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The Value and Performance of U.S. Corporations

THE VALUE OF A CORPORATION is known from hour to hour in the stock market. The performance of a corporation, from the shareholders' perspective, is measured by the corporation's ability to pay dividends, now and in the indefinite future. Our research investigates the relation between value and performance. We use modern finance theory as a benchmark for valuation. Finance theory holds that, on average, the current value of a share is the discounted value of the future dividends the share earns. The theory is explicit about the discount rate. If, on average, over firms and over time, shares sell for less than the discounted value of the dividends the shares ultimately pay, it means that the stock market undervalues those shares; investors require a higher rate of return than theory suggests they should.

Our motivation for this research is the persistent criticism that American capitalism, with its focus on stock prices determined by myopic investors, diverts managers from efficient, long-term investments toward the style of management most pleasing to the stock market. We ask if certain managerial decisions or firm characteristics result in stock prices that are higher or lower than the benchmark provided by finance theory. Is the market systematically shortsighted with respect to all activities, placing too little value on deferred payoffs? Did this problem worsen

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during the 1980s? Does the market favor higher current accounting earnings? Does it put a higher value on firms that invest in plant and equipment? Does it put a lower value on firms that invest in research and development (R&D), advertising, and other forms of intangible, difficult-to-value capital? Does it put a higher value on firms that pay high dividends? All of these are claims made by the critics of American capitalism.

If the answer is yes to any of these questions, there is an unexploited opportunity for arbitrage in the U.S. stock market. For example, if the market undervalues firms that follow a Japanese-style strategy of high investment in product design and market penetration, then an investor can beat the market by investing in these firms for the long term, deriving high net value after ten or more years of holding the shares until the payoff becomes apparent to other investors. Central to the critique of American capitalism is the absence of patient arbitrageurs with decade-long buy-and-hold strategies. The whole focus of the professional money managers who dominate shareholdings in the United States is on arbitrage strategies with payoffs in minutes, hours, or at most months, say the critics.

Our findings give strong but partial support to the critique. We find statistically unambiguous evidence of important arbitrage profits from long-term strategies. Three of our findings favor the critique.

First, the stock market is systematically shortsighted; it favors policies that generate near-term dividends over those that require waiting. All investors who place their funds in the stock market rather than in the bond market earn large extra rewards over time after consideration of the relative riskiness of stocks and bonds. This finding confirms earlier well-known results on the equity premium puzzle.¹ Second, although the bias against deferred payoffs lowers the incentive for investment of all types, the bias is smaller for investment in plant and equipment than for investments in intangibles. Third, the market disfavors intangible investment in advertising.

On the other hand, we make three findings unfavorable to the critique. First, the market puts a lower value on firms with higher book earnings, after standardizing for actual subsequent performance. In other words, the patient arbitrageur can make money by buying firms

1. Grossman and Shiller (1981) and Mehra and Prescott (1985).

with unusually high reported current earnings and holding them until subsequent performance shows that the market erred by placing such a low value on these firms. Second, the market puts a higher value on R&D investment than is warranted by subsequent performance. The patient arbitrageur comes out ahead by avoiding R&D-intensive firms. (This finding is at a lower level of statistical confidence than the previous ones.) And third, excess discounts *fell* in the 1980s relative to the 1970s.

Our work looks at the values of the shares of a sample containing about half the publicly traded U.S. manufacturing corporations from 1964 through 1991. Within the framework of modern finance theory, we study the relation between share value and actual subsequent payouts to shareholders. Our approach is an application of the general principles developed in Robert Hall's work with Steven N. Durlauf.² The approach permits us to make rigorous statements about departures of share prices from the level mandated by valuation theory and to associate those departures with particular characteristics of firms. Although our approach puts a predicted fundamental value on each firm in our sample for each year, these valuations are quite noisy. We reach stronger conclusions by looking at statistical averages of the difference between stock prices and fundamental values over many stocks and many years, which eliminates most of the noise.

Our work is a departure from the abundant recent literature on valuation anomalies.³ That literature shows that such a thing as an undervalued firm exists. The findings result from a search for the most successful current variables for forecasting later performance. The best forecasting variables are invariably ratios with the current stock price in the denominator. Thus the character of the findings is that investment in stocks with high earnings-price ratios, high dividend-price ratios, or high book value-price ratios will earn abnormally high returns. The researchers in this tradition advocate value strategies and have impressive evidence that such strategies earn high returns when applied in the real world. In contrast, we take as given that such a thing as an undervalued firm exists. We are interested in describing the association of undervaluation with the choices made by the firm's managers. For example, we are inter-

2. Durlauf and R. Hall (1990).

3. Basu (1977), De Bondt and Thaler (1985), Fama and French (1988), and Lakonishok, Shleifer, and Vishny (1993) are leading contributions. Scott (1985) shows the same thing in the framework of Shiller (1981) and LeRoy and Porter (1981).

ested in measuring the undervaluation of firms with policies of heavy investment in plant and equipment. To achieve this objective, we must exclude the current stock price from our right-hand variables. It would be uninteresting in our framework to conclude that firms with low stock prices suffer high discounting in the stock market, even though the stock-picking rule that tells the investor to look for low stock prices generates the highest expected returns. Our work is not a contribution to the finance literature showing that valuation anomalies exist. Rather, we apply the methods of finance in a new way to consider the issues raised by the critics of the stock market.

A second important warning to the reader is that our research deals with the external valuation of the firm. We can comment on how the stock market responds to the observable variables as they are determined by the firm's managers. We cannot comment on the internal responses to the valuation errors made by the stock market. For example, we show that the market is shortsighted with respect to investment; it puts a discount higher than the one merited by finance theory on the subsequent earnings from a capital project. We presume, but we do not show, that managers respond by launching too few capital projects with deferred payoffs. Our work deals with stock market myopia, not corporate myopia. Of the two major elements of the case that capitalism is shortsighted, we consider only one.

The restriction to issues of external valuation brings clarity to our work, we believe. Other approaches have to deal with conflicting internal and external influences. For example, Michael Jensen has argued that the tendency for a firm's share price to jump when the firm announces an investment project is a sign that the stock market is not myopic, and so managers driven by stock market incentives should not behave myopically.⁴ But Jeremy Stein observed that the finding is hardly dispositive.⁵ In his model, managers behave myopically in equilibrium. They set a hurdle rate above the market's discount rate, so the adoption of a project generates a positive gain for the shareholders precisely because of myopia.

Our approach in this paper is complementary to the approach taken by Bronwyn Hall in previous work.⁶ She has studied the relation be-

4. Jensen (1988). He cites the event study of McConnell and Muscarella (1985).

5. Stein (1989).

6. B. Hall (1992, 1993a).

tween the current reproduction cost of a firm's hardware and software capital (plant and equipment, inventories, ownership of other firms, R&D capital, and advertising capital) and the total value of the firm's debt and equity. She estimates an overall Tobin's q , the ratio of the market value of debt and equity to the reproduction cost of the firm's assets. This measure changes sharply over time, in line with previous findings. Novel in her work is a set of estimates of the premiums or discounts in the valuation of different types of capital relative to plant and equipment. Over the period 1973–91, she finds that inventories, equity in other firms, and the intangibles that appear on the balance sheet all enjoy stock market premiums over plant and equipment. R&D capital is valued at a discount of approximately 50 percent over the entire period; the discount changes sharply in the early 1980s from around 30 percent to roughly 80 percent. Although the value of the discount is sensitive to the depreciation rate used in constructing R&D capital, implausibly high depreciation rates (greater than 50 percent per year) would be required to place R&D capital on an equal footing with plant and equipment in this framework. On the other hand, she finds that, during the same period, the market value of advertising spending rose from zero to parity.

Examination of the market value of the firm's assets has the important advantage that the results can be brought right up to date. Our method in this paper requires us to wait until the firm actually makes use of its assets to generate earnings and thus dividends. On the other hand, we can ask a sharper question because we look only at the external valuation. A finding that a particular type of asset suffers a discount in the stock market could tell us that we measured the asset incorrectly, that managers are investing in the asset even though the market knows that the investment will be unproductive, or because the market is shortsighted about the eventual payoff from the investment. Our approach in this paper focuses cleanly on only the last issue.

The Benchmark of Finance Theory: Theoretical Framework and Example

Our framework examines the relation between the price of a share and the payouts made by a corporation to the holder of the share. The owner of a share can influence the time pattern of the payouts by choos-

ing a time to sell. In addition, corporations sometimes pay dividends by issuing additional shares to existing shareholders. We assume that all shareholders are indifferent between selling and retaining shares at all times, so that we can examine valuation under standardized assumptions about the time pattern of payouts. In so doing, we ignore habitat effects that arise from differences in tax rates and other sources of shareholder heterogeneity; these habitat effects will be part of the noise in our valuation equation (surely a very small fraction).

We will explain our theoretical framework informally, using an example based on the Standard and Poor's (S&P) 500 portfolio. Appendix A presents the technical version of the framework.

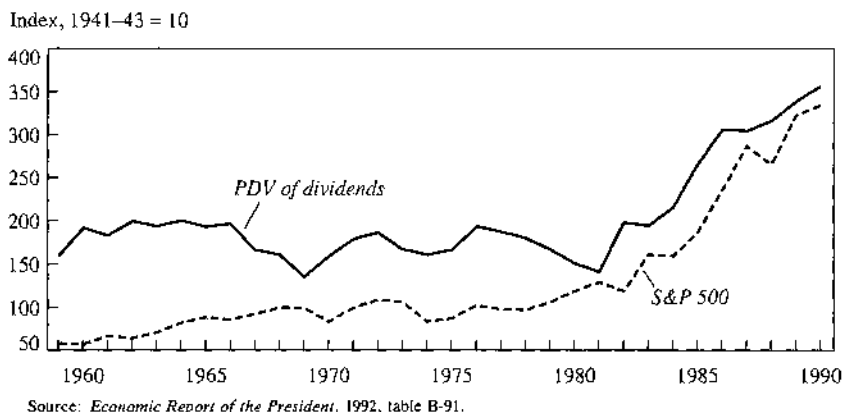
Robert Shiller and, simultaneously and independently, Stephen LeRoy and Richard Porter, introduced the idea of relating the market value of a stock to the present discounted value of its actual later dividends.⁷ They exploited statistical restrictions based on the principle that the later realization differs from the market expectation when the price is determined by an expectation error. Their main point was that an expectation or forecast must have less variance than the ultimate realization. Simple calculations for stock market indexes suggested that this variance inequality failed by a large margin, and Shiller and LeRoy-Porter interpreted the failure as a sign that the market did not adhere to the principle that the market value of a stock is the present discounted value of its dividends.⁸

Our approach moves in the direction of a structural model of the stock market's valuation of a firm. In the tradition of Shiller and LeRoy-Porter, we find a discrepancy between the actual price of a stock and the price the stock should be, given a simple financial valuation model, but we go on to build a more elaborate model that eliminates the discrepancy. We basically make two kinds of elaborations. One is to use discounting formulas that are closer to the exact prescriptions of modern finance theory. The earliest literature assumed a discount rate that was constant over time and over maturity. We use discounts derived from data on U.S. Treasury securities that vary from year to year and do not have a flat term structure. With respect to discounting, we also explore the risk premiums suggested by finance theory.

7. Shiller (1981) and LeRoy and Porter (1981).

8. See Gilles and LeRoy (1991) for a discussion of the huge literature that followed the two original papers.

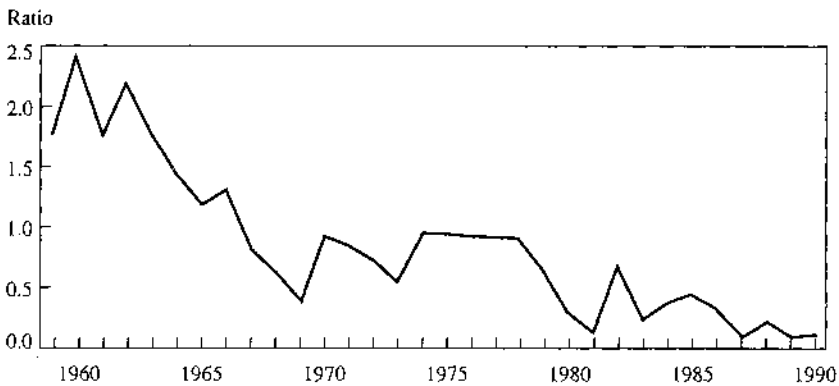
Figure 1. The S&P 500 Stock Price Index and the Risk-free Present Discounted Value of Its Future Dividends



The second type of elaboration is to characterize departures of market values from financial valuation formulas in terms of the observed characteristics of firms. We find that the market tends to use higher discount rates for firms with unusually high earnings and tends to use lower discounts for firms with unusually high R&D spending, unusually high investment in plant and equipment, or unusually high debt.

We look for effects on discount rates, rather than on the level of the market value of a firm. That is, our findings are of the sort, "A firm that raises its investment by 10 percentage points in relation to assets lowers its discount rate by 1 percentage point" rather than "A firm that raises its investment by 10 percentage points raises its market price in relation to the present value of its future dividends by 15 percent." The reason is simple. Many of the firms in our sample make a terminal payment to their shareholders within a year or two of the time we are looking at their share price. The main source of these terminal payments is takeovers. In addition, we take the 1991 share price as a terminal payment for firms surviving to the end of our sample period. Especially in the latter case, we would not expect the same ratio of theoretical to actual value to apply when the terminal payment is just around the corner as when it is in the distant future.

Figure 1 shows this point clearly. We compare the actual level of the S&P 500 stock price index to the present value of actual future divi-

Figure 2. Value Shortfall for the S&P 500^a

Source: See figure 1.

a. The value shortfall is the difference between the discounted present value of future dividends and the index price, divided by the index price. See the text for details.

dends, discounted by the risk-free discounts implicit in the Treasury securities market.⁹ The actual value of the index in 1991 is taken as the terminal dividend. Two features are immediately apparent from figure 1. First, the actual market is generally far below the present value of subsequent dividends; the ratio of theoretical to actual reaches a peak of close to 4 during the early 1960s. Second, the gap disappears as the terminal date approaches. The average ratio of theoretical to actual value would not be an interesting characterization of the discrepancy between the two.

Figure 2 plots a measure we call z_t , the value shortfall. It is the difference between the present value of future dividends, d_t , discounted by $R_{t,\tau}$, and the index price, p_t , divided by the index price,

$$(1) \quad z_t = \frac{\sum_{\tau=t+1}^T R_{t,\tau} d_\tau - p_t}{p_t}$$

where t is the year of valuation, as of the end of the year, τ is the year of future payout, and T is the terminal year, either 1991 or the last year traded.

If theory and reality agreed perfectly, the value shortfall would be an unpredictable surprise that averaged zero. Instead, as in figure 2, the

9. Taken from Coleman, Fisher, and Ibbotson (1989).

value shortfall is always positive, and the shortfall declines to zero as the terminal date approaches. A higher discount rate in the calculation of the present value of dividends could reduce the value shortfall in the right way; the downward effect would be greater in the earlier years. Our method is to infer the excess discount rate from the value shortfall by choosing a rate that makes the shortfall as small as possible. One econometric issue needs attention. Because the value shortfall is calculated from the actual future dividends, we cannot use ordinary least squares as the criterion for a small shortfall. Instead, we use nonlinear two-stage least squares.¹⁰ That is, we use instrumental variables known at time t , and thus uncorrelated with the expectation errors, to measure the magnitude of the value shortfall. Specifically, our criterion is the sum of squared residuals from the regression of the value shortfall on the instrumental variables.

Our procedure is then simply to regress the value shortfall on the instruments, with a correction for serial correlation (explained further in appendix B), for different discounts until we find the discount that makes the regression have its lowest explanatory power. Standard econometric methods permit us to recover the standard error of the estimate of the extra discount. For the S&P 500, we use only the constant as the instrument. The econometric procedure then boils down to finding the value of the extra discount that makes the sum of the value shortfalls equal zero. That value is 0.0426, with a standard error of 0.0032. The procedure indicates that the discount rate should be 4.26 percentage points higher than the risk-free discount used in the calculations for figure 1.

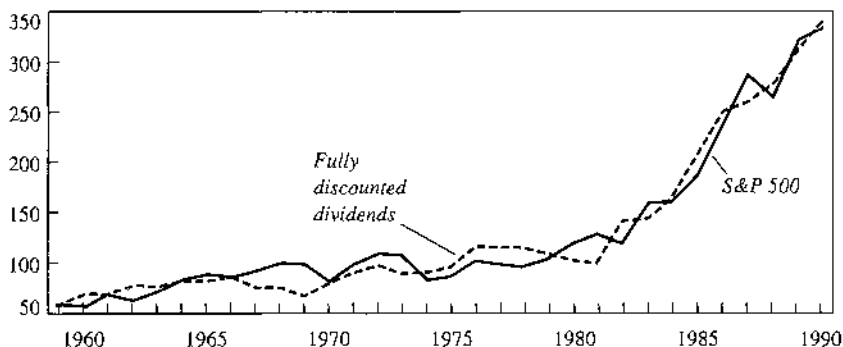
Finally, figure 3 repeats the comparison of the actual value of the S&P 500 stock price index and the present value of its future dividends, using the estimated extra discount. Most of the problems of figure 1 are solved; it is not obvious that the discrepancies are not simply the result of expectation errors about future dividends; for example, the market may have been a little optimistic in the late 1960s and a little pessimistic in the late 1970s.

Figure 3 is about as far as we can go with pure time-series evidence. Our main research makes use of a rich panel of data on the majority of publicly traded manufacturing firms in the United States. The cross-sec-

10. Amemiya (1974).

Figure 3. The S&P 500 and the Fully Discounted Present Value of Its Future Dividends^a

Index, 1941-43 = 10



Source: See figure 1.

a. Figure 3 is similar to figure 1, except that the fully discounted present value of future dividends is discounted at a higher rate to minimize the shortfall. See the text for details.

tion dimension allows us to associate valuation discrepancies with observed characteristics of firms. For example, one of our findings is that the market places a higher value (that is, uses a lower discount) on the dividends of firms with high ratios of investment to total book assets. To reach this conclusion, we use a specification that makes the extra discount depend linearly on the investment-assets ratio. We also use instrumental variables that are derived from the investment-assets ratio. The effect of this specification is to assign a higher discount rate to firms with higher investment-assets ratios, if the coefficient of the variable is positive. As it happens, the coefficient is -7.84 with a standard error of 1.78 . The interpretation is that firms with more investment get lower dividend discounts in the stock market, and thus higher market values. A firm with 10 percentage points more investment in relation to assets has a discount rate that is 0.784 percentage points lower.

We have already noted that we view many of our firms as making terminal payouts to their shareholders before the end of our sample period in 1991. Our valuation method is based on a particular strategy of a representative shareholder about when to sell. Our specific assumptions are that the shareholder keeps his or her shares, including all dividends paid in shares, and that our hypothetical shareholder takes all cash dividends as payouts. With respect to tender offers, we proceed in the following way: If the shares of a corporation continue to be traded after a tender

offer, our hypothetical shareholder does not sell to the tenderer. Dividends from the new shares are treated as dividends from the existing share (that is, a stock dividend is treated just like a split). If the shares do not continue to be traded, the shareholder sells at the last reported transaction price. The proceeds of the sale are considered the terminal payout. If a firm's shares are still traded in 1991, our hypothetical shareholder sells at the end of that year. Our hypothetical shareholder pays no taxes on any transactions.

Specification and Instruments

Our interest in this paper is in the way that market discounts are associated with observable characteristics of firms. For this purpose, we use the following model:

$$(2) \quad z_{i,t} = \mu(x_{i,t}, \gamma) + u_{i,t} + \epsilon_{i,t}$$

Here $z_{i,t}$ is the value shortfall calculated by using the standard principles of finance theory, $\mu(x_{i,t}, \gamma)$ is an extra discount obtained by applying the vector of parameters γ to $x_{i,t}$, a vector of characteristics of firm i in year t . Each element of γ tells how the corresponding characteristic influences the market discount rate applied to the dividends of the firm. The disturbance $u_{i,t}$ is noise in the firm's market value not associated with the observed characteristics of the firm, and the disturbance $\epsilon_{i,t}$ is the error in the market's expectations of future dividends.

We choose our right-hand variables, $x_{i,t}$, so that they are uncorrelated with the disturbance, $\epsilon_{i,t}$. That is, we use characteristics that are known to the market at the time that the stock price is determined. Because expectations are formed on the basis of our variables (along with many other variables that we do not include), the expectation error will not be correlated with our variables if expectations are rational.

Within the wide group of variables known at time t , we choose a particular group to suit the purposes of our research. As we explained earlier, our purposes are quite different from previous work in finance that has demonstrated the existence of valuation anomalies. Finance research has shown—without exception, as far as we know—that variables constructed from the current stock price are the best way to show that there are variables known at time t that are correlated with subsequent increases in value. In place of our equation 2, finance economists

have broken down the observed relation between the stock price and subsequent dividends into two components:

$$(3) \quad z_{i,t} = \eta_{i,t} + \epsilon_{i,t}.$$

Their research has concentrated on showing that overall noise, $\eta_{i,t}$, is present. Our procedure is, in effect, to regress overall noise on certain characteristics of the firm, chosen to answer the questions that motivate our research. We thus break down overall noise into two components, the part associated with our selected firm characteristics, $\mu(x_{i,t}, \gamma)$, and a residual, $u_{i,t}$, which is uncorrelated with the characteristics.

It would be contrary to our purposes to include any right-hand variable that is inherently correlated with the valuation error, $u_{i,t}$. As a practical matter, this means that our right-hand variables should not depend on the current stock price. It would be impossible for the stock price not to be correlated with the valuation error. By analogy, in a standard regression setting, one can never include as a right-hand variable a variable that is an important part of the left-hand variable. To put the point differently, we gain nothing by identifying a firm as having the characteristic "undervalued in the stock market" and then showing that undervalued firms suffer higher discounts of their future expected dividends. The inclusion of a variable based on the stock price would bias the coefficients of the characteristics we are interested in, because the stock price is correlated with those characteristics.

In this respect, our research is fundamentally different from work in finance that seeks to show that there are undervalued firms and that investment in those firms yields arbitrage profits. We take that point as given and ask to what extent undervaluation can be associated with firm characteristics. Our results do not identify the most promising arbitrage strategies. To find them, we would include all possible variables, both firm characteristics and pure predictors based on measures of undervaluation derived from the current stock price.

Although we generally interpret our results as showing how the market discounts firms with different characteristics, with the implicit hypothesis that causation runs from characteristics to discounting, we cannot rule out causation in the opposite direction. This issue arises most acutely for investment. If firms that enjoy purely accidental higher valuation and lower discounts respond by investing more, investment will be associated with lower discounts and higher valuations. For this reason,

we are cautious in placing an aggressive causal interpretation on our findings.

Stock Price Levels or One-year Returns?

There is a dispute within finance theory between proponents of studying the levels of security prices (the tradition started by Shiller and LeRoy-Porter) and the proponents of studying the returns over fairly brief holding periods (sometimes called the Euler equation approach). John Cochrane has argued that there is no substantive difference between the two approaches.¹¹ In our own work, the issue arises in terms of the serial correlation of the combined disturbance in our valuation equation, $u_{i,t} + \epsilon_{i,t}$. If the serial correlation coefficient is close to 1.0, once we correct for serial correlation with an autoregressive transformation, we will be dealing with a variable similar to one-year returns. In that case, our finding of higher discounts associated, say, with higher book earnings could be reformulated as persistently higher future one-year returns for a firm with above-average book earnings in a particular year.

On the other hand, if the serial correlation is substantially less than 1.0, our approach is different from, and markedly superior to, the approach based on one-year returns. A lower serial correlation will arise if the noise component of the disturbance is a large part of the story, and the serial correlation of the noise is much less than 1.0. The serial correlation of the expectation error is inherently close to 1.0. The superiority of our approach is just the standard econometric point that an estimator is more efficient if it takes proper account of the covariances of the disturbances. The effect of an autoregressive transformation with a coefficient of close to 1.0 is to give very little weight to low-frequency movements of the left- and right-hand variables. Our interest is precisely in a low-frequency phenomenon, namely chronic excess discounting of dividends in general and those of certain types of firms in particular. We get much more precise estimates of our coefficients if our autoregressive correction uses a parameter well below 1.0 than if it uses a parameter of 0.9 or above.

11. Cochrane (1991).

Our example of the S&P 500 illustrates this point dramatically. Our standard error for the excess discount is 32 basis points. The serial correlation parameter used in this estimate is 0.40. In contrast, the standard error of the estimate of the mean of the excess return is 220 basis points; the implicit autoregressive parameter is around 0.94. If we repeat our method with an autoregressive parameter of 0.94, we get a standard error of about 190 basis points.

In our panel data, however, we find serial correlations of the excess valuations of close to 1.0, so we do not achieve the sharp results that are available for aggregate data. Noise at the firm level appears to be much more persistent than at the aggregate level.

Relation to the Work of Brainard, Shoven, and Weiss

Our work has some of the same objectives as the major project of William C. Brainard, John C. Shoven, and Laurence Weiss (BSW).¹² Their project covered much more ground than ours. We consider the valuations of particular securities: the common stocks of firms. BSW considered the valuation of entire firms. They viewed the holders of the equity and debt of a firm as having access to the entire cash flow of the firm, while we look only at the value that the market places on the dividends that managers choose to pay to their shareholders.

BSW's major theme was the collapse of the market value of firms in relation to their projected cash flows from 1968 to the last year included in the paper, 1977. At the time, the perversely low level of the stock market loomed large in any analysis of corporate valuation. From today's perspective, the depressed stock market of the 1970s seems less significant. Figure 3 shows that the market did undervalue corporations from 1974 through 1979, but that this undervaluation was not severe by historical standards. The fairly close tracking of actual stock prices and discounted future dividends in the 1980s makes the overall record seem much closer to the predictions of valuation theory than the reader of the 1980 paper would think.¹³

12. Brainard, Shoven, and Weiss (1980).

13. Robert Hall was one of the discussants of the 1980 paper. He wrote, "Only the surge in stock prices since the authors began work on this paper threatens to undermine its conclusion. . . . Whatever the explanation of low market values, the lesson seems to be to buy stocks." R. Hall (1980b, pp. 506, 508). This is the only published personal financial advice he has ever offered and he plans to quit while he is ahead.

BSW's measure of undervaluation in the mid-1970s was much greater than the one shown in figure 3. Part of the reason appears to be that dividend payouts were low at that time relative to earnings. BSW projected levels of earnings that did not materialize as later dividends, it would appear.

BSW considered risk within essentially the same framework as we have adopted in this paper. In a subsequent paper, William C. Brainard, Matthew D. Shapiro, and John C. Shoven pursue risk measurement extensively.¹⁴ They use a conventional measure of the risk of a portfolio based on the covariance of its return with the market return, and also a novel measure of "fundamental" risk based on the covariance of a firm's earnings with aggregate earnings. They find that the price of fundamental risk is surprisingly low, although there is no question that fundamental risk helps explain differences in expected returns among firms. We hope to use similar risk measures in future research.

Risk and Value

Finance theory is unsettled about the measurement of risk. In principle, a household's marginal utility of consumption provides a logical way to measure the extra discount that should be applied to a risky asset. What matters is the nondiversifiable risk of an asset. Once the household has made the optimal selection of a diversified portfolio, the risk discount for one asset should be related to the covariance of the return of that asset with marginal utility. As the covariance becomes more negative, there is a greater tendency for the asset to pay less when times are bad, as measured by high marginal utility. The consumption capital asset pricing model (CCAPM) provides, in theory, a complete answer to the question of the pricing of risk.

The failure of the CCAPM is notorious in finance theory. Sanford Grossman and Robert Shiller showed that returns on stocks and bonds have almost exactly the same covariance with marginal utility, when the latter is taken from a constant-elasticity (constant relative risk aversion) utility function.¹⁵ Thus both stocks and bonds should have the same risk discount, and further, it should be a tiny fraction of 1 percent. In fact,

14. Brainard, Shapiro, and Shoven (1991).

15. Grossman and Shiller (1981).

stocks consistently provide returns of about 5 percent per year in excess of bonds. The CCAPM gives no insight into the premium paid by stocks, or, to put it differently, it cannot explain why the market prices stocks as if they were much riskier than bonds. The same puzzle was explored further by Rajnish Mehra and Edward C. Prescott in their well-known paper.¹⁶

Lars Peter Hansen and Ravi Jagannathan extended this line of work by asking about the stochastic properties of an unobserved variable that might be playing the role that theory assigns to marginal utility.¹⁷ They found that the volatility of such a variable must be surprisingly high in order to rationalize the equity premium. Cochrane and Hansen provide a detailed summary of the current state of this line of thought.¹⁸

We verified that the covariance of the dividends of our sample of firms with marginal utility calculated from aggregate consumption was almost exactly zero. We concluded that the CCAPM provided no help in understanding the substantial extra discount that the market applies to the dividends of our firms relative to the future returns from Treasury bonds.

An older view in finance theory takes a more modest and empirical approach to the pricing of risk. The traditional CAPM (TCAPM) takes no stand on why a broad, diversified portfolio like the S&P 500 is valued at a discount relative to riskless securities. Rather, it simply takes that extra discount as data. The TCAPM prices individual risky securities by comparing their risk to the risk of the market portfolio. This risk is measured by regressing the individual security's returns on the market return to find the beta. The risk premium for the security is just the beta times the market premium over the risk-free rate.

In principle, the concept of return that is relevant in our framework of long holding periods is the dividend; the beta should be measured by regressing one stock's dividend growth on the dividend growth of the market portfolio.¹⁹ We experimented with regressions of this type, but found, as with the CCAPM, that the covariances are essentially zero. The reason that the TCAPM yields sensible results as normally applied

16. Mehra and Prescott (1985). Also see Mankiw and Shapiro (1986).

17. Hansen and Jagannathan (1991).

18. Cochrane and Hansen (1992).

19. Brainard, Shapiro, and Shoven (1991) make the same observation with respect to earnings; they measure the "fundamental" beta by regressing a firm's earnings on aggregate earnings.

is that beta is measured from returns for very brief holding periods, such as one day. The high covariance of these returns with the market comes not from changes in dividends, but from changes in the market capitalization ratios for dividends that are common across stocks. Our procedure was to use an excess discount of 5.28 percent to discount all of the stocks in our sample.

The Critique of American Capitalism

Many economists, and even more managers and noneconomist commentators, believe that there are important departures from the finance-theory model of the stock market. Two important recent statements of this view by economists are by Michael Porter and by Kenneth Froot, Andre Perold, and Jeremy Stein.²⁰ James Poterba and Lawrence Summers document the extreme prevalence of the view among managers.²¹ In our framework, the critique holds that the market systematically discounts the expected future performance of some types of firms at excessive rates. Even though this fact is known in the market, arbitrageurs do not exploit the fact; they are too busy chasing arbitrage profits available from short-term trading strategies. Managers respond to the perverse market valuation of their activities by pursuing projects that are highly valued and avoiding those that are discounted excessively. The critique has an important international comparative element. In Japan and Germany, there are significant permanent investors in firms who are informed about the prospective performance of firms and are capable of and interested in arbitrage to take advantage of any valuation failures that might appear in the market. Consequently, Japanese and German firms can invest in invisible activities, with negative effects on current earnings but high contribution to eventual performance, from which the U.S. firm is barred. In particular, the Japanese firm can sacrifice current earnings by penetrating huge markets with low prices, with high deferred value once the markets are fully developed. The comparison of the Japanese and U.S. auto industries invites this interpretation.

As Froot, Perold, and Stein emphasize, high turnover among share-

20. Porter (1992) and Froot, Perold, and Stein (1993).

21. Poterba and Summers (1993).

holders is not by itself good evidence that the United States lacks investors willing to take long-term arbitrage positions. We know that the labor market has high average turnover rates at the same time that most work is done in the course of employment relationships that will last a large fraction of a lifetime.²² Similarly, in the stock market, high average turnover is completely consistent with the existence of a significant fraction of committed shareholders who will never sell. Froot, Perold, and Stein cite evidence that this is precisely the case in Germany and Japan, where turnover rates in share ownership are actually higher than in the United States. In both countries, banks hold long-term equity positions in corporations. By contrast, modern American capitalism has few core shareholders. Most shares are held by institutions that are legally required to be extremely diversified and are barred from holding significant shares of the ownership of any one corporation. Moreover, these institutions trade all their holdings actively and do not have traditions of long holding period arbitrage.

The United States has free entry in financial intermediation. Although two important types of intermediaries—banks and mutual funds—face major legal obstacles to long-term arbitrage in the stock market, other intermediaries can operate without limitations. Recently, three funds have entered the market with the precise intent of long-term arbitrage based on “relationship investing.” These are Allied Partners, created by Dillon, Read & Company, Corporate Partners, created by Lazard Freres, and Lens, created by Robert A.G. Monks. These funds make sizable investments and typically take one or more board seats. In view of the general responsiveness of the U.S. economy to arbitrage opportunities and the response that has actually occurred, it would be unreasonable to project the continuation of large arbitrage opportunities in the future. Our findings support the idea that arbitrage has improved over time; the U.S. stock market put a higher value on future dividends in the 1980s than in earlier decades.

Porter summarizes the short time-horizon critique of American capitalism in these words:

Because of their fragmented stakes in numerous companies, short expected holding periods, and the lack of access to “inside” information through disclosure or board membership, institutional investors tend to heavily base buy/sell choices on relatively limited information that is oriented toward predicting near-

22. R. Hall (1980a).

term price movements. They are driven by the system to focus on measurable company attributes, such as current earnings or patent approvals, as proxies of a company's value. The value proxies employed vary among different classes of companies and can lead to underinvestment in some industries or forms of investment, while allowing overinvestment in others.²³

Porter later explains that "the dominant value proxy employed by investors and analysts is current earnings, which has a demonstrably strong effect on share prices."²⁴ As evidence in support of this view, he observes that earnings announcements tend to cause changes in share value. But this evidence is inconclusive because even the strictest finance theory view with no arbitrage opportunities would hold that new information about earnings should cause changes in share prices. Our framework provides a way to look for excess sensitivity of stock prices to earnings. We look for an effect of earnings on stock prices beyond what is merited by actual subsequent performance. If the critique is correct and investors are using current earnings as an inappropriate proxy for subsequent performance, then we should find that firms with higher earnings enjoy lower discount rates for their future performance. In fact, we find the opposite: high-earnings firms suffer higher discounting of their subsequent performance.

Porter also identifies biases in the composition of investment:

The American system favors those forms of investment for which returns are most readily measurable, due to the importance of financial returns and the limited information available to investors and managers. For most companies, investments in plant and equipment with easy-to-measure cash flows are more confidently valued and justified than investments in R&D, training, or other forms where the returns are more difficult to quantify. Intangible assets such as reputation, a technical base, or information systems are far more difficult for value proxy and event forecast valuation methods to handle, even though they have a major impact on competitiveness. Internally intangible assets are often not treated as investments, and their cash flows are hard to assess.²⁵

For exactly the reasons Porter mentions, we lack data on many forms of intangible investment. Future research may be able to develop measures of training, reputation, market development, information systems, customer and supplier relationships, and other intangibles not reported in corporations' financial statements. We are able to study the relationship

23. Porter (1992, p. 8).

24. Porter (1992, pp. 43–44).

25. Porter (1992, pp. 63–64).

between hardware investments and the discounting of subsequent performance, with results that give considerable support to the critique. Firms with higher plant and equipment investment enjoy lower discounts and higher share prices. We also look at two intangibles, R&D and advertising. Here our results are mixed. There is weak evidence that R&D-intensive firms enjoy lower discounts of subsequent performance, contrary to the critique. On the other hand, the critique finds support in our finding that advertising-intensive firms suffer higher discounting of future performance, although Porter and others have hardly stressed that one of the failures of American capitalism is to advertise too little.

One of the themes of the short time horizon critique is that the situation has worsened over time. Porter notes that institutional shareholders rose from 8 percent of the market in 1950 to 55–60 percent in 1990 and that the average holding period for stocks fell from seven years in 1960 to two years in the 1990s.²⁶ Burton Malkiel provides evidence that the market valued expected dividend growth much less in the 1980s than in the 1960s, which he interprets as evidence that time horizons of investors in the stock market shortened.²⁷ (We will discuss his method later in this paper.) Our approach to the issue of changes over time is simply to repeat our analysis for each of the three decades spanned by our data. We find evidence of lengthening time horizons or lessening excessive discounting of future performance.

An important element of the critique of American capitalism is that managers focus attention on current stock prices when the attention would better be placed on long-term performance. Obviously, in an economy where the market gave the best possible valuation of expected future performance, the focus on the current stock price serves efficiency. But defective stock-market valuations based on value proxies will make managers emphasize activities that affect the proxies favorably, contrary to the dictates of efficiency. Because we use the benchmark of actual subsequent performance, which will include all the adverse effects of distorted managerial incentives, we cannot comment on this aspect of the critique. Bronwyn Hall looks at one important aspect of this issue—R&D investment—in a 1993 paper,²⁸ and Warren Farb considers hardware investment.²⁹

26. Porter (1992, p. 59).

27. Malkiel (1993).

28. B. Hall (1993b).

29. Farb (1993).

Data

We use a sample of the great majority of publicly traded firms in manufacturing assembled by Bronwyn Hall in connection with earlier work.³⁰ Data on year-end stock prices, on terminal prices due to takeovers, and on dividends and other distributions to shareholders are from the Center for Research on Securities Prices (CRSP), University of Chicago. Data on balance sheets and operating statements are from Compustat. Data on “bullet rates” (the implied prices of pure discount instruments) from the U.S. Treasury securities market are taken from the work of Thomas S. Coleman, Lawrence Fisher, and Roger G. Ibbotson.³¹ We define the variables as follows:

The *stock price* is the closing share price on the last business day of the year, adjusted for splits.

The *dividend* comprises dividends or other cash distribution to shareholders, including cash received from takeover or liquidation, or the terminal stock price at the end of 1991. Except for the terminal stock price, we assume all dividends are received in the middle of the year.

The *discount* is the bullet discount rate from Coleman, Fisher, and Ibbotson,³² multiplied by 0.9472 raised to the power of the number of years into the future.

Assets are the book value of plant, equipment, inventories, and investments in unconsolidated subsidiaries, taken at the end of the year and adjusted for effects of price changes.

R&D is the spending on research and development during the year.

Advertising is the spending on advertising during the year.

Investment is spending on plant and equipment during the year.

Debt is measured as the book value of outstanding long-term debt, taken at the end of the year.

30. Bound and others (1984), B. Hall and others (1988), and B. Hall (1990). The data set is the multigenerational lineal descendent of the heroic efforts of Arthur Siepien for Brainard, Shoven, and Weiss (1980). The results presented in this version of the paper are for about half the total sample: those based on companies whose fiscal years are calendar years.

31. Coleman, Fisher, and Ibbotson (1989).

32. Coleman, Fisher, and Ibbotson (1989).

Earnings are book earnings per share, after deducting interest and taxes, not including extraordinary special items, for the preceding year. (For example, for the observation using the stock price as of December 31, 1986, the earnings are for the calendar year 1985.)

Value shortfall is as defined in equation 1: the difference between actual present discounted value of dividends and share price, all divided by the share price.

We specify our regression as follows:

The *dependent variable* is the current value shortfall less the serial correlation coefficient for this year, multiplied by next year's value shortfall.

Independent variables consist of the following ratios, plus a dummy for each year, serially transformed: R&D-assets, advertising-assets, investment-assets, debt-assets, retained earnings-assets, and dividends-assets.

The *instruments* used as predictors of the independent variables are specified as follows. We define the discounted dividend predictor as the current dividend yield multiplied by the sum of the future discounts from this year through 1991 (see appendix B for a more complete discussion); the instruments are a full set of annual dummy variables, the annual dummies multiplied by the discounted dividend predictor, the six firm characteristics, the six characteristics multiplied by the discounted dividend predictor, and the six characteristics multiplied by the discounted dividend predictor with dividends lagged one year.

Table 1 presents descriptive statistics for the data: mean, median, and interquartile range (location of twenty-fifth and seventy-fifth percentiles). The information in parentheses alongside each variable name is the trimming criterion we used for excluding observations based on the values of the variable.

Note that both R&D and advertising are small in relation to assets. The low values of R&D and especially advertising in the period 1964–70 result from the fact that many firms omitted these items from their operating statements during the 1960s. (Financial Accounting Standards Board reporting requirements for these items were instituted in the early 1970s.) Because we include dummies for missing data in our valuation equation, omitted data do not bias the results, but we do not consider

Table 1. Statistics on Variables Used in Regressions
Percent

<i>Variable (cutoff)^a</i>	<i>1964-90</i>	<i>1964-70</i>	<i>1971-80</i>	<i>1981-90</i>	<i>R²</i>
R&D-assets (<50 percent)					
Mean	2.70	1.34	2.24	3.69	0.48
Median	0.94	0.00	1.04	1.56	0.19 ^b
Interquartile range	0,3.64	0,1.56	0,3.21	0,4.91	
Advertising-assets (<50 percent)					
Mean	2.16	0.16	2.26	2.76	0.48
Median	0.00	0.00	0.00	0.00	0.27 ^b
Interquartile range	0,1.94	0,0	0,2.00	0,2.73	
Investment-assets (<50 percent)					
Mean	9.06	9.73	8.39	9.58	0.41
Median	7.72	8.77	7.19	7.93	0.20 ^b
Interquartile range	5.06,11.5	6.23,12.3	4.77,10.6	5.06,12.2	
Debt-assets (<200 percent)					
Mean	25.96	26.77	23.86	28.03	0.36
Median	22.98	24.22	22.27	23.16	0.19 ^b
Interquartile range	12.2,34.7	16.2,34.0	11.6,32.6	10.9,38.3	
Lagged earnings-assets (<50 percent)					
Mean	16.66	26.13	17.41	12.50	0.57
Median	9.90	16.18	10.13	8.52	0.29 ^b
Interquartile range	4.4,21.8	6.8,34.9	4.86,22.7	3.26,17.6	
Dividends-assets (<20 percent)					
Mean	2.58	3.39	2.43	2.47	0.60
Median	2.04	3.01	1.93	1.79	0.35 ^b
Interquartile range	0.72,3.46	1.82,4.33	0.90,3.11	0,3.42	
Value shortfall (<1000 percent)					
Mean	-5.29	-23.82	7.22	-12.90	
Median	-17.83	-36.66	-7.23	-20.68	
Interquartile range	-50.8,25.1	-59.7,-0.2	-44.6,41.7	-52.5,16.7	
Addendum					
Percent on NYSE or AMEX	...	100	72	58	
Number of observations	11,032	1,561	5,022	4,449	

Source: Authors' calculations based on Compustat and CRSP data on U.S. manufacturing firms. For definitions of variables, see the text.

a. The values at which observations were trimmed are shown alongside the variable names.

b. The R^2 is for the regression of quasi-first-differences.

our estimates of the effects of the two variables on valuation in the 1960s to be reliable.

The next-to-last line in table 1 shows another important feature of the data. All our data for the 1960s come from firms listed on the two major exchanges—the New York and the American (NYSE/AMEX). The sample includes a fair number of over-the-counter (OTC) firms in the 1970s, and even more in the 1980s. The composition of the sample shifts

toward smaller firms over time. This feature of the sample, which seems to have little effect on our results, is dictated by Compustat's changing coverage of firms.

Results

Table 2 shows our basic results for the entire period, 1964–90. Each coefficient shows the number of percentage points by which the annual discount rate applied to future dividends increases for a unit change in the corresponding firm variable. For example, the coefficient of -7.84 for the investment-assets ratio indicates that an increase in investment by the amount of assets (that is, an increase of 1.0 in the investment-assets ratio) lowers the discount rate by 7.84 percentage points. Obviously, differences of this magnitude are not found in the data. The second column of table 2 shows the effect on the discount in basis points for a one-standard-deviation increase in the corresponding variable. For example, a one-standard-deviation increase in the investment-assets ratio (an increase of 0.060) decreases the discount rate by 0.47 percentage points.

Our results show that R&D-intensive firms enjoy lower discounts. A firm that is one standard deviation above average in its ratio of R&D spending to assets has a discount about half a percentage point lower than average. There is considerably more sampling variation in the estimate of this coefficient than in the one for hardware investment. Advertising-intensive firms face slightly higher discounts. Not only is the coefficient small in magnitude, but it is very small in relation to the statistical uncertainty as measured by the standard error.

On the other hand, firms with high levels of investment in plant and equipment enjoy substantially lower discounts and higher share values. The coefficient of -7.84 percentage points represents an important effect of investment on discounting: the discount rate is 47 basis points lower for a firm that is one standard deviation higher in the distribution of the investment-assets ratio. The coefficient is measured with considerable precision, as shown by its standard error of 1.78 percentage points.

The results show that debt has little effect on the firm's discount rate. A firm one standard deviation above average in this distribution has a

Table 2. Coefficient Estimates for Firm Variables and Their Corresponding Effects on the Discount Rate^a

<i>Independent variable</i>	<i>Coefficient</i>	<i>Effect on discount of one standard deviation increase (basis points)</i>
Constant	-2.02 (0.68)	...
R&D-assets	-11.87 (6.75)	-51
Advertising-assets	2.49 (3.83)	14
Investment-assets	-7.84 (1.78)	-47
Debt-assets	1.07 (1.02)	22
Lagged earnings-assets	3.12 (0.44)	74
Dividends-assets	-0.44 (7.55)	1
<i>Summary statistic</i>		
SER	30.21	
R ²	0.13	
Durbin-Watson	1.64	
Number of observations	11,032	

Source: Authors' calculations based on Compustat and CRSP data.

a. The dependent variable is the current value of the shortfall less the serial correlation coefficient for the current year, multiplied by next year's shortfall. Two dummy variables for R&D expenditures equal to zero and advertising expenditures equal to zero have also been included in the regression. Standard errors are shown in parentheses.

discount rate 22 basis points higher. This finding goes in the direction predicted by finance theory: all else held constant, a more leveraged firm has higher nondiversifiable risk and a higher discount rate. But the coefficient is not large, and is only slightly larger than its standard error.

Firms with higher book earnings in relation to assets have higher discounts in the market. Far from favoring the current bottom line, the market seems to place a lower value on a firm with unusually high earnings. A firm one standard deviation higher in the distribution of assets faces a discount about three-quarters of a percentage point higher. The finding is statistically unambiguous and is the most robust of all of our findings. Our conclusion that an investor can beat the market by selecting firms with high earnings relative to assets is an interesting complement to earlier findings that investing in firms with high earnings-price ratios is a

good strategy. Our results show that the role of earnings is more than just to normalize the stock price. It is smart to buy stocks with high earnings-price ratios both because stocks with high earnings are attractive and because stocks with low prices are attractive. We have confirmed this point by including the assets-price ratio in a variant of the equation estimated in table 2, but for reasons explained earlier, we do not pursue specifications that include the stock price.

We find only a tiny effect of dividend policy on discounting. Because there is relatively little variation in dividends compared to the other variables, the standard error of the coefficient relating dividend policy to discounting is relatively high.

Table 3 breaks the results down by decade. Recall that the sample for the 1960s is made up entirely of firms listed on the New York or American stock exchanges. The over-the-counter market is not represented in the sample until the 1970s and becomes a much larger part of the sample in the 1980s. We estimated the valuation equation separately for NYSE/AMEX firms and OTC firms, and found remarkably little difference. A second prefatory comment is that the results for the 1980s are for much shorter holding periods than for the earlier decades, both because all firms have terminal prices in 1991 if not before, and because takeovers were much more common in the 1980s.

Most of the results are reasonably consistent across the three decades, after consideration of sampling variation. The R&D coefficient—showing lower discounting for firms investing in this form of intangible capital—is considerably larger in the 1970s and 1980s, although for the 1980s this may be the result of sampling variation alone. The effect of advertising on discounting is very large in the 1980s, a puzzle we plan to investigate more thoroughly in future work. The effect of debt on a firm's discount rate is small in all three decades. The adverse effect of book earnings on discounting is also confirmed in all three decades and becomes conspicuously stronger in the 1980s.

The addendum to table 3 shows the fitted discount rate for the median and mean firms in the three decades. The median firm has the characteristics of the median values of the six firm variables calculated over the entire period (the values of the variables used to calculate the discounts in table 3 are the same for the three decades; only the coefficients change). The mean firm has the mean values of the six characteristics. By both measures, the discounts fell dramatically in the 1980s. The discount rate we find to apply in the stock market for the median or mean

Table 3. Regression Results by Decade^a

<i>Independent variable</i>	<i>1964-70</i>	<i>1971-80</i>	<i>1981-90</i>
Constant	-0.57 (1.19)	1.11 (0.65)	-3.57 (1.49)
R&D-assets	-3.70 (12.03)	-15.78 (7.70)	-20.50 (13.57)
Advertising-assets	-37.88 (10.91)	0.38 (4.63)	11.40 (6.48)
Investment-assets	-2.45 (3.80)	-8.74 (2.59)	-11.72 (4.33)
Debt-assets	2.59 (1.56)	-2.13 (1.27)	-1.11 (2.16)
Lagged earnings-assets	2.57 (0.78)	2.27 (0.62)	6.30 (1.35)
Dividends-assets	-3.45 (9.69)	18.50 (10.79)	42.79 (15.60)
<i>Summary statistic</i>			
SEr	39.53	37.05	31.41
R ²	0.05	0.14	0.01
Durbin-Watson	1.46	1.37	1.51
Number of observations	1,561	5,022	4,449
<i>Addendum</i>			
Discount rate of the median firm	-2.94 (1.56)	0.07 (0.88)	-4.80 (1.97)
Discount rate of the mean firm	-2.56 (1.50)	-0.19 (0.91)	-3.93 (1.98)

Source: See table 2.

a. The dependent variable is the current value of the shortfall less the serial correlation coefficient for the current year, multiplied by next year's shortfall. Two dummy variables for R&D expenditures equal to zero and advertising expenditures equal to zero have also been included in the regression. Standard errors are shown in parentheses.

firm is the risk-free discount plus 5.28 percent for the equity premium less the numbers given in table 3. By the 1980s, the median firm had gained back almost all of the equity premium and the mean firm had made about a percentage point less progress.

Relation of Our Findings to Burton Malkiel's

Our results offer much less support to the hypothesis of stock-market myopia than those of Burton Malkiel.³³ Whereas we find less myopia in

33. Malkiel (1993).

the 1980s than earlier, Malkiel interprets his evidence as showing much more myopia recently. Malkiel's basic finding is that the cross-section regression of firms' price-earnings ratios on earnings growth forecasts of Wall Street analysts yields a much smaller coefficient for data from the 1980s than for data from the 1960s. An additional finding, which he considers highly supportive of worsening myopia, is that much of the decline has occurred in the coefficient of five-year-ahead earnings growth expectations, rather than in the coefficient of one-year-ahead expectations.

We believe that the use of analysts' earnings growth forecasts would be a useful addition to our own work. At a minimum, they would provide extra predictive power in our first-stage regressions. However, we do not believe that Malkiel's use of the growth forecasts has much to say about myopia. The problem arises in his use of the price-earnings (P/E) ratio as the dependent variable in his regressions. Much of the cross-sectional variation in P/E ratios in a given year comes from transitory fluctuations in earnings. A company can have a lofty P/E either because it has excellent long-run growth prospects or because earnings are temporarily depressed. Studying P/E ratios in a cross section would be analogous to studying the average propensity to consume in a cross-section study of consumption. Families with temporary declines in income can have average propensities to consume of unlimited positive values; so can the P/E ratios of firms. And a family or a firm that had a loss in a particular year would be a still bigger problem.

The regression coefficient of the P/E ratio on earnings growth, as calculated in cross sections by Malkiel, does not have any tight connection to finance theory. Rather, it depends on the details of the stochastic process governing earnings. The coefficient is almost infinitely sensitive to the likelihood of near-zero earnings. It is equally sensitive to the treatment of firms with negative earnings. Changes in the mean and dispersion of earnings over time can have large effects on the cross-sectional regression coefficient. In the consumption literature, the analogous point is Milton Friedman's observation that the cross-sectional consumption function is different for farmers than for wage-earners because farmers have larger transitory components of earnings.³⁴ Had Friedman and others studying consumption in cross sections chosen to state the consumption function in terms of the ratio of consumption to income (as

34. Friedman (1957).

Malkiel did for the stock market), the differences between farmers and wage-earners would have been much larger.

The book earnings of a corporation are the creation of accounting rules, which changed a great deal between the 1960s and the 1980s. Earnings are the shareholders' residual after paying interest to debt-holders, so the probability distribution of earnings was heavily affected by the increased leveraging of the 1980s. Although we do not have the data to explain why Malkiel found such a larger reduction in his regression coefficient from the 1960s to the 1980s, nor to explain why the coefficient is so stable from year to year within each decade, we do not believe that regressions with the P/E ratio as the left-hand variable are a good way to study the issue of changing myopia.

The alternative way to use Malkiel's data would be to start from his observation that a firm's stock price, p_t^* , should be related to its current dividends, d_t ,

$$(4) \quad p_t^* = \frac{d_t}{r_t - g_t},$$

under the assumption that the current term structure is flat with interest rates for all maturities at r_t and that dividends will grow at the constant rate g_t for the indefinite future. If the actual share price, p_t , is consistently lower than p_t^* , it means that the market is shortsighted. And if the shortfall is greater in the 1980s than in the 1960s, it shows growing myopia. Our results suggest rather strongly that the first hypothesis would be supported, but not the second.

The Critique of American Capitalism in Light of Our Results

As we noted in our opening section, our finding that the equity premium—which defies explanation by standard finance theory—was about 2.5 percent in the 1960s, 5 percent in the 1970s, and 1 percent in the 1980s supports the hypothesis that the stock market is systematically shortsighted. It values payoffs in the more distant future at a low level compared to similar payoffs from government bonds. This finding supports the most basic element of the critique.

The critique holds that standard hardware investment—plant and equipment—should enjoy higher valuation on its future payoffs than intangible and invisible investments in market development and other

nonhardware areas. Our results also support this hypothesis strongly. Firms with high levels of plant and equipment investment have higher values in the market, given their actual subsequent performance. The remarkably high positive coefficient on one measurable intangible—advertising—also supports the critique, but only in the 1980s.

One of the central propositions of the critique is that the U.S. stock market forces managers to aim for maximum reported bottom-line earnings, to the detriment of investments that hurt the bottom line in the short run but provide strong performance in the longer run. Our results reject this proposition decisively. To the contrary, one of the most promising long-run arbitrages suggested by our results is to buy firms that have unusually high current earnings. They are differentially likely to yield high ultimate value to their shareholders.

Our results for intangible R&D are also somewhat unfavorable to the critique. In the two decades when R&D was generally reported in financial statements, it receives negative coefficients, showing that an investment in an R&D-intensive firm has a higher than average long-term payoff to an investor than a normal firm. The statistical confidence in this finding is lower than for the others we have highlighted.

A final proposition central to the critique of American capitalism is that shortsightedness has worsened over time. Our results show just the opposite. Although the market valuation of the typical stock in the 1980s was still below the finance-theory benchmark, the shortfall was smaller. The U.S. stock market seems to be moving toward erasing its puzzling tendency toward excessive discounting. With steady rises in stock market values since the mid-1980s (even counting the collapse of the market in 1987), the problem of overdiscounting and shortsightedness may have vanished from the market, on the average, in the 1990s.

APPENDIX A

Derivation of the Valuation Equation

Let:

- t = year of valuation, as of the end of the year;
- τ = year of future payout;

- T = terminal year, 1991 or last year traded;
 i = firm identifier;
 $d_{i,\tau}$ = actual dividend or distribution to shareholders, paid at end of year;
 $p_{i,t}$ = price of share at year end, ex dividend;
 $y_{i,t,\tau}$ = ratio of future dividend to current price, $d_{i,\tau} / p_{i,t}$;
 $R_{i,\tau}^c$ = price in year t of \$1 to be received with certainty at end of year τ ;
 ϕ = discount rate for nondiversifiable risk; and
 E_t = expected value, conditional on information in year t .

The valuation equation from finance theory is

$$(A-1) \quad p_t = \sum_{\tau=t+1}^T (1 - \phi)^{\tau-t} R_{i,\tau}^c E_t d_{i,\tau}.$$

The present value of the future expected dividend yield of a stock should be equal to the price of the stock, with the present value calculated using the risk-free rate adjusted for extra discounting at rate ϕ . The magnitude of the risk adjustment ϕ depends on the amount of economy-wide risk in the dividends of the stock. A stock has a higher discount if there is a general tendency for its dividends to fall in times of poorer general conditions.

We rewrite the valuation equation as

$$(A-2) \quad p_t = \sum_{\tau=t+1}^T R_{i,\tau} E_t d_{i,\tau},$$

where $R_{i,\tau} = (1 - \phi)^{\tau-t} R_{i,\tau}^c$, the discount including the nondiversifiable risk factor. Our work is concerned with departures in the market from this valuation model. Our general approach is to look for excess discounts, $\delta_{i,t}$. Using the firm identifier, i , where appropriate, our generalized valuation model is

$$(A-3) \quad p_{i,t} = \sum_{\tau=t+1}^T R_{i,\tau} (1 - \delta_{i,t})^{\tau-t} E_t d_{i,\tau}.$$

We will find it convenient to restate the valuation model in terms of the dividend yields as

$$(A-4) \quad 1 = \sum_{\tau=t+1}^T R_{i,\tau} (1 - \delta_{i,t})^{\tau-t} E_t y_{i,t,\tau}.$$

We define the unexpected element of payouts as

$$(A-5) \quad \eta_{i,t,\tau} = y_{i,t,\tau} - E_t y_{i,t,\tau},$$

and define the composite surprise,

$$(A-6) \quad \epsilon_{i,t} = \sum_{\tau=t+1}^T R_{t,\tau} (1 - \delta_{i,t})^{\tau-t} \eta_{i,t,\tau}.$$

Then we write the valuation model as

$$(A-7) \quad 1 = \sum_{\tau=t+1}^T R_{t,\tau} (1 - \delta_{i,t})^{\tau-t} y_{i,t,\tau} - \epsilon_{i,t}.$$

Our next step is to linearize the model in the excess discount, δ , around the point $\delta = 0$:

$$(A-8) \quad 1 = \sum_{\tau=t+1}^T R_{t,\tau} y_{i,t,\tau} - \delta_{i,t} \sum_{\tau=t+1}^T (\tau - t) R_{t,\tau} y_{i,t,\tau} - \epsilon_{i,t}.$$

Excess discounting contributes a negative term to value, in which the discounted future dividends are weighted in proportion to their futurity.

Next we define

$$(A-9) \quad z_{i,t} = \sum_{\tau=t+1}^T R_{t,\tau} y_{i,t,\tau} - 1,$$

the realized excess present value of the future dividend yields. Now we can write the valuation equation as:

$$(A-10) \quad z_{i,t} = \delta_{i,t} \sum_{\tau=t+1}^T (\tau - t) R_{t,\tau} y_{i,t,\tau} + \epsilon_{i,t}.$$

We define $k_{i,t}$ as the weighted discounted dividends,

$$(A-11) \quad k_{i,t} = \sum_{\tau=t+1}^T (\tau - t) R_{t,\tau} y_{i,t,\tau}.$$

We assume that the discount, $\delta_{i,t}$, can be written as a linear function of observed characteristics, $x_{i,t}$, with parameter vector γ , and a random noise component, $u_{i,t}/k_{i,t}$:

$$(A-12) \quad \delta_{i,t} = x_{i,t}\gamma + u_{i,t}/k_{i,t}.$$

Then the valuation equation takes the simple form,

$$(A-13) \quad z_{i,t} = k_{i,t} x_{i,t}\gamma + u_{i,t} + \epsilon_{i,t}.$$

The literature on orthogonality tests of valuation equations is closely related to this equation.³⁵ The literature can be interpreted as saying that, absent noise, the realization $z_{i,t}$ is orthogonal to any variable observed at time t . Durlauf and Hall noted that the fitted values from the regression of $z_{i,t}$ on variables known at time t provided an estimate of the time series of valuation noise. The estimate is conservative in that the variance of the fitted value is a lower bound on the variance of the noise.

The difference between our approach and earlier work on orthogonality tests is easy to explain in this framework. The orthogonality approach makes inferences about the importance of the entire valuation noise, $k_{i,t}x_{i,t}\gamma + u_{i,t}$, whereas we are interested only in the first term and combine the second term with the expectation error. The Durlauf-Hall method could be used to make inferences about the part of our residual that comes from valuation noise not associated with our variables. The basic method would be to project our residuals onto variables constructed from the current stock price.

APPENDIX B

Econometric Issues

To estimate the model, we define the regressor vector

$$(B-1) \quad X_{i,t} = k_{i,t}x_{i,t},$$

so the valuation model becomes

$$(B-2) \quad z_{i,t} = X_{i,t}\gamma + u_{i,t} + \epsilon_{i,t}.$$

The distribution of the disturbance, $u_{i,t} + \epsilon_{i,t}$, is distinctly nonspherical. By dividing both sides of the valuation equation of the current share price, we eliminate the most obvious sources of heteroskedasticity across firms and across time. But there is likely to be high serial correlation of $u + \epsilon$, because it is a moving average of future expectation errors, and because valuation noise may also be persistent. There is a simple transformation that will make the disturbances of this equation roughly

35. See Startz (1982), Scott (1985), and Durlauf and R. Hall (1990).

spherical and yet retain the orthogonality of $\epsilon_{i,t}$ to the instrumental variables. Suppose that the serial correlation of the disturbance, $u_{i,t} + \epsilon_{i,t}$, is approximately the same for all firms in year t ; call the common value ρ_t . The standard forward autoregressive transformation of the data would make the covariance matrix diagonal, but it would destroy the orthogonality. Instead, we use a backward transformation:

$$(B-3) \quad \tilde{z}_{i,t} = z_{i,t} - \rho_t z_{i,t+1}.$$

We use the one-year Treasury bill discount as an estimate of ρ_t . We calculate transformed left- and right-hand variables using the backward autoregressive transformation.

Instruments

The estimating equation is

$$(B-4) \quad z_{i,t} = X_{i,t}\gamma + u_{i,t} + \epsilon_{i,t}.$$

Each element of $X_{i,t}$ is the product of a firm characteristic, $x_{i,t}$, and the weighted realization of discounted dividends, $k_{i,t}$. The instruments need to deal with the fact that $k_{i,t}$ declines in value as t approaches the terminal date. We use the variable,

$$(B-5) \quad h_t = \sum_{\tau=t+1}^T (\tau - t) R_{t,\tau},$$

which is eligible as an instrument because it depends on information available at t . Then we use instruments of the form,

$$(B-6) \quad (d_{i,t-j} / A_{i,t}) h_t x_{i,t}$$

or various lags, j , which should be the best predictors of $x_{i,t} k_{i,t}$.