	20				
M	200	200	200	200	200	200	200				
δM		20	20	20	20	20	20				
I		10	10	10	10	10	10				
Example 3: A shift from $r = .10$ to $r = .20$											
K	100	100	100	100	100	100	100	34.4	55.6	50	1.80
Dep		10	10	10	10	10	10				
r		.10	.20	.20	.20	.20	.20				
K_0	100	100	90	81	72.9	65.6	0				
K_N	0	0	10	19	27.1	34.4	100				
π		10	10	11	11.9	12.7	20				
Div		10	10	11	11.9	12.7	20				
M	100	100	110	119	127.1	134.4	200				
δM		10	10	11	11.9	12.71	20				
I		10	10	10	10	10	10				
M'	145.4	150	155	159.5	163.5	167.2	200	21.8	77.3	50	1.98
$\delta M'$		14.5	15.0	15.5	16.0	16.3	20				
Example 4: Unexpected shift from $r = .10$ to $r = .20$ on old and new capital											
K	100	100	100	100	100	100	100	100	90	50	3.8
Dep		10	10	10	10	10	10				
r		.10	.20	.20	.20	.20	.20				
π		10	20	20	20	20	20				
Div		10	20	20	20	20	20				
M	100	200	200	200	200	200	200				
δM		10	20	20	20	20	20				
I		10	10	10	10	10	10				
Example 5: Unexpected expansions in capital through new debt with $r_0 = .10$ and $r_N = .05$											
K	100	100	110	120	130	140	300	20	53	96	0.76
Dep		10	10	11	12	13	30				
K_0	100	100	100	100	100	100	100				
K_N	0	0	10	20	30	40	100				
r_0		.10	.10	.10	.10	.10	.10				
r_N			.05	.05	.05	.05	.05				

Table I. Continued

Time	0	1	2	3	4	5 . . . ∞		$M_5 - M_0$	$\Sigma_{t=1}^{5} \delta M_t$	$\Sigma_{t=1}^{5} I_t$	c
π		10	10	9.5	9.0	8.5	0				
Div		10	10	9.5	9.0	8.5	0				
M	100	100	105	110	115	120	200				
δM		10	10	10.5	11	11.5	20				
I		10	20	21	22	23	30				
ΔD		0	10	10	10	10	0				
Int		0	0	1	2	3	20				

Notes: $c = (M_{t+n} - M_{t-1})/\Sigma_{j=0}^{n} I_{t+j} + \Sigma_{j=0}^{n} \delta M_{t+j-1}/\Sigma_{j=0}^{n} I_{t+j}$.
$i = .10$, $\delta = .10$ for all calculations.

ticipations to be large. In Example 3, the return on investment doubled and we calculated c over only five periods, yet the error in c was only 10 percent of its true value. For smaller anticipated changes in r and longer intervals over which c is calculated, the changes will be much smaller.[5] We calculate cs for intervals of up to 19 years below, after 19 years the error in our calculation of c from the correct anticipation of all future dividends would be 2 percent.

Example 4 begins like Example 1 but now the return on both new and existing capital doubles in period 2. Such a change might occur from say a tariff increase that raises profits on all capital, or a reduction in the corporate income tax that raises after tax profits on all capital. The calculated c of 3.8 is more than double the true c of 1.8 based on a \$10 investment at $r = .10$, and \$40 at $r = .20$. This substantial error comes about because our formula assumes that the market always correctly prices existing capital, and therefore that all changes in market values reflect changes in the returns on investment (new capital). When the market value of all of the firm's capital doubles, and we interpret this change as arising just from its additions to capital, the implied returns on these additions will, of course, be large. We discuss in section V whether this kind of bias may explain our findings.

In Example 5, we again start out as in Example 1. In period 2 the firm begins to add capital on which the return is only .05. It does so by issuing debt on which, let us say, the interest charge is 10 percent. The firm adds \$10 in capital per period by issuing \$10 in new debt for 20 periods, after which the amount of debt outstanding equals \$200. The firm then has \$100 in old capital earning 10 percent, and \$200 in new capital earning 5 percent. The resulting revenue of \$20 is paid entirely to the debt holders as interest. Dividends and the market value of the firm's equity are both 0. The market value of the firm equals the value of its debt, \$200. Over the first five periods, the firm invests \$50 at .10 and \$46 at .05 for a weighted average r of .076, as given by our calculated c of .76. Note again the independence of the returns on investment from the returns to the owners of the firm. Debt holders earn a normal .10 return, while shareholders experience a .045 return per period as their wealth is gradually wiped out. If the shareholders were to anticipate all of the future declines in dividends at, say, the end of period 1, then only the shareholders at that point in time would suffer a loss. Any shares bought afterward would earn a normal return.

Note that the true marginal return on investment—the return on new capital—is actually less than the return we estimate. That is because we estimate a weighted average of the returns on *all*

5. Although M' is 45.4 percent greater in period 0 than the M needed to make our calculation exact, by period 4 it is only 19.6 percent higher, and both M' and $\delta M'$ converge on M and δM as time transpires.

of the firm's investment, both replacement of and additions to existing capital. If the marginal return on capital is declining, and the return on replacing existing capital exceeds the return on new capital, then our procedure for estimating returns *over*estimates the *marginal* return on capital.

The procedure we employ to calculate returns on investment assumes that the capital market correctly prices the firm's current capital stock and that future changes in profits and dividends are brought about by changes in returns on investment.[6] Small errors are introduced to the extent that current market values reflect future anticipated *changes* in returns on investment. Large errors are introduced to the extent that market value changes reflect changes in the return on total capital and not investment. We shall have more to say about these biases after we discuss our results.

III. Calculated Returns on Investment

Table II presents the distribution of c's for our sample of firms from 1970 through 1988. The values under 70 are for the single year 1970. The figures under 71 give the distribution of c's calculated as a weighted average, $\sum c_t I_t / \sum I_t$, over the years 1970 and 1971. The 1972 column is for the weighted averages of 1970, 1971, and 1972, and so on.

It is possible for our measure of investment to be negative in years of low (negative) profits or reductions in outstanding debt or equity. Equation (7) does not make sense when $\sum I$ is zero or negative and so no calculations are presented in these cases. For this reason the number of firms does not sum to 699 in some years. To see whether our results are sensitive to the use of 1987, the year of the October stock market plunge, as our end year, we extended our original data set through 1988. Disappearances from the COMPUSTAT tape for one reason or another, mostly mergers, reduced our 699 firm sample to 641 in 1988.

The most reliable figures are for 1987 and 1988, since they average the market's annual errors over the longest time intervals. The last two columns in Table II indicate that only 19 percent of the 699 companies had a weighted average c from 1970 through 1987 greater than or equal to 1.0. Only 22 percent of the 641 c's calculated through 1988 were equal to or greater than 1.0. For four out of every five companies, the return on investment over the 1970–87/88 period was less than their owners' opportunity costs of capital. The median c for the sample of 641 in 1988 was 0.71. For half of the companies, the return on investment averaged less than 71 percent of their cost of capital over the 1970–88 period; for more than a fourth of the sample, it averaged less than 50 percent of the cost of capital. As in the earlier studies of the 1950s and 1960s, the typical firm over the 1970s and 1980s did not earn a return on investment equal to its cost of capital.

This conclusion is not sensitive to the choice of end point. Indeed, the end of 1988 comes after a long stock market upswing, so that any earlier cutoff would yield even lower values for c, as 1987 does. Since both 1969 and 1988 were preceded by long market upswings, no obvious bias is introduced by these choices.

In Table III, we present the beginning and ending period market values, the change in these values, the cumulated investments over the time period, and calculated c's for the 50 largest

6. It would be better if the procedure was insensitive to the assumptions one makes about market expectations, of course. *All* of the procedures calculating rates of return extant are conditional on some assumptions such as those we have made, however. The BHMQ methodology, for example, assumes that capital at time t will generate profits at time t in perpetuity, an assumption quite analogous to ours.

Table II. Distribution of Company Return-Cost Ratios Cumulated from 1970 $\delta = 0.10$

Range of c	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88
> 4.00	27	43	47	13	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0
3.75 to 4.00	1	2	5	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
3.50 to 3.75	2	6	5	6	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
3.25 to 3.50	5	4	8	3	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0
3.00 to 3.25	0	5	5	9	0	2	0	0	0	0	0	0	0	0	0	1	1	0	2
2.75 to 3.00	2	9	11	5	2	1	1	0	0	0	1	0	1	0	0	1	1	2	1
2.50 to 2.75	3	14	9	5	2	3	3	1	0	3	4	0	1	1	2	0	1	2	0
2.25 to 2.50	6	12	15	5	2	0	3	2	2	1	3	2	3	8	0	3	6	1	6
2.00 to 2.25	13	18	17	9	4	8	1	5	2	1	7	6	3	4	6	5	4	6	5
1.75 to 2.00	16	26	21	11	7	10	11	4	4	4	9	6	3	6	4	11	8	8	5
1.50 to 1.75	20	27	27	18	4	14	10	8	7	14	13	4	11	17	9	10	13	16	16
1.25 to 1.50	17	25	32	19	15	11	25	13	19	16	21	13	25	31	24	29	34	32	32
1.00 to 1.25	32	46	44	24	17	20	30	27	25	33	44	37	39	49	43	56	65	60	60
0.75 to 1.00	38	56	62	34	20	37	64	68	68	78	80	82	68	94	100	103	131	124	145
0.50 to 0.75	48	61	92	76	51	77	116	129	153	159	120	130	162	182	192	212	202	218	189
0.25 to 0.50	41	52	68	95	119	126	128	162	162	165	176	182	180	157	168	152	127	121	104
0.00 to 0.25	42	51	45	114	137	127	92	104	102	103	112	136	117	88	92	72	65	65	46

−0.25 to 0.00	44	35	37	52	96	64	81	59	66	53	46	50	45	32	30	18	15	18	12
−0.50 to −0.25	32	24	18	41	55	68	36	40	31	25	23	18	18	13	13	11	10	12	8
−0.75 to −0.50	26	24	20	31	36	28	21	19	17	14	15	18	11	7	6	6	5	3	2
−1.00 to −0.75	20	18	14	20	25	17	19	18	18	10	6	4	3	3	4	3	3	3	3
−1.25 to −1.00	25	14	12	20	19	19	14	6	6	4	9	2	3	3	2	1	0	1	2
−1.50 to −1.25	20	16	5	10	15	16	9	12	1	1	1	1	0	0	1	0	2	1	0
−1.75 to −1.50	22	6	9	10	11	7	9	1	1	1	0	1	0	0	0	1	0	0	1
−2.00 to −1.75	9	7	7	6	7	4	3	4	3	3	1	0	1	0	0	1	1	1	0
−2.25 to −2.00	14	8	4	5	8	10	2	1	0	0	1	0	0	1	0	0	0	1	0
−2.50 to −2.25	7	8	5	0	3	6	2	1	1	3	0	3	2	0	1	0	0	0	0
−2.75 to −2.50	9	3	0	4	3	0	1	0	2	0	0	0	0	1	0	0	0	0	0
−3.00 to −2.75	7	2	3	5	6	3	1	0	0	0	1	1	1	0	0	0	0	0	1
−3.25 to −3.00	6	3	1	1	2	2	0	1	2	0	0	0	0	0	0	0	0	0	0
−3.50 to −3.25	10	1	2	5	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0
−3.75 to −3.50	12	5	1	1	2	0	1	1	0	0	1	0	0	0	0	0	0	0	0
−4.00 to −3.75	6	2	2	3	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1
< −4.00	84	39	26	23	12	5	7	4	3	4	2	1	1	1	1	1	1	1	0
Number of firms: $c > 1.0$	144	237	246	129	57	70	85	60	59	73	104	68	86	116	88	117	135	128	127
Number of firms: $c < 1.0$	522	435	433	556	630	617	606	632	637	624	594	630	612	582	610	581	562	569	514
Number of firms: total	666	672	679	685	687	687	691	692	696	697	698	698	698	698	698	698	697	697	641

Table III. Figures for 50 Largest Companies of 1969

Company Name	M_{1969} [a]	M_{1988} [a]	$M_{88} - M_{69}$ [a]	ΣINV [a]	c [b]	δ [c]
IBM	114398.5	72031.1	−42367.4	165499.3	.604	.146
GENERAL MOTORS	55919.1	132921.8	77002.7	297572.0	.481	.333
EXXON CORP	44081.3	56219.0	12137.7	113870.3	.862	.118
EASTMAN KODAK	36417.9	20628.9	−15789.0	47325.8	.587	.145
TEXACO INC	25957.9	17309.1	−8648.8	55723.5	.456	.189
XEROX CORP	23237.7	11991.7	−11246.0	43708.5	.262	.242
GENERAL ELECTRIC	21542.2	86051.7	64509.4	116836.7	.971	.107
ROYAL DUTCH	17555.0	30808.9	13254.0	92393.7	.551	.210
MINNESOTA MINING	16907.1	12391.6	−4515.5	22239.1	.899	.109
ITT CORP	16258.6	15654.7	−604.0	47781.6	.466	.212
BRITISH PETR.	15751.6	34198.5	18446.9	84924.5	.654	.179
MOBIL CORP	15160.2	21989.5	6829.4	61026.5	.683	.156
DU PONT	14333.6	22461.7	8128.0	66531.5	.567	.197
ATLANTIC RICH.	14178.7	17515.9	3337.3	40762.4	.799	.128
FORD MOTOR CO	14057.7	82647.6	68589.9	169904.0	.551	.405
CHEVRON CORP	13534.1	19624.3	6090.2	54485.0	.675	.158
AVON PRODUCTS	13521.1	2007.5	−11513.6	4530.7	−.062	.143
COCA-COLA CO	12973.2	15238.3	2265.1	18047.9	1.259	.077
PROCTOR & GAMBLE	12504.3	15434.0	2929.7	37311.6	.746	.138
AMOCO CORP	11581.0	22261.4	10680.4	56588.2	.775	.138
IMPERIAL CHEM	11263.9	13586.8	2322.9	42159.3	.490	.217
POLAROID CORP	11181.2	2708.2	−8473.0	7793.4	−.299	.265
MERCK & CO	11123.3	19881.1	8757.8	14390.4	1.972	.029
AMERICAN HOME	9969.5	10382.3	412.9	14283.3	1.238	.080
LILLY (ELI) & CO	9424.1	10359.2	935.2	16736.6	.928	.108
JOHNSON & JOHNSON	9079.2	13452.0	4372.8	20332.9	1.131	.086
UNISYS CORP	8616.6	7898.1	−718.5	19520.1	.546	.178
UNION CARBIDE	8449.3	5204.3	−3245.0	20273.0	.505	.175
DOW CHEMICAL	8410.2	16983.1	8572.9	36991.3	.861	.122
GOODYEAR	8341.1	5540.0	−2801.1	18643.2	.368	.222
USX CORP	8308.8	13764.0	5455.2	53819.6	.403	.298
GEORGIA-PACIFIC	8220.2	5425.5	−2794.7	13275.9	.604	.149
WEYERHAEUSER	7953.5	8760.2	806.7	17524.5	.910	.110
WESTINGHOUSE	7826.5	13812.8	5986.3	23660.9	.745	.152
CATERPILLAR	7739.1	8187.3	448.2	19389.5	.766	.131
CHRYSLER CORP	7219.9	28241.7	21021.9	54334.4	.559	.356
BOISE CASCADE	7178.1	2435.3	−4742.9	5412.5	−.014	.218
PHILLIPS PETR.	6912.4	7959.6	1047.2	23682.7	.762	.133
RJR NABISCO INC	6776.9	22355.4	15578.6	28113.6	1.117	.079
HONEYWELL INC	6705.3	3148.9	−3556.4	18500.9	.208	.298
BRISTOL-MYERS CO	6326.5	11326.3	4999.8	21944.4	.715	.159
SUN CO INC	6231.1	4752.4	−1478.7	22660.3	.493	.191
PFIZER INC	6171.1	9132.8	2961.7	15339.7	.980	.103
ALCO	6071.6	5643.1	−428.5	14453.9	.567	.173
IMPERIAL OIL LTD	6025.2	6384.9	359.7	11586.2	1.162	.086
NCR CORP	5956.8	3991.8	−1965.0	13024.0	.325	.242
WARNER-LAMBERT	5942.1	4924.8	−1017.2	19103.5	.419	.223
INTL PAPER CO	5722.5	6336.5	614.0	13155.8	.766	.133
CONTROL DATA COR	5445.3	1045.2	−4400.1	10798.9	.074	.293
UNOCAL CORP	5428.5	7792.8	2364.3	24142.1	.589	.184

a. millions of 1982 dollars
b. calculated given $\delta = 0.10$
c. calculated given $c = 1.00$

companies in 1969, as measured by their market values. The results are fairly representative of those for the full sample, with nine of the 50 companies having a $c \geq 1.0$. An examination of the figures gives a good feel for both the nature of the calculations made, and the investment performance of U.S. corporations over the 1970–88 period. Nineteen of the fifty companies (including IBM) had lower market values at the end of 1988 than in 1969, measured in constant 1982 dollars. All of the investments these firms made over the 19 year period failed to maintain their real market values. For all 19 companies the estimated c, assuming $\delta = .10$, is less than 1.0. The largest absolute increments in market value were for General Motors and Ford. But these companies made such massive amounts of investment over the 19 years that their average c's were only .48 and .56, respectively. On average the return on GM's and Ford's investments are estimated to be only half of their costs of capital. At the other extreme, Merck's return on investment was on average double its cost of capital over the time period under the assumption that its total assets depreciated at a rate of 10 percent per annum.

All c's in Table III are, of course, contingent on the 10 percent depreciation assumption. To give the reader a feel for how sensitive they are to the choice of δ, we have set $c = 1$ for each firm and used equation (7) to solve for δ. These figures are presented in Table III under the column headed δ. Each entry gives the constant annual depreciation in a firm's total assets (physical capital, intangible capital, and goodwill capital) that makes the observed pattern of investments and market value changes correspond to a return on investment equal to the firm's cost of capital.

In some cases only slightly higher values for δ need to be assumed to make $c = 1$. But in the preponderance of cases the values of δ one would have to assume to make $c = 1$ seem to us to be too large to be plausible. The assumption that $\delta = 0.10$ yields an estimate of c for General Electric, for example, of almost precisely 1.0. To get a c of 1.0 for IBM, on the other hand, one needs to assume a δ of .145. Why is it reasonable to assume that IBM's assets depreciate 45 percent more rapidly than GE's? Is it likely that Texaco, BP, and Sun Oil actually experience depreciation rates between 17 and 19 percent, while Exxon and Atlantic Richfield's assets depreciate only 12 percent per year? To make Ford's investments have a return equal to its cost of capital on average, one would need to assume a δ of 0.40, meaning that Ford must invest an amount *each year* equal to 40 percent of its beginning market value just to maintain that market value. The issue of depreciation is taken up again in the next section, when we further examine differences in rates of return across firms.[7]

IV. Estimating Depreciation and Returns on Investment

The methodology developed in Section I can be used to estimate both the depreciation on total assets and the returns on investment. From (2), (3) and (5), we have

$$M_t = M_{t-1} + c_t I_t - \delta_t M_{t-1} + \mu_t \qquad (10)$$

where I_t is defined by (9). If we assume that the c_t and δ_t are constant both over time and across firms, we can use (10) to estimate both of these parameters. The efficient market hypothesis implies that μ_t should be normally distributed with mean zero.

7. Of the four types of capital discussed above, advertising is likely to have the highest depreciation rate. To check the sensitivity of our results to assuming $\delta = 0.10$ for all four stocks, we recalculated the figures in Table II after dropping advertising from total investment. This alteration, which is equivalent to assigning advertising a depreciation rate of 100 percent, had very little impact on the results.

Table IV. Estimates of Returns on Total Investment and for Sources and Uses of Investment Funds

Eq.	$-\delta$	I	NCF	ΔD	ΔE	A	RD	KI	Acq	Res	$\bar{R}^2$	n
1	−.082	0.74									.414	12,179
	23.04	76.73										
2	−0.059		0.56	0.92	0.65	0.27	0.88				.390	9,823
	11.4		22.4	50.5	21.0	6.66	11.1					
3	−.086					0.27	0.87	0.87	0.98	0.70	.386	9,823
	15.50					6.76	10.98	24.05	26.31	46.98		

Notes:
$(M_t - M_{t-1})/M_{t-1} = -\delta + cI_t/M_{t-1} + \mu_t/M_{t-1}$
t values under coefficients. Year dummies not reported.
I = total investment
NCF = profits + depreciation − dividends
Div = dividends
ΔD = change in debt
ΔE = change in equity
A = advertising
RD = research & development
KI = capital investment
Acq = mergers and takeovers
$Res = NCF + \Delta D + \Delta E - KI - Acq$
$\hat{\delta}$ = average annual depreciation (the intercept)

To estimate c and δ, we first subtract M_{t-1} from both sides of (10) and, to reduce heteroscedasticity,[8] deflate all terms by M_{t-1}. The estimated equation then becomes (11), with the intercept an estimate of $-\delta$.

$$(M_t - M_{t-1})/M_{t-1} = -\delta_t + c_t(I_t/M_{t-1}) + \mu_t \tag{11}$$

In any given year, all firm market values may be subject to large exogenous shocks as the stock market rises and falls. Nineteen year dummies were added to (11) to control for these shifts. Equation (11) was estimated under the constraint that these dummies sum to zero. The intercept then becomes an estimate of the average depreciation rate over the 19 year period, with the dummies representing annual deviations from the average [44].

Equation (1) in Table IV presents estimates for the pooled cross-section-time series of firms, with the time dummies not reported. The coefficient on I, total investment per year, is 0.74 very near the 0.71 median c calculated in the previous section. Treating this coefficient as an estimate of an average c, we find that the average firm earned a return on investment less than 3/4 of its cost of capital. The estimate of depreciation in equation (1) is 0.082. This is less than the 0.10 assumed in our calculations in section III. If the true annual depreciation on total assets does average 0.082 per annum, then the c's we report in Tables II and III are biased upward.

Returns by Source of Funds

The original BHMQ paper presented separate estimates of returns on reinvested cash flows, new debt, and new equity issues, as did many of the follow-up papers. Similar estimates can be made using our methodology by breaking I into its separate components, and assuming a constant re-

8. Tests for heteroscedasticity revealed that dividing all variables by M_{t-1} to the 1.1 power was required to remove this problem completely. We report results for the simple deflation, however.

turn on a given source of funds over time and across firms. Estimates made under this assumption are presented in equation (2) of Table IV. The return on reinvested cash flow (NCF) is only 56 percent of the cost of capital. The return on new debt issues is slightly below the cost of capital ($\hat{c}$ = .92), while the return on new equity is only 65 percent of the cost of capital. This pattern of returns differs from that reported by BHMQ, in that new equity earns a lower return than new debt, but is consistent with the view that debt provides the tightest constraint on managerial discretion [18, 322–3]. That reinvested cash flows earn the lowest returns of all three sources of funds is fully consistent with the earlier literature.

Advertising and R&D are revenues earmarked for particular uses. We include them in the sources-of-funds equations because they are a part of total investment, as we have defined it, and thus a source of investment revenue. The coefficient on R&D is .86, implying a return on this investment averaging 14 percent below the cost of capital. This result differs from those of most others, who find private returns on R&D generally greater than the cost of capital [22, 65–80; 23; 13; 34]. The results for advertising are even more dramatic, however, implying a return on this investment of but 26 percent of the cost of capital.[9] The estimated depreciation rate, $\hat{\delta}$, is even lower than that of equation (1).

Returns by Uses of Funds

The major uses of investment funds in addition to advertising and R&D are plant and capital equipment purchases (*KI*) and assets acquired through net mergers and takeovers (*Acq*). The latter were defined as the consideration paid for another firm, when this figure was available, or the assets of the acquired unit, when it was not. For large acquisitions, one of these two figures was generally available, for small ones the assets acquired were estimated (see the appendix). Since the values of changes in outstanding debt and equity are also estimated, and we have not taken into account changes in cash balances, a residual term, *Res*, was added to the uses side to make sources and uses as we measure them equivalent.[10] *Res* averaged less than 1 percent of total investment over the whole sample period.

Equation 3 in Table IV presents the results for the uses equation. All five uses have estimated coefficients less than 1.0 with *Acq* having the highest estimated returns relative to the cost of capital, advertising the lowest. The estimated depreciation rate on total capital is similar to that of equation (1) and still below the 10 percent figure used to calculate the c's in Tables II and III. The overall fit to the data is reasonably good and about the same across the three equations.

One of the obvious developments over the 1970s and 1980s that might explain low returns on investment is the growth of import competition. We used Commerce Department data on imports

9. When estimating the c's in Tables I and II, we approximated advertising and R&D for some companies using industry expenditure to sales ratios. These estimates appear quite accurate (a check is presented in the appendix). Given the increased importance of the timing of investment and market value changes in (11), we estimated this equation omitting in turn firms for which either advertising or R and D were approximated in this way. The estimates of returns on advertising are not affected by this approximation, but the coefficient on R and D is much higher when the estimated figures are excluded. Thus, the estimates reported in Table IV include only the 517 firms for which R&D data were reported by COMPUSTAT.

10. Revenue raised from spinoffs and other asset sales is excluded from our measure of cash flow. If \$$S$ of assets are sold, the market value of the firm's remaining assets should decline by S. If S were paid out in dividends or used to retire debt or equity, the decline in market value caused by the spin-off, S, would be matched by a decline in our measure of investment by S. Spin-offs are then treated as negative investments and should produce a c = 1.0. In these cases, although our measure of I on the sources side declines by S, there is no offsetting decline in KI, Acq, A, or RD, and S will appear as a negative in Res, and should therefore produce a c of 1.0 on this term.

by 3-digit SIC industry to construct import penetration ratios, and then used these to reestimate returns or depreciate rates that varied with imports (e.g., $\delta = a + b$ (Imports)). The coefficients were of the correct signs, e.g. depreciation rates were higher or returns lower, the greater the degree of import competition, but the improvement in fit to the data was negligible. The import variables were generally insignificant, $\overline{R}^2$ increased by about .001. The low returns on investment relative to the cost of capital apparent in Tables II, III and IV cannot be explained by the growth of import penetration.

We also divided our sample of firms into separate two-digit industries and estimated returns for the sources and uses of investment funds by industry. Considerable variation in the estimated returns was observed across industries, with some doing very well (e.g., electronic and electrical equipment, SIC 36), and others quite badly (e.g., petroleum, SIC 29). Similarly, there was a lot of variation in the estimated coefficients on the different sources and uses of funds, although mergers and acquisitions were generally the best use of investment funds, advertising the worst. To conserve space, we shall not discuss the results for individual industries; they are available from the authors upon request, however.

V. Discussion

The methodology described in section I allows us to estimate c's in two different ways. Equation (7) can be utilized to calculate separate, cumulative c's for each company, given assumed depreciation rates on total capital. In section III, calculations under the assumption that the total capital of each firm depreciated at a constant 10 percent per annum indicated that 80 percent of the firms failed to earn a return on investment over the 1970–88 period at least as great as their cost of capital.[11]

In section IV the methodology was used to estimate both the annual depreciation on total capital, the returns on total investment, and the returns on the major source and use components of investment funds. These estimates constrain depreciation and returns on investment to be the same across all firms (although annual dummy variables allow depreciation rates to vary over time). The estimates of returns on total investment under these assumptions are consistent with those of section III. The estimates of the returns on the different sources of investment funds are consistent with those of the existing literature. The common depreciation rates estimated in this way are somewhat lower than those assumed in the calculations of section III, suggesting that the individually calculated c's may overstate the ratios of r to i on average.

The methodology employed here assumes that capital markets are efficient. This assumption can be questioned. Studies that judged the consequences of mergers at the end of the 1960s based on the stock market's immediate reaction to these mergers concluded that they were an economic success, increasing the market values of the acquiring firms.[12] But, in seeming contradiction to the efficient market hypothesis, several studies have recorded steady declines in the returns on

11. It should be remembered that this return on investment corresponds to the capital gains portion only of the total return that shareholders receive. The average real total return on equity calculated using dividend and market value data for the sample companies for 1970–1987 is 4.2 percent. This is very close to the 3.9 percent real return on common stocks calculated by Ibbotson and Sinquefield [17] for the same time period.

12. Jensen and Ruback [19] survey numerous studies, whose samples of acquisitions were heavily weighted toward acquisitions in the 1960s and conclude that shareholders of acquiring firms are significantly better off at the time acquisitions are announced.

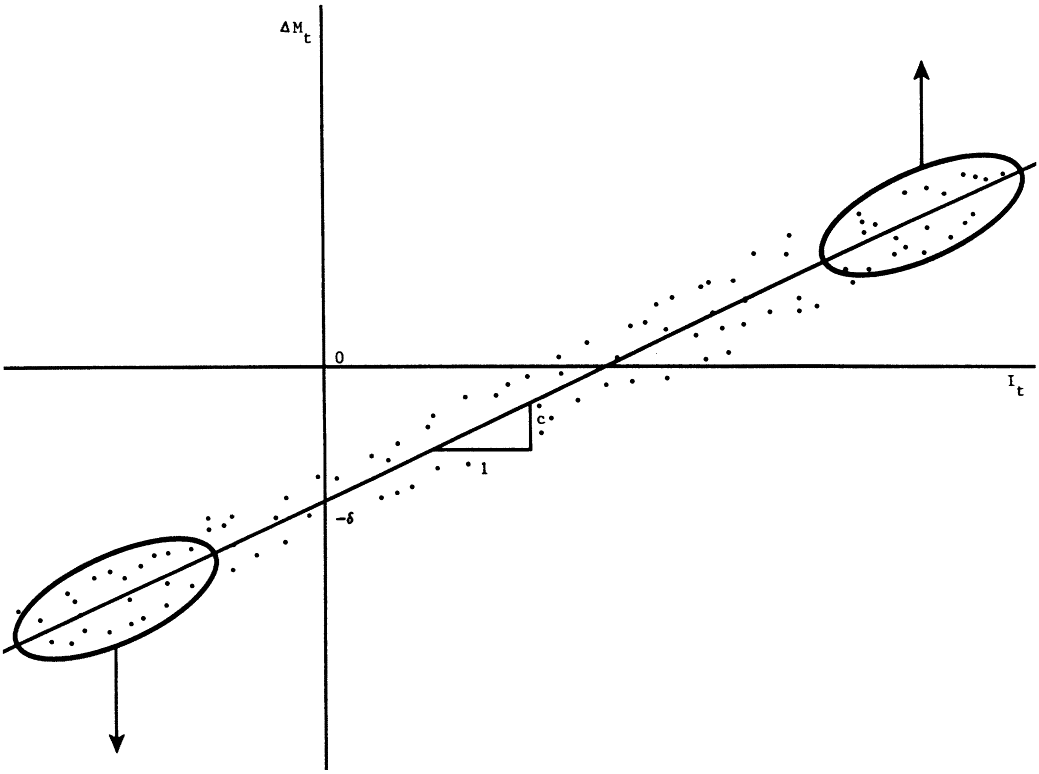

Figure 1

acquiring comanies' shares over extended periods following the acquisitions [32; 19; 21; 38]. Thus, there is reason to doubt whether the capital market does make an unbiased evaluation of information about mergers and acquisitions when they are announced. Perhaps the same is true for other investments.

Doubts concerning the efficiency of capital markets have also been raised by the evidence presented by Robert Shiller [41] and others of excessive price volatility in stock and bond markets. Shiller's results imply that market value increases at financial market peaks, and declines at troughs are greater than prove subsequently to be warranted. These findings are relevant to our results.

Figure 1 depicts the relationship between gross investment and changes in market value for a firm predicted under the efficient market hypothesis. The intercept should be negative, measuring the downward drift in a firm's market value attributable to the depreciation of its total capital. The slope of the line measures c. Now suppose that market value increases (decreases) are greater than predicted by the efficient market hypothesis at capital market peaks (troughs). Since investment levels are positively correlated with swings in capital market prices, when investment levels are high the stock market is likely to be in an expansionary phase with prices rising by more than future returns will warrant. Similarly, low investment levels will coincide with declining stock prices. Observed market value changes will be displaced from the time line as illustrated in Figure 1. Capital market volatility of the kind Shiller has reported will produce estimates of δ and of c, based on short run market reactions to investment, that are greater than one would obtain if the efficient market hypothesis were valid. Given the strong correlation that exists between merger activity and stock market value increases [27; 11], the estimated c's for mergers and acquisitions can be expected to have a particularly strong upward bias, but the same may be true of other estimates.

These considerations favor the methodology used to calculate firm specific c's in Tables II and III. By cumulating investments and market value changes over 19 years, we allow the market to correct errors made in earlier years. The market has to be unbiased only over the cumulative 19 year period, not in each year, for our calculated c's in Tables II and III to be interpretable as the ratio of return on investment to cost of capital. Should lags exist between the announcement of a particular investment and the market's full reaction to the announcement, a more complicated specification than equation (11) will be required. We do not pursue this issue here, but offer the estimates of Table IV as suggestive of the relative magnitudes of returns.

The results reported here indicate that the return on investment, r, is below owner opportunity costs, i, for most U.S. companies. Consistent with the literature reviewed in the introduction, we have interpreted these results as implying that corporate managers overinvest in some activities. But alternative interpretations are possible. We pursue some of these here.

Unanticipated Exogenous Shocks. The discussion of Example 4 in section II revealed that our estimated return on investment would be biased downward, if an event occurred that reduced the returns on existing capital as well as the returns on newly acquired capital. The oil price shocks in the 1970s are obvious candidates for such events. To the extent that these and other events in the 1970s and 1980s reduced the value of existing capital the rates of return earned on the *investments* over this period are higher than our figures imply (and, of course, the returns on investments made in the 1960s would be accordingly lower than the market had thought they would be).

In Table V we present the distribution of c's for the 641 companies for which we have data through 1988, assuming different intial year starting points (M_0) for the calculation of c. The column under 1975, for example, gives the distribution of investment weighted c_t's on investments made from 1976 through 1988 (M_0 = 1975, M_{t+n} = 1988). Table V can be viewed as a check on the sensitivity of our results to the choice of starting point, just as Table II illustrates the impact of the choice of ending point. Note in particular the figures for the 1973 column. Even after the 1973 oil price shock and the decline in market values it produced, the market's reaction to the investments firms made implies that 77 percent of the 641 companies earned a lower return on investment following the 1973 OPEC price increase than their cost of capital. Of course, other negative shocks occurred in the 1970s and 1980s (e.g., the second oil price increase in the late 1970s, the double digit interest rates of the early 1980s). But there were positive shocks too. The Reagan Administration weakened the power of unions, relaxed antitrust policy enforcement, and furthered the deregulation process begun under Carter. No single negative shock accounts for our results, and the 1970s and 1980s appear to be a sufficiently long and diverse period that no systematic bias in favor of negative shocks is present.

The possibility of unexpected shocks raises another issue, however, concerning the proper interpretation of our findings. We view our work as an extension of that of BHMQ and others measuring returns on ploughback and other sources of investment funds. The earlier work was based on hypotheses concerning managerial discretion and our findings are consistent with these hypotheses. But it is, of course, possible that managers did not consciously invest in projects promising returns below the value shareholders placed upon these funds. Managers might have expected to earn $r \geq i$ when they invested, but were disappointed by the events that occurred. We see no way to test this alternative interpretation, since it would entail determining what events managers were anticipating when they made their investment decisions. We prefer to leave it to the reader to place his or her own interpretation on the findings.

Changes in Tax Policy. Among the positive exogenous shocks that affected returns on investment during the 1970s and 1980s were the liberalizations of tax policy with respect to depreciation, tax credits for investment and reductions in the tax on corporate profits. Such changes increase the returns on investment by increasing the cash flows investment generates (either after-tax profits or reported depreciation). The market's reaction to these changes is reflected in the market value of the firm and our procedure for measuring returns on investment will capture these to the extent that the market correctly evaluates the effects of tax policy changes.

Reductions in effective corporate tax rates will increase measured returns on investment based on after-tax earnings even when no increase in the before-tax returns on investment has taken place. Moreover, as Example 4 in section II illustrates, our procedure interprets *all* increases in earnings as resulting from new investment. Thus, when returns on existing capital rise, our measured returns on investment are biased upwards. The more than 25 percent decline in the effective average tax on corporate income between the end of the 1960s and the 1980s will have induced a strong upward bias in our estimates of c [15]. For example, if we interpret the π's in Table I, as after tax profits, and assume an average tax rate of .40 in period 1 (roughly the average rate for 1969), then a decline in the average tax rate of 25 percent in period 2 and thereafter raises π to 11.67 in Example 1, and raises our estimate of c over the five years to 1.333. In this example a 25 percent decline in effective tax rates raises our estimate of returns on investment by 33.3 percent, even though the before tax return on investment is unchanged.

Anticipated Exogenous Events. As the discussion of Example 3 illustrates, some bias may be introduced into the estimates to the extent that future changes in rates of return have been anticipated by the market. Given our assumption that depreciation, δ, is .10, and the likelihood that the cost of capital, i, is less than .10, the bias in the $\sum \delta M_{t-1}$ term of equation (7) will outweigh that of the $(M_{t+n} - M_{t-1})$ term. For this possible bias to produce a preponderance of low c's, the 1969–88 period would have to have been dominated by the anticipation of future declines in earnings. This downward bias is certainly unlikely for the initial year of our study, since 1969 was the peak of the 1960s stock market advance. While some years in the 1970s may have market values depressed in anticipation of future declines in market values, some years in the 1980s may be inflated as a result of future increases. We see no reason to expect that market values were uniformly depressed throughout the 19 year period by anticipations of future declines in returns on investment.

The Differential Tax Treatment of Dividends and Capital Gains. During most of our sample period the marginal statutory tax rate on dividends for a person in the highest tax bracket was higher than this person's marginal tax on capital gains. The capital gains associated with investments at $r < i$ could produce greater after-tax wealth changes for some shareholders than would occur if the funds were paid out as dividends.

Institutional shareholders pay no taxes on dividends, on the other hand, and this category of shareholder has grown in importance accounting for more than 35 percent of equity holdings by the 1980s [35, 479]. Institutional investors typically hold a greater concentration of shares in particular companies and are in a better position to lodge complaints with management or become parties to takeover attempts. One might expect management to give greater weight to the interests of institutional shareholders, therefore. One difficulty in trying to assess the impact of tax

Table V. Distribution of Company Return-Cost Ratios Cumulated to 1988 641 Firms; $\delta = 0.10$

Range of c	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88
> 4.00	0	0	0	0	0	1	4	1	1	3	3	7	8	11	11	18	14	15	29
3.75 TO 4.00	0	0	0	0	0	0	0	1	1	1	0	0	2	1	1	2	2	2	2
3.50 TO 3.75	0	0	0	0	0	0	3	1	2	0	2	2	2	2	1	2	2	4	4
3.25 TO 3.50	0	0	0	0	1	2	0	0	3	5	2	4	7	5	8	6	3	1	6
3.00 TO 3.25	2	2	0	1	2	0	3	4	2	1	5	4	5	3	3	4	2	2	9
2.75 TO 3.00	1	1	2	1	1	5	2	3	3	5	3	4	2	5	2	10	5	2	7
2.50 TO 2.75	0	1	2	1	6	4	5	3	4	5	5	3	5	7	8	4	9	6	16
2.25 TO 2.50	6	8	7	11	4	7	3	5	7	11	7	6	10	9	11	17	9	8	20
2.00 TO 2.25	5	6	4	1	4	6	9	8	10	6	15	13	18	22	16	23	21	18	21
1.75 TO 2.00	5	4	5	4	9	15	15	15	12	16	15	24	35	31	25	31	22	15	14
1.50 TO 1.75	16	19	16	16	17	28	21	19	26	35	41	36	48	55	35	48	43	26	31
1.25 TO 1.50	32	41	27	26	44	52	52	48	56	47	45	59	75	64	54	77	64	34	48
1.00 TO 1.25	60	67	68	58	72	102	102	88	84	96	113	115	119	121	91	99	89	75	67
0.75 TO 1.00	145	143	135	133	160	178	173	158	173	163	133	116	114	129	115	92	98	96	81
0.50 TO 0.75	189	194	189	180	179	161	163	173	149	149	144	109	93	72	93	72	76	85	64
0.25 TO 0.50	104	101	110	123	101	62	73	77	76	62	64	64	38	37	55	40	54	64	36
0.00 TO 0.25	46	32	45	48	23	8	6	23	18	17	20	28	16	14	30	17	29	35	39

−0.25 TO 0.00	12	10	8	12	5	2	1	5	1	4	7	10	4	7	10	9	11	27	23
−0.50 TO −0.25	8	5	7	4	2	1	0	1	2	2	2	10	4	5	8	8	11	12	11
−0.75 TO −0.50	2	2	2	5	3	0	2	0	0	1	0	2	3	3	7	3	0	11	9
−1.00 TO −0.75	3	2	2	3	0	0	0	0	0	0	0	3	3	0	5	3	4	11	3
−1.25 TO −1.00	2	1	2	3	0	1	0	0	1	0	0	1	0	1	3	3	3	4	2
−1.50 TO −1.25	0	0	1	0	0	0	0	1	1	0	2	0	0	0	3	0	1	2	1
−1.75 TO −1.50	1	1	3	1	0	0	0	0	0	0	0	0	0	2	2	1	0	3	4
−2.00 TO −1.75	0	0	1	1	0	0	0	0	0	0	0	1	0	0	2	0	4	1	4
−2.25 TO −2.00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	2	1
−2.50 TO −2.25	0	0	1	0	1	0	0	0	0	0	0	1	2	1	1	3	1	0	0
−2.75 TO −2.50	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
−3.00 TO −2.75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
−3.25 TO −3.00	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	2	0
−3.50 TO −3.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
−3.75 TO −3.50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	3	0
−4.00 TO −3.75	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
< −4.00	0	1	2	4	3	1	0	0	0	1	1	1	0	1	2	2	4	9	7
Firms with $c > 1$	127	149	131	119	160	222	219	196	211	231	256	277	336	336	266	341	285	208	274
Firms with $c < 1$	514	492	510	522	481	419	422	445	430	410	385	364	305	305	375	300	356	433	367

policy on corporate investment and dividend decisions is to assess which category of shareholder management has in mind when it makes these decisions.

Taking into account the importance of institutional investors and the opportunities individuals have to avoid taxation, Miller and Scholes [28; 29] conclude that the marginal shareholder is untaxed on *both* dividends and capital gains. Poterba and Summers [36], on the other hand, present evidence that the dividends-capital gains tax differential does affect corporate dividends and investment policies.

Poterba [35, 475–488] has estimated the ratio of the after-tax income from dividends to the after-tax income from undistributed profits to be 0.78 before the 1986 tax changes for a weighted average of all shareholders. Thus, $1 of investment that generated $.78 would produce the same after tax income as $1 of dividends. The median ratio of return on investment to cost of capital for our sample through 1988 was 0.71. Thus, for more than half of our firms the returns on investment are too low to be justified by the differential tax treatment of dividends and capital gains, even assuming that managers are maximizing the weighted sum of all shareholders' after-tax wealth.

One riddle that exists, if low returns on investment are explained by higher tax rates on dividends, is why managers do not provide capital gains to shareholders through stock repurchases, since a dollar of earnings, when used to repurchase shares, produces a dollar of capital gains [31]. A common explanation for why managers pay dividends despite their heavier taxation is "that the payment of dividends restricts the actions of management in a manner that helps reduce the control problems brought about by the separation of management and ownership" [42, 30]. But if these control problems are so severe that they require shareholders to make substantial, unnecessary tax payments to mitigate them, they may also allow managers to make investments at low rates of return.

The literature on the effects of the tax differential on dividends and capital gains is so large and the disagreement among experts is so great that we shall not attempt to draw a conclusion here on this issue. We leave it as a possible explanation for a part of our low estimates of returns.

VI. Conclusions

The 699 companies for which we had complete data from 1970 through 1987 or 1988 invested a cumulative total of $3,670 billion over the period. This investment increased the firms' combined market values by only $558 billion. Assuming an annual depreciation rate of 0.10 of a firm's market value, total cumulative depreciation amounted to $2,029 billion. When this sum is subtracted from gross investment, we find that, on average, each dollar of net investment increased market value by 34 cents. The findings of BHMQ and others for the 1950s and 1960s that larger corporations earn relatively low rates of return on investment are corroborated for the 1970s and 1980s using our measurement technique. The regression results following from this technique corroborate the BHMQ findings that reinvested cash flows earned lower returns than externally raised funds, particularly lower than for debt.

One of the interesting findings of section IV was that the returns on mergers and acquisitions were highest among the several possible company investments. Although we discussed a possible bias that might account for this result,[13] this aside the result is consistent with the hypothesis that

13. A second less serious bias occurs for those mergers for which we proxied the value of the assets purchased by the book value of the acquired firm's assets, since bid prices usually exceed book values of assets by a substantial amount.

large, mature companies undertake mergers that promise lower returns than shareholder opportunity costs, because these investments promise returns that are nevertheless better than what they can earn on reinvested cash flows [30; 18]. This interpretation would also explain why mature firms are more active in undertaking mergers when cash flows are high, and thus why merger waves exhibit a procyclical pattern.

As we have emphasized, our findings that corporations earn low rates of return on investment are fully consistent with shareholders having earned a normal return on their investments. Once the market adjusts to the investment pattern of a firm, its shareholders earn a normal return until the firm changes its investment pattern in an unexpected way. Our results imply, for example, that General Motors' stock would have risen considerably had it chosen to invest less and used those funds to repurchase its own shares. Had General Motors' management announced such an investment policy, its share price would have risen. Following the market's adjustment shareholders would again earn a normal return. Our results imply that a massive increase in corporate market values would have taken place, if the 80 percent of our sample with c's < 1 had cut back on their investments and repurchased their shares. Of course, had all of them chosen to do so, this would have implied a massive shift of resources from corporations back to investors. Had such an event occurred, what would shareholders have done with the funds received? Increased consumption? Invested in real estate? Bought shares abroad? Reinvested in the stock market? If the latter, would that have lowered the cost of capital making heretofore unprofitable investments now profitable? We cannot pursue these questions here. To do so would require a general equilibrium analysis that is beyond the scope of this paper. What our results show is that for four out of five companies shareholders preferred *on the margin* a greater payout of corporate cash flows.

Many observers have complained in recent years that managers follow "myopic" investment strategies out of too much concern for the short run reactions of the stock market. They point to the very low discount rates that Japanese firms use to evaluate investment projects compared to U.S. companies, and claim that the United States suffers from *under*investment in the private sector. Large government deficits and low personal savings rates have been blamed for making the cost of capital to U.S. companies too high, thereby discouraging investment. Our results could be interpreted as being consistent with this view. We find that the owners of most companies prefer less investment and greater cash payouts. Whether such outcomes are consistent with optimal macro policies is another question, as is the issue of what shareholders would want if government debt were not available in such great supply.

As discussed in the previous section, the gap between corporate returns on investment, and the shareholders' discount rate could also be due to the differential tax treatment of dividends and capital gains. If it is, then this tax policy appears to have significantly distorted the allocation of corporate cash flows, and the wisdom of narrowing the tax differential as the 1986 tax reforms did, is confirmed.

On the other hand, if the returns on corporate investment are low relative to the cost of capital because some managers use their discretion to maintain or expand the size of their firm beyond what would maximize shareholder wealth, as the earlier literature hypothesized, then one must conclude that the misallocation of capital due to managerial discretion is a serious and persistent problem in the United States.

We shall not speculate further on which of these or the other possible explanations of our findings is more plausible. We believe that we have developed a useful procedure for measuring returns on investment relative to the cost of capital and that our findings for the 1970s and 1980s are sufficiently important to warrant future research as to their cause.

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