Are Stocks Overvalued?

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By most standards, the price of equities in the United States has risen remarkably rapidly during the last 15 years. Since 1994 alone, the Standard & Poor's index of 500 stock prices has doubled. Although the rapid growth of corporations' profits has propelled the price of their stock, shareholders also are willing to pay a greater price per dollar of their companies' profits, and the valuation of corporations' earnings now is nearly as high as it has been since World War II.

In the past, the value of equities often has been greatest when shareholders expected corporations' earnings to grow most rapidly. Now that the current business cycle recovery has matured, this explanation for the recent rapid appreciation of the price of stocks seems more tenuous. To be sure, many analysts predict that their companies' earnings will increase, on average, about 15 percent at an annual rate over the next year and one-half. Macro forecasts, on the other hand, expect earnings to grow more slowly and to decelerate toward the growth of GDP, now that the economy is near the limits of its productive capacity.

For the moment, the value of equity may rest on the growth of earnings, but in the longer run the price of stocks depends on the return that corporations earn on their investments, the growth of their opportunities for making new investments without sacrificing their return, and the return that shareholders require of their stocks. Recent data do not yet indicate that corporations' capacity for earning a profit is greater now than it has been during other business cycles over the past four decades. As impressive as the recent growth of reported earnings has been, much of this growth can be attributed to the recovery of profit margins lost in previous recessions as well as to corporations' sharp reduction of leverage during the past five years. If shareholders expect profits to continue rising rapidly in coming years, then even the simple deceleration of earnings as predicted in macro forecasts could precipitate a substantial drop in the value of equity. If, on the other hand, shareholders do not anticipate a rapid growth of profits, the prevailing high

value of equity rests, instead, on shareholders' requiring a lower rate of return from their investments in equities today than they had in the past.

The first section of this article compares the recent price of stocks to traditional standards for valuing equities, finding not only that prices are high by almost all measures but also that the appreciation of equity has been exceptionally dependable. The second section discusses a simple model for valuing equity, emphasizing the importance of shareholders' discount rates, as well as companies' returns and growth, for setting the value of equity. The third section uses the implications of the model to compare the recent data for returns and growth with the value of equity, concluding that companies' recent performance does not support fully the current price of stocks. Although the current values of corporations' assets and earnings in financial markets exceed those that prevailed in the 1960s, the rate of return earned by corporations is only three-quarters as great as it was in the 1960s. The article concludes that a lower shareholders' discount rate, perhaps fostered by the consistently high growth of profits during much of the 1990s, could explain the prevailing value of equities. If so, this value might be prone to collapse once the current expansion matures and the growth of profits subsides and becomes more volatile, thereby ending the exceptional pattern of high returns with little risk.

I. Recent Experience

The rate of appreciation of equities has been remarkably high during the past 15 years. For much of this century, the average annual rate of return on equities, comprising dividends and capital gains, has averaged between 8 and 10 percent (Bernstein 1997). Since 1979, this return has averaged 18 percent; the rate of appreciation of equities alone has exceeded 15 percent. This bull market, persisting for almost two decades, is matched only by the surge in the price of stocks from the 1940s to the 1960s, when equities appreciated approximately 10 percent annually. The recent performance of equities is even more exceptional considering the comparatively low rate of inflation after 1982. Since the early 1980s, the real rate of return on equity has been nearly double its previous average of approximately 6 percent. The rate of appreciation of equities alone exceeded the rate of inflation by more than 11 percentage points.

The rewards to holding equities not only have been great recently, they also have been remarkably

Figure 1

Returns on the S&P 500
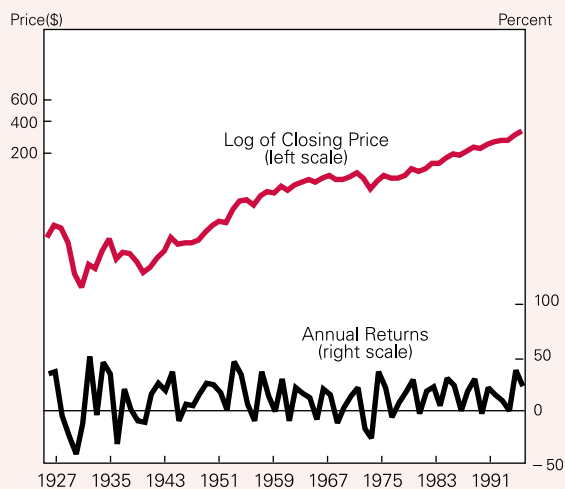
Source: Board of Governors of the Federal Reserve System, Fame database, and author's calculations. See the Appendix.

dependable: The course of prices has been smoother after 1982 than it was during the previous two decades (Figure 1). Before the 1980s, the volatility of the returns on equity generally exceeded its average rate of return (Table 1). After the 1970s, the volatility of returns has fallen as returns have risen, so that average returns have exceeded volatilities. As volatility
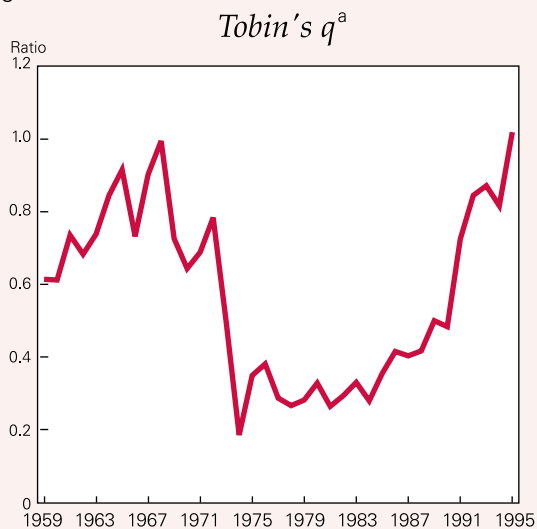
Table 1
Rate of Return on the S&P 500
Percent

	Average Return	Monthly Volatility	Daily Volatility
1930s	2.4	30.5	33.9
1940s	9.9	13.1	15.5
1950s	16.4	10.0	11.4
1960s	8.0	10.2	9.9
1970s	5.8	13.0	13.8
1980s	14.3	12.9	17.1
1990s	15.2	9.4	11.5
1993–1996	14.9	7.9	9.7

Source: Board of Governors of the Federal Reserve System, FAME database.
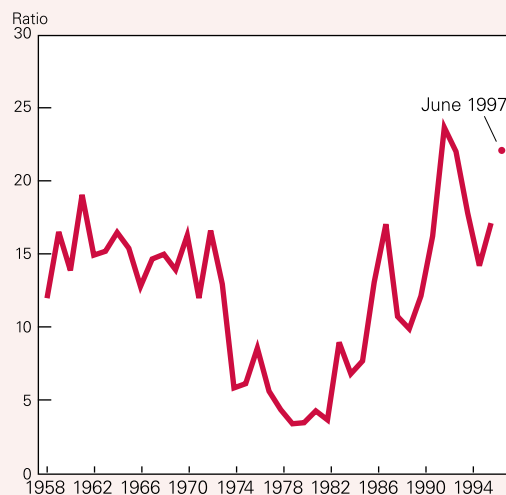
Figure 2

Tobin's q[a]

Ratio

a Market value of equity plus net debt/current value of land, inventories, equipment, and structures.
Source: U.S. Bureau of Economic Analysis.

Figure 3

Price-Earnings Ratio for the S&P 500

Ratio

Source: Board of Governors of the Federal Reserve System, Fame database.

has subsided, so has the incidence of substantial "corrections" in the price of equities. The S&P 500 index, for example, had fallen at least 10 percent 14 times in 34 years between 1957 and 1990, an average frequency of once every 2.4 years. The index fell at least 20 percent, on average, once every six years. During the last seven years, however, this index has not fallen more than 10 percent between one day's closing value and that of any subsequent day.

As a result of equity's rapid appreciation, the value of corporations' stocks, bonds, and other liabilities is now significantly greater than the value of their assets. Tobin's q, the ratio of the value of securities issued by companies to the replacement value of their assets (Tobin 1969), should tend to vary as the return on companies' assets varies relative to their cost of debt and equity financing, making q an index of companies' rents.[1] During the three decades before the 1990s, estimates of q using data from the national accounts and the flow of funds were greatest during the 1960s, generally ranging

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[1] A company earns an economic rent when the return on its investments exceeds a "normal rate of return" for those investments which may be regarded as its cost of capital. A rent, therefore, is an excess return. Returns may rise relative to the cost of financing either as companies' recognized tangible assets become more productive or as their earnings from intangible assets increase.

between 0.8 and 1 (Figure 2). As a result of the recent bull market, q currently matches its previous peaks, indicating that shareholders value the potential rents accruing on corporations' assets at least as much as they did in the 1960s.

The Value of Earnings

Although much of equity's appreciation can be attributed to the relatively rapid growth of corporate earnings since the early 1980s, the value of equity per dollar of earnings also has risen substantially. Between 1982 and 1996, earnings for the equities constituting the S&P 500 more than doubled, growing on average 6 percent annually. As earnings recovered, the price of a share of stock increased from about 8 times earnings per share to more than 20 times earnings (Figure 3). This multiple now is higher than its previous peaks during the past four decades except for the early 1990s, just before companies' earnings surged as the recession ended. Almost two-thirds of this revaluation of earnings represented a return to a more normal multiple: Before the 1990s, the price of equity averaged about 16 times earnings. Accordingly, the growth of earnings coupled with the restoration of
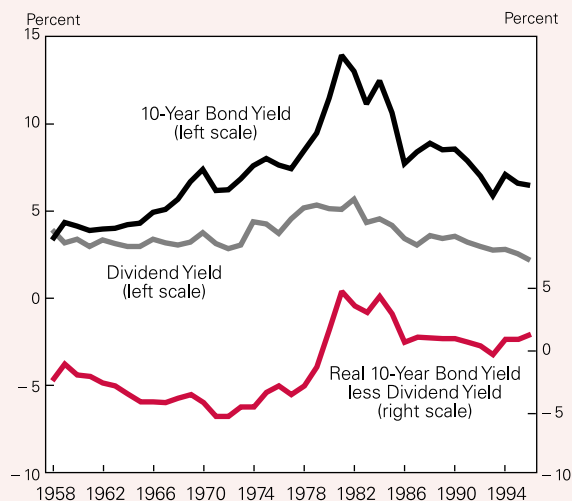
Earnings-Price Ratio for the S&P 500 and Yield on 10-Year Bonds

Percent   Percent
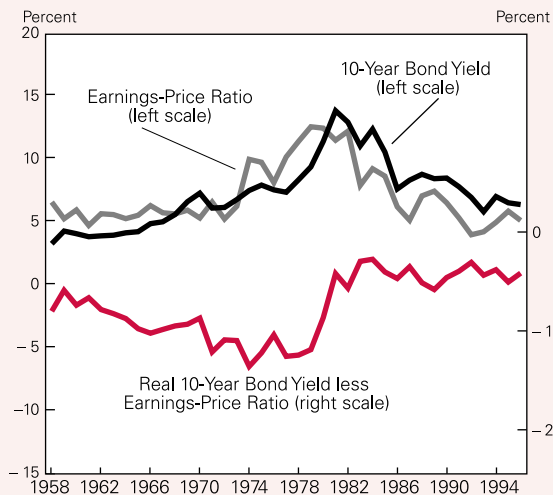
Source: Board of Governors of the Federal Reserve System, Fame database, dividend yield; Haver database, earnings-price ratio and 10-year bond yield. See the Appendix.

Dividend Yield for the S&P 500 and Yield on 10-Year Bonds

Percent   Percent

Source: See Figure 4.

more customary price-earnings ratios have accounted for most of the recent ninefold appreciation in the price of equity. Approximately one-third of this appreciation can be attributed to values' rising beyond customary standards.

Shareholders are more willing to pay a higher price per dollar of earnings partly because interest rates on bonds have fallen significantly since the early 1980s. Lower yields on bonds encourage shareholders to bid more aggressively for equity, and two common measures of equity's yield, the dividend–price ratio and the earnings–price ratio, fall as its price rises. During the past 15 years, however, interest rates appear to have fallen more than equity's yield (Figures 4 and 5), especially the dividend–price ratio. While the yield on Treasury notes fell approximately 9 percentage points from its peak in 1981 to nearly 6 percent today, the dividend yield fell only 4 percentage points to 1.6 percent.

Because the coupon on bonds is fixed and the dividends on stocks tend to increase with earnings, the rate of interest includes an inflation premium, a premium that diminishes as inflation subsides. For this reason, the rate of interest should have fallen more than equity's yield since the early 1980s, as
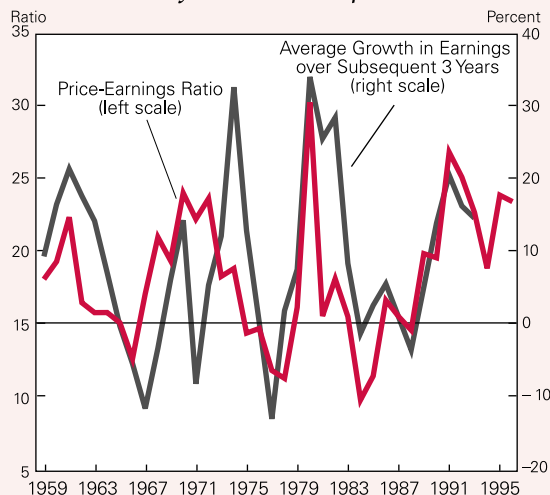
inflation fell from rates exceeding 10 percent to rates less than 3 percent. The difference between the real rate of interest, which depends less on changes in this inflation premium, and the earnings–price ratio rose in the late 1970s, but has changed comparatively little since the early 1980s. This measure of equity's yield remains low compared to the real yield on bonds even though the promise of rapidly growing earnings probably is fading as the business cycle expansion matures. The difference between the real rate of interest and equity's dividend yield also remains comparatively high according to historical norms.

The Growth of Earnings

The yield on equity tends to fall when shareholders expect earnings to grow more rapidly, because the promise of greater dividends and the attendant appreciation of equity compensate shareholders for accepting a relatively low current yield. In the past four decades, the valuation of earnings has varied with the subsequent rate of growth of earnings (Figures 6 and 7). Price–earnings ratios generally rose before earnings accelerated and fell before earnings grew more
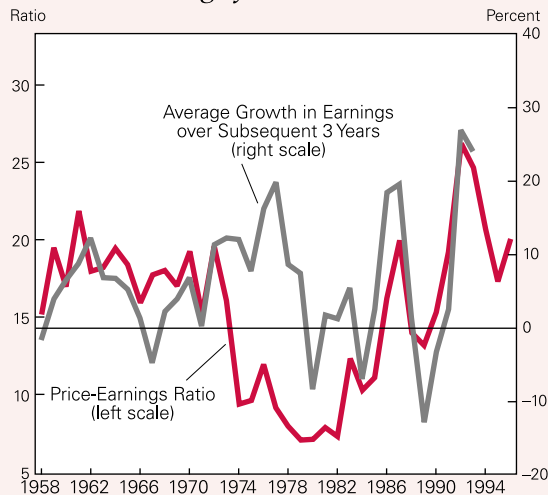
Figure 6

Price-Earnings Ratio and Growth in Earnings for All Nonfinancial Corporations

Ratio   Percent

Price-Earnings Ratio
(left scale)

Average Growth in Earnings
over Subsequent 3 Years
(right scale)

1959 1963 1967 1971 1975 1979 1983 1987 1991 1995

Source: Board of Governors of the Federal Reserve System, Flow of Funds Accounts, nonfarm nonfinancial business sector. See the Appendix.

Figure 7

Price-Earnings Ratio and Growth in Earnings for the S&P 500

Ratio   Percent

Average Growth in Earnings
over Subsequent 3 Years
(right scale)

Price-Earnings Ratio
(left scale)

1958 1962 1966 1970 1974 1978 1982 1986 1990 1994

Source: Board of Governors of the Federal Reserve System, Fame database, price of S&P 500; Haver database, earnings-price ratio. See the Appendix.

slowly. By this standard, the current valuation of earnings appears to anticipate that earnings will continue to grow relatively rapidly, increasing more than 10 percent annually.

The relatively high price–earnings ratio also might indicate that shareholders now regard equities as less risky investments than they did in the past. If shareholders expect the rate of growth of earnings to be less volatile in the future than previously, then they should be willing to pay a higher price for each dollar of earnings even if they expect the rate of growth of earnings to fall somewhat in coming years (Table 2). Since 1992, for example, the volatility of the growth of real GDP has been less than half that of the three previous decades. This relatively smooth growth promoted a comparatively rapid and dependable growth of companies' earnings (McKelvey 1997). Before 1993, the volatility of earnings exceeded the growth of earnings, often by a substantial margin. Since 1992, however, the volatility of earnings for the corporations constituting the S&P 500 has been less than half their rate of growth; for all nonfinancial corporations, the growth of earnings has nearly equaled its volatility.

Regression in the Valuation of Earnings

However strongly we believe that shareholders price equities according to their fundamentals, the recent bull market suggests that "momentum" investing might have carried the price of stocks too far. The very high returns, especially during the last three years, and the accompanying high price–earnings ratio are extraordinary. Perhaps more important is the consistently high rate of appreciation of stocks, as indicated by the low volatility of shareholders' returns (Table 1). A run of high annual returns that can be attributed to a few instances of shareholders' receiving unexpected, favorable information would not be too exceptional. The persistent run of high returns, on the other hand, could mark the course of a bandwagon or a bubble (Fortune 1991).

Even if the value of equity rests firmly on "fundamentals," the prices of stocks often have reversed course once they rise uncommonly high or fall unusually low. Fundamentals themselves often regress to the mean, for example, when companies that earn exceptionally high profits attract competition or when profits wax and wane with the phases of the business cycle. As companies' abilities to earn rents shift over

Table 2
Growth of GDP and Corporate Earnings
Percent change, annual rate

	Real GDP		S&P 500		All Nonfinancial Corporations	
	Average Growth	Volatility	Average Growth	Volatility	Average Growth	Volatility
1960s	4.06	1.75	5.94	6.36	3.84	12.53
1970s	3.24	2.22	11.17	16.75	9.23	25.04
1980s	2.68	1.96	5.22	8.74	10.75	20.39
1990s	2.22	1.11	7.44	10.35	9.97	18.34
1993–1996	2.62	.84	17.87	7.12	11.96	13.88

Source: Haver Database, GDP and S&P 500; Board of Governors of the Federal Reserve System, Flow of Funds Accounts, nonfarm nonfinancial corporate businesses.

time, the prices of their stocks change. Consequently, after the returns on equities have been unusually high, they are prone to fall, and conversely (Poterba and Summers 1988). For this reason, strategies promoting investing in "value stocks" or "dogs of the Dow" command considerable followings.

II. Earnings and the Value of Equity

The prices of stocks today might seem high according to customary standards, as explained in the previous section; nonetheless, current business conditions might justify this valuation. This section presents a simple description of the price of a stock in order to isolate the fundamental elements that determine its value: the company's return on assets, the rate of growth of its opportunities for making profitable investments, and its cost of equity and debt financing. The following section then examines whether earnings are yet sufficiently great to justify the high price of equity.

The description of the price of shares in this section offers several general conclusions. First, if shareholders act rationally, the rate of return that shareholders expect to earn on equities essentially matches the rate of return they require of equities, their discount rate. Consequently, comparatively high returns persisting for long periods in the stock market imply that shareholders' discount rates also are high. Second, the difference between the real rate of interest on Treasury notes and equity's yield depends on the difference between the rate of growth of companies' assets and their shareholders' discount rates. Third, price–earnings ratios tend to rise with the magnitude

of companies' rents and the growth of their returns. A higher growth of earnings per share of stock need not entail a higher price–earnings ratio, however, when companies earn no rents, repurchase their shares, or reduce their leverage. Price–earnings ratios vary with leverage, but they might rise or fall, depending on the magnitude of companies' rents and the rate of increase of shareholders' risk premiums. In particular, when the cost of debt financing rises relative to companies' return on assets and shareholders' discount rates, price–earnings ratios should fall as companies reduce their leverage. Finally, both Tobin's q and price–earnings ratios vary with shareholders' discount rates or companies' rents in similar ways, implying that q need not be analyzed independently of the price–earnings ratio.

A Simple Model of the Price of Equity

Shareholders value a corporation's equity by its prospective dividends and capital gains, which in turn depend on its earnings. Earnings benefit shareholders directly when companies distribute a share of their earnings as dividends, less directly when companies invest their earnings on behalf of their shareholders, thereby increasing their assets and their capacity for paying dividends in the future. Because the price of stocks ordinarily rises with the promise of greater dividends, retained earnings commonly reward shareholders with capital gains instead of current dividends.

The value of equity equals the present value of its dividends and capital gains. In assessing their capital gains, current shareholders must anticipate the price others will be willing to pay for the shares when they eventually sell. The bids of these new investors will be governed by their expectations of future dividends and their own capital gains, which in turn will depend on the present value of dividends and capital gains expected by the next round of shareholders. This chain of logic concludes that rational shareholders value their stock by discounting prevailing estimates of all future dividends. This approach, which rules out bubbles wherein prices rise mainly because everyone expects them to rise, highlights the correspondence between the price of stocks and their earnings, thereby

emphasizing the contribution of fundamentals to the current pricing of equity.

Shareholders expect a company's dividends to grow each year, but they also expect these dividends to vary as earnings vary with unforeseen changes in business conditions. The shareholders' discount rate, δ, equals the sum of the rate of interest on safe government bonds, i, and the risk premium that shareholders require, p, for accepting equity's uncertain return. Each year the company divides its profits, paying a portion as dividends to shareholders while retaining the remainder to increase the assets backing its stock. Currently the company pays an annual

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The fundamental elements that determine a stock's value are the company's return on assets, the rate of growth of its opportunities for making profitable investments, and its cost of equity and debt financing.

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dividend of D dollars, which shareholders expect to grow at the rate γ annually as a result of the company's retention of earnings. The price of the company's stock is:

$$P = D \int_0^\infty e^{\gamma t} \cdot e^{-\delta t} \, dt$$

$$= D / (\delta - \gamma).$$

In this simplified, steady-state description of equity's value, shareholders expect the price of the corporation's stock as well as its dividend, earnings, and assets to grow at the same rate each year. In this steady state, the shareholders' discount rate exceeds the company's rate of growth; otherwise, this approach would fix no price for equity.

In practice, companies' expected rents and rates of growth vary as their fortunes change with the times—during the different phases of a business cycle, shareholders may expect rents and growth to differ from steady-state values for several years. Such temporary differences often carry a weight resembling

that of a more lasting change in prospects (Figures 6 and 7). Assessments of companies' longer-run returns can vary considerably with their current performance as suggested by the speed and frequency with which analysts often alter their views, ratings, and coverage of companies. Moreover, when shareholders do not expect temporary changes in a company's earnings to be reversed very quickly, these changes can seem enduring if the shareholders' rate of discount is sufficiently great.

Any theory that describes the price of equity as the discounted value of its dividends equates the shareholders' return on their stocks with their discount rate. In this example,

$$\delta = \frac{D}{P} + \gamma.$$

As discussed below, when the company's rate of growth is higher than that of other companies or its rate of return on assets exceeds the shareholders' discount rate, the company's stock will sell at a premium, but will not yield more than the shareholders' discount rate. If the price of a stock were sufficiently low to offer a return that exceeds the shareholders' discount rate, the aggressive bidding of shareholders would quickly eliminate this excess return. Therefore, a consistently high rate of return on equities would indicate that shareholders require high returns.

The Dividend–Price Ratio

The difference between the rate of interest on government bonds and the dividend–price ratio equals the difference between the expected rate of growth of dividends and the shareholders' risk premium.

$$D/P = (i + p) - \gamma, \quad \text{or}$$

$$i - D/P = \gamma - p.$$

Although these expressions describe steady-state relationships, they also suggest how the price of equities might respond to temporary changes in business conditions. Near the end of a recession, for example, the prospect of rapid growth at little risk allows the dividend yield on equity to be relatively low compared to interest rates on bonds. But, once the recovery has run its course, bringing slower growth and a greater risk of a recession, then the difference between interest rates on bonds and the dividend yield on equity should shrink. This difference might not change

or even increase, however, if shareholders required a smaller risk premium for their investing in equities.

Other things equal, the price of the stock increases with the rate of growth of prospective earnings and dividends, but if greater growth is a result of rising inflation, then the price may fall. The dividend–price ratio does not change with rising inflation if both the rate of interest and the rate of growth increase point-for-point with inflation. The dividend–price ratio would fall with the rate of inflation, however, if the shareholders' discount rate falls more than the rate of growth, as would be the case if either the risk of recession or the burden of taxes on corporate income rose with the rate of inflation (Kopcke 1988).

The Price–Earnings Ratio

The rate of growth of the company's dividends depends on the rate of return that it earns on its assets and on the proportion of its earnings that it retains. If shareholders expect the rate of return on the company's assets to average r, and they expect the company to retain over time a constant proportion of its earnings, α, then the rate of growth of its assets, its dividends, and the price of its stock is r times α ($\gamma = r\alpha$). Therefore, if the company's earnings currently are E, then its current dividend is $(1 - \alpha)E$, and the price of its stock is

$$P = D/(\delta - \gamma)$$

$$= (1 - \alpha)E/(\delta - \alpha r), \quad \text{or}$$

$$P/E = (1 - \alpha)/(\delta - \alpha r)$$

$$= \delta^{-1} \frac{(1 - \alpha)}{\left(1 - \alpha \dfrac{r}{\delta}\right)}.$$

This price–earnings ratio equates the expected return on stock with the shareholders' discount rate. Shareholders are willing to pay a higher price for each dollar of the company's earnings, other things equal, the greater is the rate of return on the company's assets. The price–earnings ratio also rises, other things equal, if the company retains a greater proportion of its earnings, provided that the company earns an economic rent—the average rate of return on its assets exceeds the shareholders' discount rate ($r > \delta$). The retention of earnings raises the intrinsic value of stock in this case, because the company can earn a return exceeding that otherwise available to its shareholders.

Not all growth is valuable. In the absence of a rent ($r = \delta$), the price that shareholders pay per dollar of earnings in the formula above depends only on their discount rate, not the retention of earnings. In other words, if a company's rate of return on its capital is no greater than the return required by shareholders, then the company offers its shareholders no special reward by retaining its earnings instead of paying dividends.[2] The greater growth of dividends and attendant capital gains for shareholders in these circumstances only pays them a return that they could have earned by reinvesting the earnings for themselves.

Other things equal, the price of a stock increases with the rate of growth of prospective earnings and dividends, but if greater growth is a result of rising inflation, then the price may fall.

The rate of retention and the return on assets typically are not mutually independent. A company invests until the marginal return on its investments no longer is sufficiently great compared to its marginal cost of capital (see the Appendix). Therefore, a company's rate of retention of earnings should be governed by the growth of its opportunities for making attractive investments.[3] When a company can retain a greater proportion of its earnings without reducing its rents too greatly, the company grows more rapidly and its price–earnings ratio rises as a result of its expanding opportunities for profit, not as a result of its greater retention of earnings alone.

The price–earnings ratio varies inversely with the difference between the shareholders' discount rate and the company's rate of growth:

[2] Corporations tend to increase, rather than reduce their shareholders' personal tax burdens by "paying" their earnings in the form of capital gains rather than dividends (Kopcke 1989). Accordingly, the retention of earnings typically offers shareholders no tax benefits.

[3] New investments also are less attractive if their returns are more risky. If new investments entail more risk, they also entail a greater discount rate and cost of capital which tends to reduce the price–earnings ratio.

$$P/E = \frac{1 - \alpha}{\delta - \gamma} \ .$$

Viewed another way, due to the influence of the factor $(1 - \alpha)$, the *earnings–price ratio* varies more than the dividend–price ratio in response to any change in the shareholders' discount rate or the company's rate of growth.

Share Repurchases, Mergers, and the Price of Stock

The growth of dividends per share of stock rises when companies repurchase their shares, but this type of growth, unlike the growth of total dividend payments (γ), does not necessarily increase the price of stock. Because $P = D/(\delta - \gamma)$, any given dividend and rate of growth of dividends (which equals the rate of appreciation of stock) determine the price of the stock in the steady state. Suppose a company increases the rate of growth of dividends per share by repurchasing a constant proportion of its outstanding equity each year, β, while financing these purchases by reducing its dividends—dividends per share fall today, but grow more rapidly subsequently. Current dividends fall to $(1 - \beta)D$, and the company's shares outstanding will shrink at the rate of $\beta D/P$ every year, so the annual rate of growth of dividends per share increases by $\beta D/P$. The net result of these changes does not alter the current price of equity:

$$P = \frac{(1 - \beta)D}{\delta - (\gamma + \beta D/P)} = \frac{D}{\delta - \gamma} \ ,$$

and the repurchasing of shares does not affect the value of equity in these circumstances.

In repurchasing its own shares or in purchasing the shares of another corporation's stock, a company is buying an asset whose yield equals its shareholders' discount rate as long as all shareholders assess the company's prospects similarly. The company is offering its shareholders a return no better than that they could have earned by reinvesting the forgone dividends themselves.[4] Repurchases of equity, therefore, do not increase the value of a company's stock. In mergers, however, one company's purchase of another's shares can increase the value of both companies' equity provided that their union achieves economies that otherwise would be unattainable.

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[4] Because a company's expected return on assets is no less than its shareholders' discount rate, it also does not offer its shareholders a better return by reducing its acquisition of assets in order to repurchase its shares.

If some of a company's shareholders regarded its prospects more optimistically than others, then the company might increase the value of its equity by repurchasing its stock. The price of the company's equity reflects the assessments of its least optimistic owners; if the price were higher, these owners would sell their stock. Therefore, the repurchase of shares at prices somewhat above the marginal shareholders' valuation, but somewhat below the valuation of more optimistic shareholders, could benefit both classes of owners. If the company repurchased all the shares of its least optimistic shareholders, its remaining owners could receive an excess return on this investment as the price of their stock rose subsequently to match their valuation. Unless other investors eventually accepted the assessments of the remaining shareholders, then these more optimistic owners could subsequently sell their stock only at a discount.

Leverage

When a company finances its assets partly with equity and partly with debt, the rate of return on shareholders' share of the company's assets, r_c, equals the return to assets less the interest paid to creditors, divided by the shareholders' capital. Denoting total assets as A, the share of assets financed by creditors as l, and the rate of interest on debt as r_d, then

$$r_c = \frac{E}{A(1 - l)} = \frac{rA - r_d A l}{A(1 - l)} = \frac{r - r_d l}{1 - l} \ , \quad \text{and}$$

$$P/E = \delta^{-1} \frac{(1 - \alpha)}{\left(1 - \alpha \dfrac{r_c}{\delta}\right)} \ .$$

When leverage is constant, the shareholders' capital is growing at the same rate as total assets, so $\gamma = \alpha r_c$, and

$$P/E = \delta^{-1} \frac{(1 - \gamma/r_c)}{(1 - \gamma/\delta)} \ .$$

The relationship between the company's price–earnings ratio and its leverage is complex. Although shareholders' expected return on capital often rises with leverage, the shareholders' risk premium also increases, reflecting the greater volatility of earnings that accompanies greater leverage (see the Appendix). When all investors assess the company's prospects similarly and they expect the company to earn no rent on its assets, r_c equals δ for any degree of leverage, and the price–earnings ratio varies inversely with the

shareholders' discount rate, which in turn rises with leverage. When investors expect the company to earn rents, the price–earnings ratio might rise or fall with leverage, depending on how rapidly the shareholders' risk premium changes with leverage. Finally, if creditors are less optimistic about the company's prospects than its shareholders, the price–earnings ratio once again might rise or fall with leverage, depending on how rapidly both shareholders' and creditors' risk premiums change with leverage.

> *Because the optimum choice of leverage for a company depends on its cost of debt financing and its shareholders' discount rate as well as its return on investment, its shareholders profit from a reduction in leverage only when its leverage exceeds that optimum.*

Because the optimum choice of leverage for a company depends on its cost of debt financing and its shareholders' discount rate as well as its return on investment, its shareholders profit from a reduction in leverage only when its leverage exceeds that optimum. If changing assessments of returns or risks induce the company to reduce its leverage and if, as a result, the value of its equity increases, then shareholders profit from these new assessments, not the lower leverage itself. When the company's return on assets rises relative to its cost of capital, for example, then its shareholders benefit from the resulting increase in rents and leverage. When the company's marginal cost of debt financing falls relative to its return on assets, then the value of its equity ordinarily rises with its rents and leverage. But, when the shareholders' discount rate falls relative to its cost of debt financing, then the value of its equity might rise as its leverage decreases. The value of the company's equity principally depends on its ability to earn a rent.

Tobin's q

In addition to comparing a company's dividends or earnings to the price of its stock, some compare the value of the company's securities to the value of its assets. The value of the company in financial markets exceeds the value of its assets when its expected earnings are high or rising rapidly; the company can be worth less than its assets when its prospects are especially poor or uncertain. The value of the company's shares, which equals the product of its price–earnings ratio and its earnings, is

$$P/E \cdot r_c(1 - l)A = \frac{r_c}{\delta} \cdot \frac{(1 - \gamma/r_c)}{(1 - \gamma/\delta)} \cdot (1 - l)A.$$

The value of its debt is lA. Therefore, Tobin's q, the value of a company's equity and debt divided by the replacement value of its assets, is:

$$q = \frac{(P/E)r_c(1 - l)A + lA}{A}$$

$$= \frac{r_c}{\delta} \cdot \frac{(1 - \gamma/r_c)}{(1 - \gamma/\delta)} \cdot (1 - l) + l.$$

The premium implied by q is sufficient to equate the expected return on stock with the shareholders' discount rate. When a company earns no rent, r_c equals δ, and q equals one—the value of the company equals the value of its assets—for all choices of α and l. When a company earns rents, q exceeds one, and q rises as its return on shareholders' capital increases relative to their discount rate. q also tends to rise with α, other things equal: The more rapidly the company can grow without sacrificing its rent, the more its shareholders value each dollar of their earnings. Leverage affects q in much the same way that it affects the price–earnings ratio, but q varies less with leverage than does the price–earnings ratio, if it varies at all, because q reflects the values of both equity and debt.

III. Earnings and the Value of Equity

The value of a company's equity essentially depends on the rate of return it receives on its assets, the rate of growth of its opportunities for making profitable investments, and its cost of debt and equity financing. When companies' returns exceed their cost of financing by a greater margin or they can increase their rate of investment without sacrificing their rents, the value of their equity increases.

This section, applying the model discussed in the previous section, finds that neither an exceptionally high rate of return on companies' assets nor an exceptionally high rate of growth of companies' assets

explains today's high valuation of equity. Unless shareholders expect companies' return on assets to rise substantially sometime soon, then today's high price–earnings ratios imply that shareholders' risk premiums are now comparatively low. Although the combination of high price–earnings ratios and high real interest rates encouraged companies to reduce their leverage, the cost of equity and debt financing taken together is not sufficiently low compared to companies' return on assets to foster a greater rate of investment.

A lower risk premium certainly could explain the uncommonly high price–earnings ratio, but then all bubbles could be described as passing waves of optimism. Therefore, the principal questions remain: Does the high valuation of equity reflect shareholders' new willingness to hold stocks for an expected rate of return only 1 or 2 percentage points above that on Treasury securities? Or, is the high valuation riding a bandwagon lately propelled by the temporary growth of earnings that often occurs when economic growth is comparatively high or as leverage shrinks?

Return on Assets

The following discussion uses two sets of data for analyzing corporations' returns. The first is the data for all nonfinancial corporations (NFCs) taken from the national accounts published by the U.S. Bureau of Economic Analysis. The second is a sample of 368 companies (Cosgrove 368) taken from companies' financial statements published by Compustat (see the Appendix). For both sets, the return to assets is total net revenues (before interest and taxes) less any extraordinary items—such as gains from the sale of assets or a charge for restructuring—that generally do not recur very frequently and do not reflect assets' "paycheck" for their productive effort.

Returns for the NFCs include inventory valuation and capital consumption adjustments, which are not included in returns for the Cosgrove 368. The estimates of returns in the national accounts recognize that companies' costs of sales typically are misstated when prices are changing. Because common methods of accounting often value goods taken from inventory at past rather than current prices, companies tend to understate their costs and overstate their returns when prices are rising. Depreciation expenses that are reported in tax returns or annual reports are governed by rules that typically do not reflect the decay in the value of companies' assets. Accordingly, these rules have both understated and overstated the cost of

companies' investments, depending on the rate of inflation, changes in the value of capital goods, and the capital consumption allowances permitted by tax regulations and accounting standards. Companies' financial data do not provide sufficient detail about their inventories, their assets, or their types of investments to support reasonably accurate estimates of inventory and capital consumption adjustments for the Cosgrove 368.

Just as the concept governing the measurement of returns is not the same for the NFCs and the Cosgrove 368, the measurement of assets also differs. For the NFCs, the rate of return on assets divides returns before interest and taxes by the replacement value of assets. Because companies do not report the replacement value of their assets, the rate of return for the Cosgrove 368 divides returns by the book value of assets. The use of book values rather than replacement values ordinarily misstates the return on assets, because the generally accepted methods of accounting for depreciation do not necessarily represent accurately assets' loss of value due either to obsolescence or to physical decay, and book values do not revalue assets as their prices change. Using book values, the measured rate of return tends to fall as the rate of inflation falls, and the rate of return tends to rise with the average age of assets provided the rate of inflation exceeds the understatement of depreciation in annual reports.

The return on assets during the past 20 years for either the NFCs or the Cosgrove 368 suggests that the "earning power" of companies' assets has not increased dramatically since the 1970s (Figures 8 and 9, black lines). The rate of return for NFCs, currently about 7.5 percent, is no more than 1 percentage point higher than its peaks from the 1970s and 1980s, while it is about 2.5 percentage points lower than its peaks from the 1960s. The rate of return for the Cosgrove 368, currently about 22 percent, does not differ significantly from its previous peaks during the past 20 years.

Leverage and the Return on Shareholders' Capital

The following section considers two measures of shareholders' returns for both the NFCs and the Cosgrove 368. The first is simply the return to assets, as defined above, less interest paid to creditors (earnings). The second adjusts the first to reflect the real rate of return on debt (adjusted earnings). The return on shareholders' capital equals their earnings divided by the difference between the value of their companies' assets and the value of debt.

Figure 8

*Return on Assets and Shareholders'
Capital for Nonfinancial Corporations*
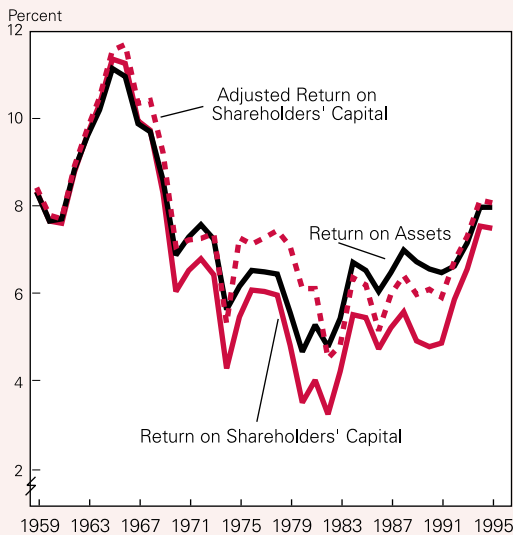
Percent

Adjusted Return on
Shareholders' Capital

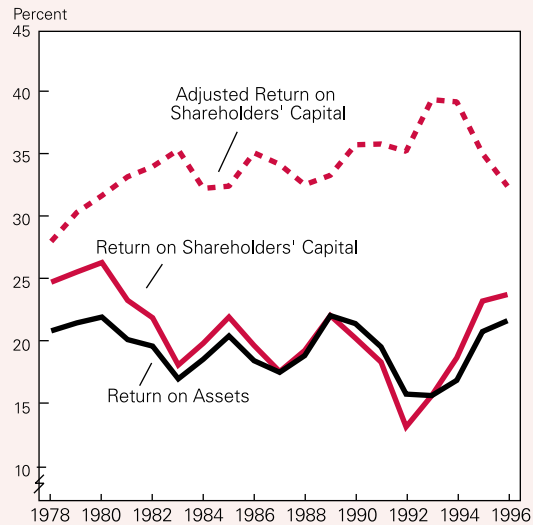Return on Assets

Return on Shareholders' Capital

Source: Board of Governors of the Federal Reserve System, Flow of Funds Accounts, nonfarm nonfinancial business sector, corporate profits; U.S. Bureau of Economic Analysis, capital stock. See the Appendix.

Figure 9

*Return on Assets and Shareholders'
Capital for the Cosgrove 368*

Percent

Adjusted Return on
Shareholders' Capital

Return on Shareholders' Capital

Return on Assets

Source: Compustat database. See the Appendix.

The rate of interest on debt includes an inflation premium in order to compensate creditors for the inflation gains that shareholders earn at creditors' expense on debt contracts. When prices are rising, businesses that have financed a portion of their assets with debt benefit as the real burden of their obligations falls over the life of their loans. Creditors, who anticipate a matching real loss, protect themselves by requiring an inflation premium in the rate of interest on their loans. Consequently, when prices are rising, measures of earnings that subtract interest expense from the return to assets understate shareholders' earnings by recognizing the inflation premium that companies pay on their debt without recognizing their reason for paying the premium. Adjusted earnings compensates for this bias by adding the inflation gain on debt to earnings.

According to the data for the NFCs, shareholders' return on capital has risen in recent years, but still remains below peaks attained in the 1960s and even the 1970s (Figure 8 red lines). Using earnings, the current rate of return of 7 percent is, for example, about 2 percentage points higher than it was at any
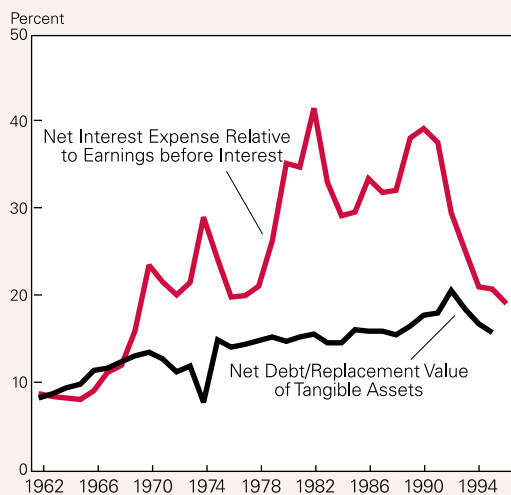
time during the 1980s, but about 3.5 percentage points below its peak in 1965 and 1966. This measure of returns tends to overstate the recent rise in earnings, partly because inflation premiums in interest rates are now lower than they have been in years. After recognizing the erosion of the real value of debt, the rate of return on shareholders' capital using adjusted earnings is only about 1.5 percentage points higher than its peaks during the 1980s, and about 3 percentage points below its peaks of the 1960s.

Although the returns for the Cosgrove 368 generally are much greater than those for the NFCs, the pattern of returns for the Cosgrove 368 resembles that for the NFCs (Figure 9, red lines).[5] The current return on capital is below that of the late 1980s and does

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[5] The Cosgrove 368 uses the book value instead of the replacement value of assets to calculate rates of return. As mentioned above, this use of book values tends to overstate the return on assets. The use of book values overstates the return on capital by a greater proportion because of leverage. Suppose the book value of assets equals two-thirds of their replacement value and liabilities equals one-third of the replacement value of assets. Then, shareholders' capital calculated by subtracting liabilities from the replacement value of assets is twice as great as that calculated by subtracting liabilities from the book value of assets. Book values tend to overstate the rate of return on assets by 50 percent and the return on capital by 100 percent.
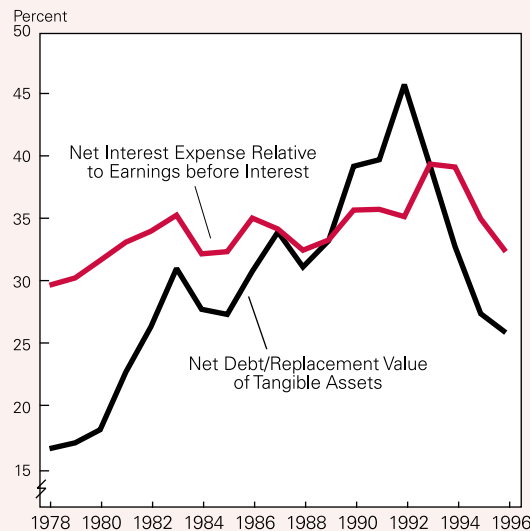
Leverage of Nonfinancial Corporations

Percent

Net Interest Expense Relative to Earnings before Interest

Net Debt/Replacement Value of Tangible Assets

1962 1966 1970 1974 1978 1982 1986 1990 1994

Source: Board of Governors of the Federal Reserve System, Flow of Funds Accounts, nonfarm nonfinancial business sector, corporate earnings and net interest; U.S. Bureau of Economic Analysis, capital stock. See the Appendix.

Leverage of the Cosgrove 368

Percent

Net Interest Expense Relative to Earnings before Interest

Net Debt/Replacement Value of Tangible Assets

1978 1980 1982 1984 1986 1988 1990 1992 1994 1996

Source: Compustat database. See the Appendix.

not exceed very greatly the average rate of return achieved in the 1980s.

The rapid growth in earnings per share of stock in recent years might suggest that shareholders' rate of return on capital is rising. Yet, earnings per share increased in the 1990s partly because companies' leverage has fallen sharply (Figures 10 and 11). Since the early 1990s, interest expense has fallen by approximately one-third relative to the return to assets, which added approximately 5 percentage points to the average annual rate of growth of shareholders' earnings.

In any case, price–earnings ratios should not rise very greatly as a result of falling leverage unless the circumstances that entail less leverage also increase shareholders' current or future rent. When companies displace debt financing by retaining more of their earnings, the resulting growth in earnings per share of stock diminishes as leverage shrinks, ending once companies attain their new optimum degree of leverage. The increase in earnings per share of stock resulting from the displacement of debt only reflects the shareholders' greater investment in each share. Although this investment might warrant a greater price per share of stock, it would not warrant a greater price–earnings ratio unless companies could earn greater rents on their investments.

### *Rate of Growth of Assets, Earnings, and Shareholders' Capital*

The opportunity for profitable growth during the 1990s apparently has not exceeded that of previous decades, especially that of the 1960s. Instead of issuing more new securities to finance more investment this decade, companies reduced their reliance on external financing as their capital budgets grew less rapidly than their cash flow.

Companies' capital budgets have been lower relative to their cash flow during the 1990s than during the three previous decades (Figure 12). For the NFCs, investment spending typically rose to 110 or 120 percent of cash flow during previous business cycle expansions, until the 1990s. During this expansion, investment spending has seldom exceeded cash flow by a significant margin. The story is much the same for the Cosgrove 368: Capital spending appears to have been falling relative to cash flow since the early 1980s.

As a result of this restraint, the rate of growth of companies' stock of assets has not been exceptionally high during the past five years (Figure 13). Real capital spending for NFCs during the 1960s and early 1970s almost always exceeded 12 percent of the real value of

Figure 12

Corporations' Capital Spending Relative to Their Cash Flow
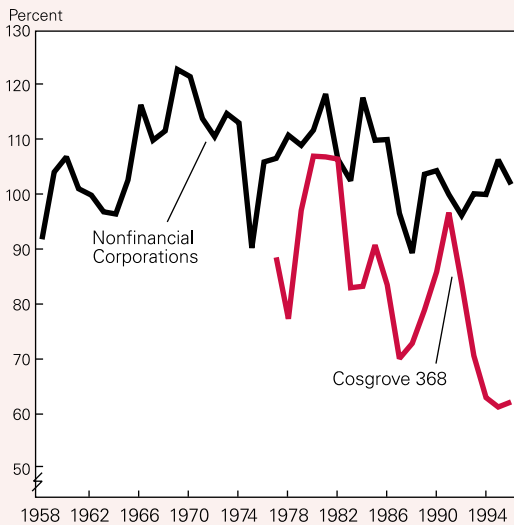
Percent

Nonfinancial Corporations

Cosgrove 368

Source: Board of Governors of the Federal Reserve System, Flow of Funds Accounts, nonfarm nonfinancial business sector; Compustat database. See the Appendix.

Figure 13

Corporations' Capital Spending Relative to Their Stock of Capital

Percent

Cosgrove 368

Nonfinancial Corporations
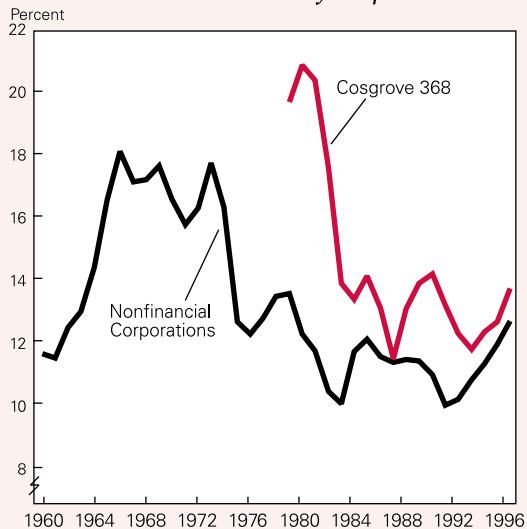
Source: Haver database, real fixed investment; U.S. Bureau of Economic Analysis, real capital stock; Compustat database. See the Appendix.

the existing stock of capital, and this spending frequently ranged between 16 percent and 18 percent of capital. During the 1990s, however, capital spending exceeded 12 percent of capital only in 1996, and the recent pattern of spending conforms closely to that of the late 1970s and 1980s. After taking the rate of depreciation of the stock of capital into account, today's rate of net investment is less than half that of the late 1960s and early 1970s. Using book values for capital yields much the same description of investment and the rate of growth of companies' assets. The growth of assets for the Cosgrove 368 in recent years has neither risen substantially nor exceeded its average for the past 20 years.

Implications for the Value of Equity

Inasmuch as companies' rates of return are not exceptionally high and their opportunities for making profitable investments apparently are not growing more rapidly than they have in the past, today's high price–earnings ratios suggest that shareholders' discount rates have fallen approximately 1 percentage point, unless shareholders expect companies' return

on assets to increase substantially sometime soon. During the 1960s, the prevailing price–earnings multiples just under 20 implied that the real discount rate was at least 6 percent. (Table 3 shows the expected price–earnings ratios at various shareholders' discount rates and rates of real growth of assets and net return on capital.) The return on shareholders' capital for the NFCs for much of that decade averaged more than 9 percent, yielding a net return of nearly 7 percent after allowing for corporate income tax liabilities. When companies' assets grow at least 4 percent annually, their stock would sell for 21 times earnings if the discount rate were 6 percent. If the discount rate were any lower, the price of stocks would be even greater: 29 times earnings for a discount rate of 5.5 percent, or 43 times earnings for a discount rate of 5 percent. During the last half of the 1970s and the first half of the 1980s, the shareholders' discount rate appears to have remained at least as high as 6 percent, as the price of stocks fell below 10 times earnings and the net return on shareholders' capital for the NFCs fell to 4 percent. Today, when the net return on capital is just over 5 percent, price–earnings multiples that are nearly 25 imply that the real discount rate has

Table 3

Expected Price–Earnings Ratios at Various Shareholders' Discount Rates, Rates of Return on Capital, and Rates of Growth of Assets

Expected P/E ratios at	Shareholders' Real Discount Rate 5%				Shareholders' Real Discount Rate 5.5%				Shareholders' Real Discount Rate 6%			
	Net Return on Capital				Net Return on Capital				Net Return on Capital			
	5%	5.5%	6%	7%	5%	5.5%	6%	7%	5%	5.5%	6%	7%
3% real growth of assets	20	23	25	29	16	18	20	23	13	15	17	19
4% real growth of assets	20	27	33	43	13	18	22	29	10	14	17	21

Source: Author's calculations. See the Appendix.

fallen to approximately 5 percent, unless shareholders expect the return on capital to increase substantially. If, for example, shareholders expect net returns to rise to 8.5 percent, exceeding the peak from the 1960s, then a discount rate near 6 percent would produce the current price–earnings ratio.

This drop in discount rates, at a time when the real yield on bonds has risen, suggests that shareholders' risk premiums have fallen at least by half. In the 1960s, when the discount rate was approximately 6 percent and the ex ante real rate of return on Treasury notes and bonds was no greater than 2 percent, the difference between shareholders' real rate of discount and the real yield on bonds was no less than 4 percentage points. Today, the real yield on Treasury bonds is 3.5 percent. If the shareholders' real discount rate is approximately 5 percent, the risk premium is no more than 1.5 percentage points.

These estimates of the current discount rate and risk premium assume that shareholders price their stocks nearly 25 times earnings, expecting earnings to grow 4 percent annually after removing the contribution of inflation. If shareholders, instead, are paying current multiples because they expect earnings to grow much more rapidly or otherwise expect the relative prices of shares to appreciate more than 4 percent annually, then, as noted above, their real discount rate still might be as great as 6 percent. Nonetheless, even this discount rate would imply that shareholders' risk premiums have fallen by two-fifths since the 1960s.

IV. Conclusion

By most standards, the value of equity is remarkably high. The current price–earnings ratio for the S&P 500, for example, is near its peak values for the past four decades. In the past, such high valuations have not endured, falling as they did in 1992 when high prices anticipated the rapid growth of companies' earnings and price–earnings multiples subsided as earnings overtook prices, or falling as in 1987 when shareholders' bids overreached companies' returns and prices subsequently relapsed to match earnings. In view of these experiences, current price–earnings multiples seem especially lofty if they anticipate that earnings will grow much more rapidly than companies' assets now that the economic recovery has matured.

The value of equity depends on the rate of return that shareholders require of their stocks as well as their views of earnings. Equity's dividend yield plus its expected real rate of appreciation must match shareholders' real discount rate. If companies' opportunities for making profitable investments grow about 3 or 4 percent annually, figures consistent with recent experience and most macroeconomic forecasts, then the real value of companies' shares will tend to appreciate at the same rate. Consequently, a 5 percent discount rate implies that the dividend yield on equities should be about 1.5 percent and that the price of equity should be about 25 times earnings. If, however, shareholders require a real return of 6 percent, then shares should be worth only about 15 times earnings in order to raise the dividend yield by the necessary 1 percentage point. The price of equity in this second case would be two-fifths less than in the first.

A 5 percent discount rate implies that shareholders are willing to accept a risk premium of 1.5 percentage points, about one-half the premium that they had required previously. Economists never were very comfortable explaining why the shareholders' risk

premium was so high in the past, so a substantial drop in the premium, especially given the comparatively smooth course of GDP and corporations' earnings in recent years, would require little rationalization (Abel 1991; Kocherlakota 1996).

Although other evidence suggests that the shareholders' risk premium might have fallen, this evidence is not entirely reassuring. The comparatively high rate of return that has persisted for almost two decades in the stock market implies that shareholders' discount rates and risk premiums also are high. Even if the discount rate has fallen recently, it might have done so only temporarily. Without a good explanation for the

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The recent bull market depends on shareholders' foreseeing a substantial increase in corporations' returns, or shareholders' requiring a lower rate of return, or both.

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subsidence of shareholders' risk premium, we might suspect that it could rebound with the next slump in profits (Figures 6 and 7)—certainly the prices of shares often have fallen significantly for companies that have announced disappointing earnings these last three years. Although the yields on low-grade corporate bonds recently have fallen steadily relative to the yields on Treasury bonds, this implied risk premium has varied greatly in the past with the outlook for companies' earnings. Moreover, in some respects the current risk premiums for low-grade bonds appear very low: These premiums have fallen much more in public than in private markets. Similarly, the risk premiums in venture capital financing have fallen sufficiently to deter some established financiers from accepting new investments, much as they did in the late 1980s. The prices of securities in public markets, therefore, appear too high according to some expert appraisals of their risks.

The high value of equity, on the other hand, might depend on the belief that profits and the price of stocks will continue to grow at double-digit rates. If

their risk premium has not changed since the 1960s, shareholders would now require a real return of nearly 8 percent. In order to bid 25 times earnings for their stocks in this case, shareholders might anticipate, for example, that real earnings and the real price of stocks will grow 6 percent annually and that the return on shareholders' capital after taxes will double. This expectation roughly corresponds with analysts' current forecast that earnings for the companies constituting the S&P 500 should grow nearly 14 percent annually over the coming five years (Doherty 1997; Ip 1997). Despite this very promising view, companies themselves apparently do not foresee sufficient profit from new investments to warrant a more rapid expansion of their capital budgets; instead, they have reduced their reliance on external financing, and their investment spending is modest compared to their cash flow.

If price–earnings multiples are high because shareholders expect corporations' earnings and the price of stocks to increase relatively rapidly, then the shareholders' discount rate might not have fallen relative to the yield on bonds. The high expected yields on equity, instead, might help explain why savers require relatively high real rates of interest. If so, should the growth of earnings subside as the return on assets fails to rise significantly, then not only could the price of equity fall as much as two-fifths, but the real return on bonds could fall as much as 1.5 percentage points.

The recent bull market depends on shareholders' foreseeing a substantial increase in corporations' returns, or shareholders' requiring a lower rate of return, or both. Corporations' return on assets has not yet increased sufficiently during this recovery to support equity's selling for more than 20 times earnings. Although the values of corporations' assets and earnings now exceed those that prevailed in the 1960s, the rate of return on corporations' assets and the rate of growth of their assets are not as great as they were in the 1960s. The consistently high growth of profits during much of the 1990s could have fostered both an optimistic view of future earnings and low discount rates. Yet, the returns on corporations' assets and on their shareholders' capital might have nearly completed their recovery from the troughs of the late 1970s and early 1980s, now that the current economic recovery has matured and corporations' leverage no longer is falling so rapidly. If so, the value of equity is prone to fall as the growth of earnings subsides and becomes more volatile, thereby ending the exceptional pattern of high returns with little risk.

Appendix

The Optimal Choice of Investment and Leverage

A assets
r shareholders' expected return on assets
α proportion of earning retained
l leverage, debt divided by assets
i risk-free rate of interest
i_d rate of interest on debt
δ shareholders' discount rate
r_c rate of return on shareholders' capital.

Uniform Opinions, No Rents

A company finances its assets partly with equity, partly with debt. If the company's creditors hold unlimited recourse to shareholders' assets should the company default on its debt, the cost of debt financing would be the risk-free rate of interest for any degree of leverage. Because recourse is limited to the company's assets, however, the rate of interest on debt exceeds i; creditors require a premium to compensate them for the risk that their claim will exceed the value of the company's assets, a premium that increases with leverage. If all investors assess the company's returns the same, shareholders derive a benefit from the shelter of limited liability that equals the risk premium they must pay creditors. Denoting this common value of the put option as $p(l)$,

$$i_d(l) = i + p(l)$$

$$\delta(l) = \delta(0)/(1 - l) - lp(l)/(1 - l).$$

If the value of this put option is included in the cost of debt financing, so that this cost is regarded as i_d, then the risk premium that is implicit in the shareholders' discount rate should be reduced by this risk that is transferred to creditors (a deduction of $p(l)l/(1 - l)$). Both the shareholders' discount rate and the cost of debt financing rise with leverage, other things equal, because creditors are protected less from the volatility of the return on assets and the shareholders' residual claim becomes more volatile.

The company's cost of capital is the weighted average of the cost of its debt and equity financing. If investors hold uniform opinions, this cost of capital does not vary with the company's choice of leverage (Modigliani and Miller 1958; Miller and Modigliani 1961; Miller and Scholes 1978):[6]

$$(1 - l) \cdot \delta(l) + l \cdot i_d(l) = \delta(0).$$

The company divides its return on assets between its creditors and shareholders.

$$(1 - l) \cdot r_c(l) + l \cdot i_d(l) = r.$$

When the company earns no rents, its cost of capital equals its return on assets ($r = \delta(0)$), and the previous two expressions imply that

$$r_c(l) = \delta(l).$$

Consequently, the value of the company does not depend on its leverage.

Rents

When the company earns a rent, its return on assets exceeds its cost of capital. Denoting this difference as $\Delta = r - \delta(0)$, the expressions above imply

$$r_c(l) = \delta(l) + \Delta/(1 - l)$$

$$\frac{r_c(l)}{\delta(l)} = \frac{\Delta/(1 - l)}{\delta(l)}$$

In these cases, the return on shareholders' capital exceeds their discount rate by a margin that increases with leverage when investors assess their companies' prospects similarly. Consequently, when $\delta(l)$ does not rise with l as rapidly as $(1 - l)^{-1}$, both r_c/δ and the value of the company increase with leverage, as indicated by the expression for Tobin's q in the text.

Differing Opinions

When investors do not hold the same opinions regarding their companies' rents, the cost of capital for these companies typically depends on their leverage and the size of the company. As a company's assets increase, it eventually exhausts the resources of its most optimistic investors.[7] Subsequent expansion is financed by issuing securities to less optimistic investors. As a rule, the company achieves its lowest cost of capital by issuing senior debt to the least optimistic investors, common stock to the most optimistic, and intermediate securities to investors falling between these extremes.

Suppose a company's investors comprise two types: optimistic and cautious. If the portions of the return on assets that are paid to creditors and to shareholders were taxed alike as corporate income, then the company initially would issue only equity, which would be purchased only by the optimists who are willing to pay the highest price for new equity relative to that of debt. For this first tranche of financing, the cost of capital would remain constant, $\delta(0)$ (Figure A-1). If the marginal return on assets remains above $\delta(0)$, then the company would issue debt to the cautious to finance its expansion beyond the resources of the optimists (point A_1). The cautious expect a lower return on assets or a greater volatility of returns than the optimists, so the risk premium they require exceeds the optimists' assessment of a fair premium,

$$\pi(l) = p_c(l) - p_o(l),$$

$$\pi(l) > 0 \quad \text{when} \quad l > 0,$$

$$\pi'(l) > 0.$$

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[6] The different treatment of interest payments and profits by the corporate tax code, and the consideration of bankruptcy costs will, in practice, cause the cost of capital to vary with leverage, as discussed below.

[7] Well before the most optimistic investors fully commit their resources, they too will require a greater return on this investment, because the risk inherent in their portfolios of assets increases with the loss of diversification.

Figure A-1
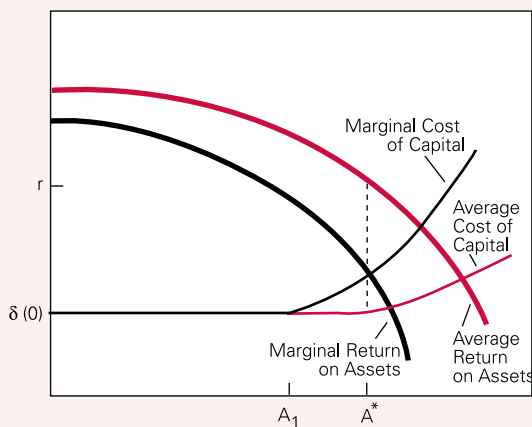
Accordingly, when A exceeds A_1 and l equals $(A - A_1)/A$, the cost of capital becomes

$$(l - l)\delta(l) + l(i + p_c(l)) = \delta(0) + l\pi(l),$$

and the marginal cost of capital is

$$D_A((\delta(0) + l\pi(l))A) = \delta(0) + \pi(l) + l(1 - l)\pi^l(l).$$

The Optimal Choice of Investment and Leverage

In this simple example, leverage is merely a function of the size of the company's assets, but other considerations also can influence the mix of financing. For example, if the portion of the return on assets that is paid to creditors is not taxed as much as that paid to shareholders, then the company can reduce its cost of capital for any value of A by increasing its leverage. Its choice of leverage depends on the balance between tax shelters and excess risk premiums. Furthermore, if bankruptcy is expensive, then the marginal cost of capital above should include terms reflecting the creditors' risk premium for bearing the expected value of this expense, which rises with leverage. Before l reaches 1, this augmented marginal cost of capital exceeds the cost of capital for issuing new equity to cautious investors instead of debt. Therefore, the company can manage its cost of capital by switching between equity and debt financing once its leverage becomes sufficiently high. Finally, δ and π most likely vary with the company's assets, because the expected return on assets (and probably the variance of returns) changes with the amount of assets.

The choice of investment which maximizes shareholders' wealth, A^*, equates the marginal cost of capital with the marginal return on capital. The company's cost of funds typically rises with its assets, because it generally makes use of the most economical financing first. Each point along the marginal cost of capital curve assumes the most suitable mix

of debt and equity financing; consequently, A^* also implicitly determines the optimal choice of leverage.

Leverage ordinarily rises with any shifts of the marginal return or cost curves that increase A^*. Other things equal, if shareholders foresee greater returns on their company's assets, they become more willing and able to pay the greater risk premium in order to obtain additional financing from cautious investors. On the other hand, if cautious investors become more optimistic about the company's returns, the marginal cost of capital curve shifts to the right as their risk premium falls.

The Cost of Capital, the Return on Assets, and the Value of Equity

There need not be a close correlation between the price–earnings ratio and leverage. Because the cost curve slopes up and the return curve slopes down, the average return on the company's assets exceeds its average cost of funds at A^*. This rent per unit of investment (the dotted line in Figure A-1) changes whenever the curves representing the cost of capital or the return on assets either shift or change their shapes.

Shifts of the marginal return or cost curves that increase A^* and leverage do not necessarily entail higher price-earnings ratios or greater values of Tobin's q. Should marginal returns become more horizontal—the return on assets does not change very greatly as assets grow, perhaps as a result of more competition—then the difference between the average return on assets and the average cost of assets could fall substantially even if this new curve for returns entails a higher A^* (Figure A-2). According to the formulas in the text, the price–earnings ratio and Tobin's q would tend to fall with the company's rent. Similarly, when cautious investors become more optimistic, the cost curve becomes more horizontal, and the price–earnings ratio falls with the rent, other things equal. On the other hand, should the curve

Figure A-2
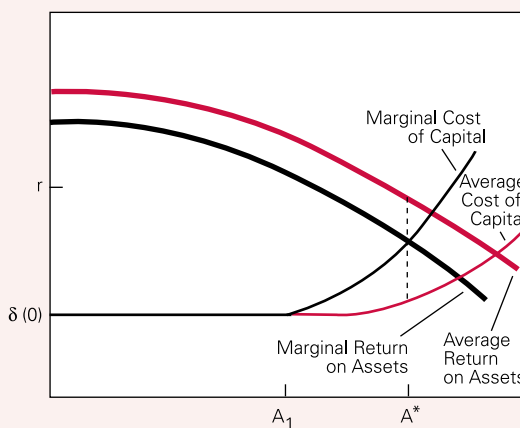
representing marginal returns become steeper, the price-earnings ratio and Tobin's q would rise with this greater rent. The value of equity also could increase with the rent should the cost curve become steeper.

Growth, Dividends, and the Value of Equity

As the company's opportunity for making new investments grows over time, the curve representing returns shifts to the right. By retaining earnings, the company also shifts the point A_1 and, consequently, the cost of capital curve to the right. If the point A^* is well to the right of A_1, the company will tend to retain all of its earnings in order to reduce its cost of capital. If, on the other hand, point A^* is near A_1, the company combines debt and equity financing to benefit from the tax shelter provided by debt financing, and its optimal stock of assets is not growing too rapidly (the return curve shifts to the right sufficiently slowly), then the company will simultaneously pay a share of its earnings as dividends on its stock while financing a portion of its new investments with debt. The retention of too much or too little of its earnings would not maintain its optimal degree of leverage.

Data Sources and Definitions

The Cosgrove 368

The Cosgrove 368 comprises companies selected from the Compustat database that meet several criteria. Companies that are primarily involved in the financial, real estate, investment, or utilities sectors were excluded. Of the remaining companies, those that were included in the Fortune 500 listing in 1996 and had 20 years of continuous balance sheet data available were selected, for a total of 368.

Data for Total Nonfarm Nonfinancial Corporate Businesses (NFCs)

From the Board of Governors of the Federal Reserve System, Flow of Funds Accounts:

Pre-tax Profits, not including net interest (Prof)
Taxes (Tax)
Inventory Valuation Adjustment (IVA)
Capital Consumption Adjustment (CCAdj)
Market Value of Equity (MVE)
Total Assets (TotA)
Total Financial Assets (TotFA)
Total Liabilities (TotL)
Net Debt (NetD) = TotL − TotFA
Capital Expenditures (CX)
Cash Flow (CF)

From the National Income and Product Accounts, U.S. Bureau of Economic Analysis:

Net Interest of Nonfarm Nonfinancial Corporate Businesses (NetInt)
Total Tangible Assets (TanA)
Chain-Weighted Index for Tangible Assets (IndexTanA)

From the Haver database:

Gross Domestic Product (GDP)

S&P 500 Price-Earnings Ratio (PE)
10-year Bond Yield (10yr)
Business Fixed Investment, chain-weighted 92$ (RBFI)

From the Board of Governors of the Federal Reserve System, FAME database:

S&P 500 Dividend Yield (DY)
S&P 500 closing price (SP500)

From the U.S. Bureau of Labor Statistics:

Consumer Price Index (CPI)

From the Compustat Database for the Cosgrove 368:

Income before Extraordinary Items Adjusted for Common Stock Equivalents (IBADJ) = Profits after Depreciation less Interest Expense and Taxes.
Interest Expense (XINT)
Total Taxes (TXT)
Earnings before Interest and Taxes (EBIT) = (IBADJ + TXT + XINT)
Total Assets (AT)
Inventories (INVT)
Net Property, Plant, and Equipment (PPENT)
Total Liabilities (LT)
Market Value of Equity − Fiscal Year End (MKVALF)
Net Debt (ND) = LT − (AT − (PPENT + INVT))
Capital Expenditures (Capx)
Cash Flow (CFL)

Figure 1

The upper line in Figure 1 is the natural log of the closing price of the S&P 500 (lnSP500).
The lower line is the annual return on the S&P 500 = capital appreciation + dividend yield.
Annual return = $((SP500(t) − SP500(t − 1))/Sp500(t − 1)) + DY$.

Figure 2

Tobin's Q is the market value of equity plus net debt divided by the current value of tangible assets.
Tobin's Q = $(MVE + NetD)/TanA$.

Figure 3

The price–earnings ratio for the S&P 500 (PE).

Figure 4

The earnings–price ratio(EP) for the S&P 500 is $1/PE$.
The real 10-year bond yield less the earnings–price ratio = $(10yr −$ average annual inflation rate$) − EP$.

From 1958 to 1986:
Average annual inflation rate = $((1 + ((CPI(t + 10) − CPI(t))/CPI(t)) \wedge (1/10)) − 1$.

From 1987 to 1990:
Average annual 10-year inflation rate = Blue Chip Economic Indicators Forecast.

From 1991 to present:
Average annual 10-year inflation rate = Survey of Professional Forecasters.

Figure 5

The real 10-year bond yield less the dividend yield =
(10yr − average annual inflation rate) − DY.

Figure 6

The value of equity, the PE ratio, for the NFCs is the
market value of equity divided by basic earnings.
NFCs' PE = MVE/Basic Earnings.
Basic earnings (BE) = Prof + IVA + CCadj − Taxes.
The average growth in earnings over the subsequent
three years is the annualized three-year growth rate.
Growth in earnings = $((1 + ((BE(t + 3) − BE(t))/BE(t)))$
$\wedge (1/3)) − 1$.

Figure 7

The average growth in earnings for the S&P500 over
the subsequent 3 years is the annualized three-year
growth rate.
Earnings (E) = SP500/PE.
Growth in earnings = $((1 + ((E(t + 3) − E(t))/E(t))) \wedge$
$(1/3)) − 1$.

Figure 8

Return on Assets = ((Prof + IVA + CCadj + NetInt)/
TanA) * 100.
Return on Shareholders' Capital = ((Prof + IVA +
CCadj)/(TotA − Liabs)) * 100.
Adjusted Return on Shareholders' Capital = ((Prof +
IVA + CCadj + Inflation Adjustment)/(TotA −
Liabs)) * 100.
Inflation Adjustment = Rate of Inflation * Net Debt =
((CPI(t) − CPI(t − 1)/CPI(t − 1)) * NetD.

Figure 9

Return on Assets = ((EBIT)/(PPENT + INVT)) * 100.
Return on Shareholders' Capital = ((IBADJ + TXT)/
(AT − LT)) * 100.
Adjusted Return on Shareholders' Capital = ((IBADJ +

TXT + Inflation Adjustment)/(AT − LT)) * 100.
Inflation Adjustment = Rate of Inflation * Net Debt =
((CPI(t) − CPI(t − 1)/CPI(t − 1)) * ND.

Figure 10

Net Interest Expense Relative to Earnings before Inter-
est = (NetInt/(Prof + IVA + CCadj + NetInt)) * 100.
Net Debt/Replacement Value of Tangible Assets =
(NetD/TanA) * 100.

Figure 11

Net Interest Expense Relative to Earnings before
Interest = (XINT/EBIT) * 100.
Net Debt/Replacement Value of Tangible Assets =
(ND/(PPENT + INVT)) * 100.

Figure 12

Capital Spending as a Percent of Cash Flow:
For NFCs = (CX/CF) * 100.
For Cosgrove 368 = (Capx/CFL) * 100.

Figure 13

Capital Spending Relative to the Stock of Capital:
For NFCs = (RBFI/(IndexTanA * TanA)) * 100.
For Cosgrove 368 = (Capx/(PPENT + INVT)) * 100.

Table 3

The price–earnings ratios were derived from the
formula:

$$P/E = \delta^{-1} \frac{(1 − \gamma/r_c)}{(1 − \gamma/\delta)},$$

where,

δ = shareholders' discount rate
γ = rate of growth of assets
r_c = net return on shareholders' capital.

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