

# *Stock Prices and the Equity Premium during the Recent Bull and Bear Markets*

From the 1940s to the mid 1990s, the value of equity in U.S. corporations doubled every 7 or 8 years, except during the 1970s. Then, during the late 1990s, stock prices soared especially rapidly as the value of equity tripled in 6 years. Capital gains appeared to breed their own momentum as prices rose more rapidly than companies' earnings on the prospect of rapidly expanding revenues and generous profit margins to come—a prospect which, if anything, grew more compelling the more prices rose.

During the bull market, traditional standards for valuing equity seemed to fade. For most companies, shareholders were willing to pay uncommonly high prices per dollar of current earnings, anticipating a rapid growth of earnings in the future. As prices soared for many high-tech companies and for others that aggressively adopted new technologies, the performance of a few companies appeared to dominate familiar indexes of stock prices too greatly. Eventually, as the indexes rose, the valuations of other corporations also rose, albeit to a lesser degree. Although stock prices collapsed after 1999, the value of equity has remained high relative to many companies' earnings and assets. As a result of this recent experience, particularly the persistence of high valuations, the financial press has speculated that familiar indexes of stock prices and conventional relationships between stock prices and other economic variables are becoming dated.

The first section of this article reviews the performance of the stocks that constituted the S&P 500 index during the recent bull and bear markets. The distribution of their valuations squares well with the past as,

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true to previous experience, the companies with the greatest market capitalization and the highest price-earnings ratios accounted for most of the value of the index and most of its variation. The particularly high stock prices that emerged in the 1990s, especially for the few companies that accounted for an uncommonly large share of the appreciation of the index, coincided with analysts' expectations that earnings for the S&P 500 would grow extraordinarily fast compared with previous experience and with GDP.

The second section analyzes the performance of the S&P 500 index, using a common model of stock prices. The results suggest that recent valuations do not necessarily mark a bubble or a break from the standard model. Instead, the variables behind the model broke with conventional historical patterns when prices soared with uncommonly high forecasts of earnings. Moreover, the results suggest that the value of equity might not have benefited so greatly from a falling risk premium for equity. The premium probably fell during the 1990s, but then rose sharply by 2003 to a value well above its average for the past half century. Current stock prices at 22 times trailing earnings are not really very high in view of the promising outlook for earnings. Should the risk premium fall in the future, as is likely with the recovery of business conditions and the return to full employment, this could insulate the price of stocks to a degree from the consequences of rising real interest rates.

## ***I. The Recent Bull and Bear Markets***

Since World War II, the S&P 500 index of equity prices has increased just over 8 percent annually. Although its rate of appreciation has varied, sometimes substantially from year to year, over remarkably long periods, these variations have tended to offset one another, allowing the index to rise at a comparatively consistent pace (Figure 1). Consequently, the postwar performance of the S&P 500 through 1994 essentially reflects the blend of two distinct regimes: two periods of rapid growth separated by an interval of stagnation. From 1949 to 1969 and from 1978 to 1994, the index adhered closely to trend lines that represent an annual rate of appreciation of approximately 10 percent. During the nine-year interval between these periods, the index changed relatively little.

Against this history, the surge in the index during the late 1990s marked a break with the past, a break that faltered before it apparently could establish a compelling foundation. After the sharp drop in stock

prices during 2001 and 2002, few expect prices to approach their previous peaks very quickly, even though companies are restoring their former profit margins, the growth of productivity remains high, and both inflation and interest rates remain near their postwar lows. Yet, by historical standards the prices of stocks are still uncommonly high relative to companies' current and prospective earnings, especially for those industries that seem to offer the most promise for future growth in output and productivity.

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During the 1990s, the previous conventions for reporting and valuing companies' earnings increasingly seemed inadequate for the times. The potential for many companies appeared to exceed their current performance so greatly that shareholders valued equities according to their revenues or their share of what promised to be rapidly growing markets. As investors and analysts experimented with new yardsticks, they often valued companies in different industries very differently. During the bull market, a small number of companies enjoying very high valuations seemed to dominate the market for equities and the performance of indexes such as the S&P 500. Similarly, the ensuing collapse of these valuations also dominated our perception of stocks' performance. The stock market seemed to become too narrow and too uneven, causing many to question the relevance of the standard indexes of equity values.

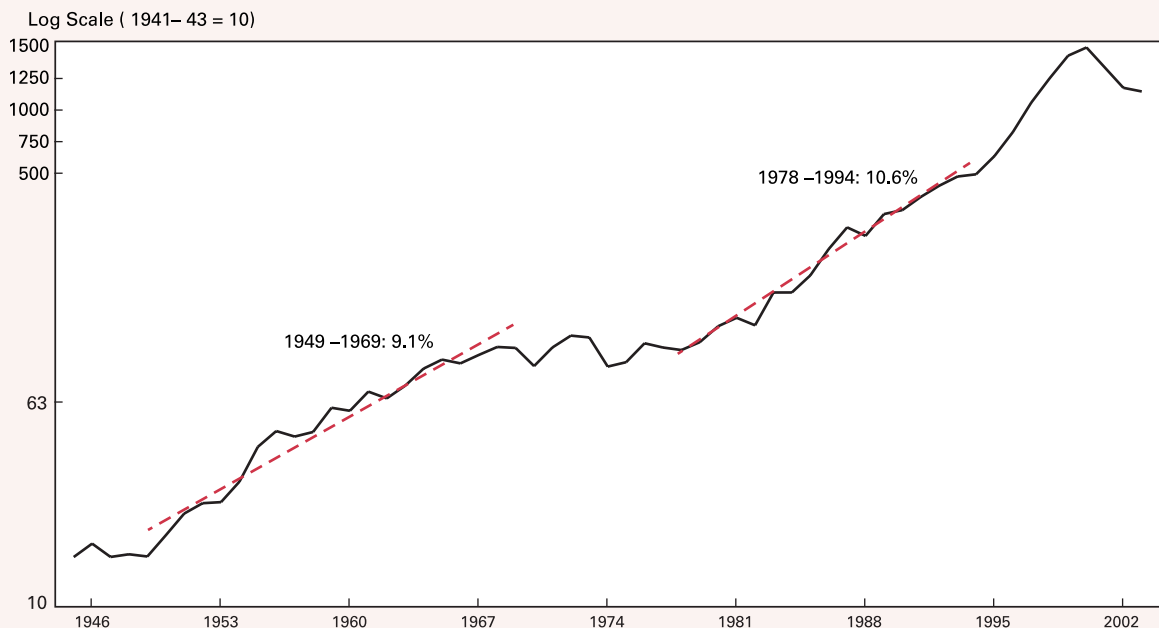
### ***The Breadth of the Market***

The sharp increase in the S&P 500 index of stock prices during the 1990s and its subsequent drop did not reflect the experience of the average corporation among the thousands traded in the United States, or even that of the 500 companies that constitute the index itself. Consequently, some analysts are questioning whether the S&P 500 is a proper measure of the value of equities (Blake 2002). Although the S&P 500

Figure 1

### Standard & Poor's 500 Composite Index

1945 to 2003



Source: Standard & Poor's, Haver Analytics.

represent only about one-tenth of the companies traded on domestic exchanges, the 500 account for almost 80 percent of the capital of all these corporations.

The S&P 500 weights the prices for its constituent companies by the total value of their outstanding equity, their market capitalization, allowing the performance of larger companies' stocks to dominate the index. Value-weighted indexes like the S&P 500 are designed to represent a broadly diversified portfolio of equity assets, the market portfolio, which reflects the supply of assets available to investors. Consequently, the performance of the index can differ from the performance of its average constituent, particularly the performance of smaller companies. For example, in 1999 the index rose 20 percent, while the prices of just over half its companies' stocks fell. In 2000, the index fell almost 7 percent, while the prices of more than half its stocks rose.

Although some have advocated using the Russell 3000 or the Wilshire 5000 instead of the S&P 500, these alternative indexes also weight their constituents by value, so their behavior resembles that of the S&P 500 rather closely (Fortune 1998). The top 25 companies,

ranked by market capitalization, accounted for 38 percent of the total value of the S&P 500 at the end of January 2004. At the same time, the top 25 accounted for 30 percent and 29 percent, respectively, of the total value of the Russell 3000 and the Wilshire 5000 indexes (Table 1). More important, the average returns and volatility of returns for the S&P 500 over the last five or ten years closely match those of the Russell 3000 and the Wilshire 5000. These observations suggest that most of the smaller companies are indeed small compared with the largest companies. Most investors, portfolio managers, and analysts essentially regard "the market" as the collection of the largest, most actively traded, and most visible companies, whose valuation on stock exchanges represents the prevailing view of the financial prospects of "corporate America."

Over the last three decades, the value of the equity of the largest companies in the S&P 500 has varied more than the value of the others (Figure 2). In 1967, the five companies with the greatest market capitalization accounted for almost 25 percent of the total value of the index; the largest 20 companies, almost 45 percent. By 1979, these contributions had fallen to 17 per-

Table 1  
*Comparisons of Broad Market Indexes  
 As of January 30, 2004*

	S&P 500	Wilshire 5000	Russell 3000
Inception date	3/4/1957	12/1/1970	12/31/1978
Number of stocks	500	5206	3000
Average market capitalization	\$21.93 bil	\$2.58 bil	\$4.49 bil
Top 25 companies by market cap as a percent of total market cap	37.80%	29.20%	29.80%
Year-to-date performance	1.84%	2.23%	2.09%
Five-year average annualized return	-1.02%	0.14%	0.11%
Five-year standard deviation	4.8%	5.1%	4.9%
Ten-year average annualized return	10.90%	10.49%	10.67%
Ten-year standard deviation	4.6%	4.7%	4.5%
Reconstitution frequency	As needed	Monthly	Annual
Share of total market	79%	100%	98%

Sources: Wilshire Associates, Standard & Poor's, Frank Russell Co., *Institutional Investor*, S&P Compustat, Bloomberg.

those of the 1960s. During the recent bear market, their contribution once again slipped. As a result of this variation, the valuations of the largest companies can account for a very large share of the change in the value of the entire S&P 500 in both bull and bear markets. From 1994 to 1999, the 20 companies with the largest market capitalization accounted for almost 31 percent of the increase in the index. Then, from 1999 to 2002, the top 20 accounted for almost 38 percent of the drop in the index.

cent and 35 percent, respectively. Then, after the value of equity recovered during the 1980s and 1990s, the contribution of the largest companies rose to match

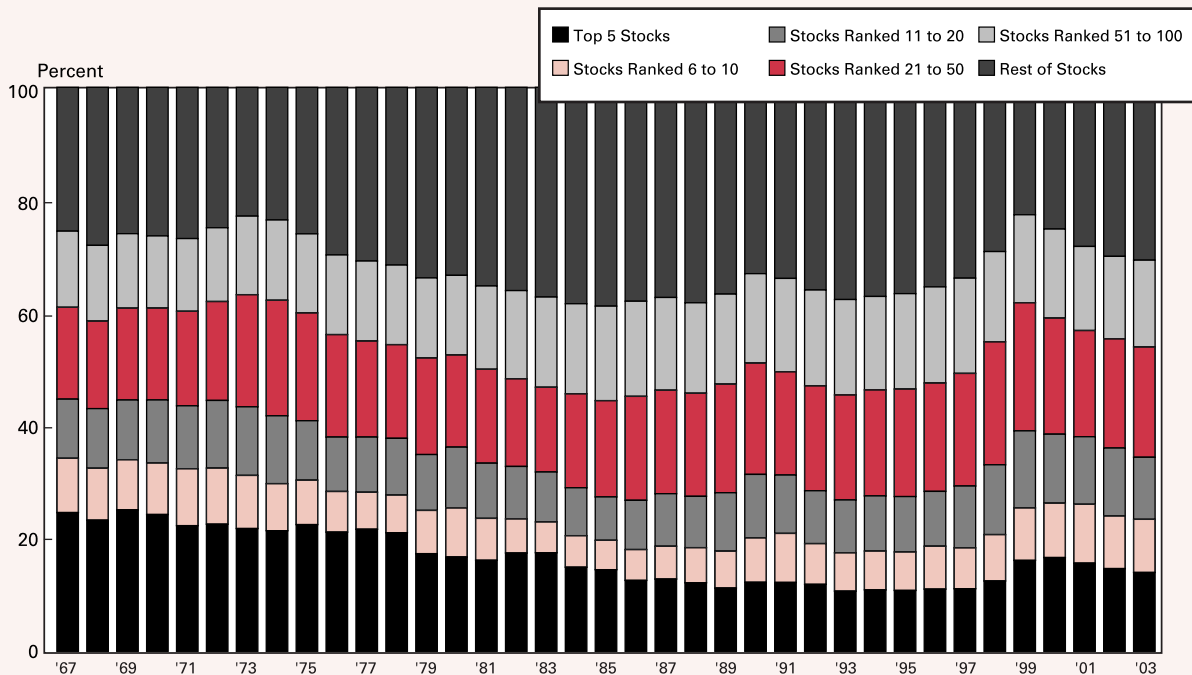
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The prices of stocks relative to earnings for the largest

companies are also more volatile than those for smaller companies. From 1977 to 1979, the price-earnings ratios of the companies in the top two deciles of mar-

Figure 2

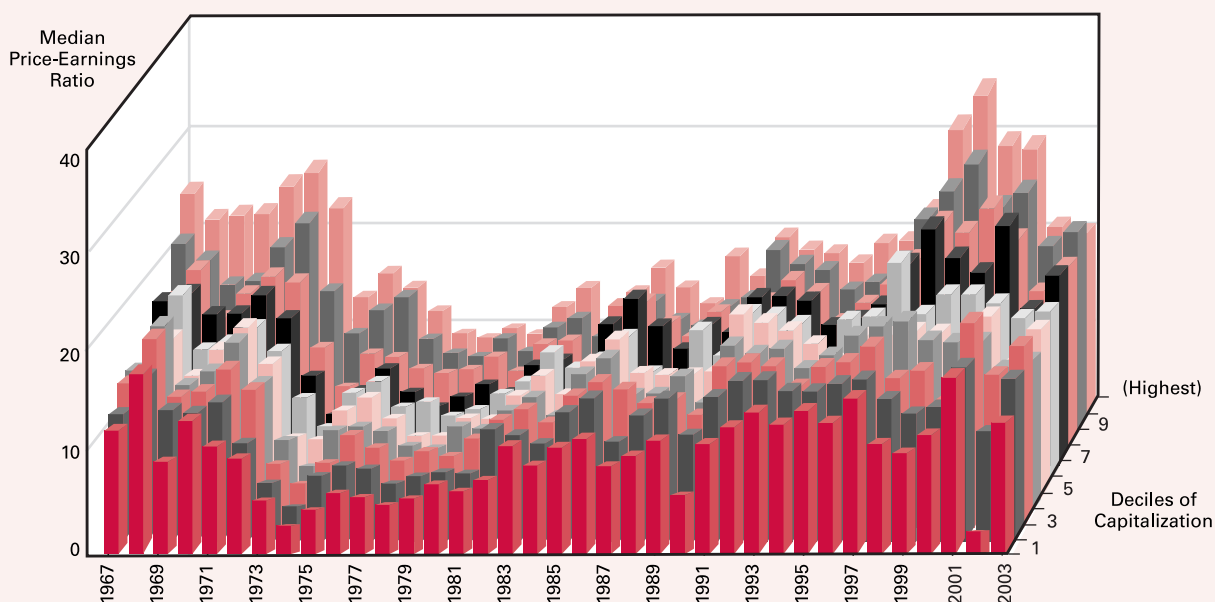
*Composition of Value of S&P 500 by Market Capitalization*



Source: Compustat.

Figure 3

*Price-Earnings Ratios for S&P 500 Stocks Sorted by Total Value of Companies' Equity*  
1967 to 2003



Note: The 500 companies are ranked by the total value of their equity each year. The bars show the median price-earnings ratio (December price divided by operating earnings for the year) for each group of 50 companies.

Source: Compustat.

ket capitalization averaged 8.8, while the average of the remaining deciles was 7.2 (Figure 3). By 1999, the average price-earnings ratio of the top two deciles had risen by 247 percent to 30.4, while that of the other eight had risen 141 percent to 17.4. From 1999 to the end of 2002, the average ratio of the top deciles fell 36 percent to 19.4, while that of the other deciles dropped 22 percent to 13.6.

***The Distribution of Performance within the S&P 500***

Although the largest companies can dominate changes in the index of stock prices, the prices of stocks of the other companies also participate in bull and bear markets. Ranking the 500 companies by the rate of appreciation in their equity each year shows that the performance of equities in all deciles rose and fell together until 1998 (Figure 4). The median rate of appreciation of the top decile of 50 companies typically

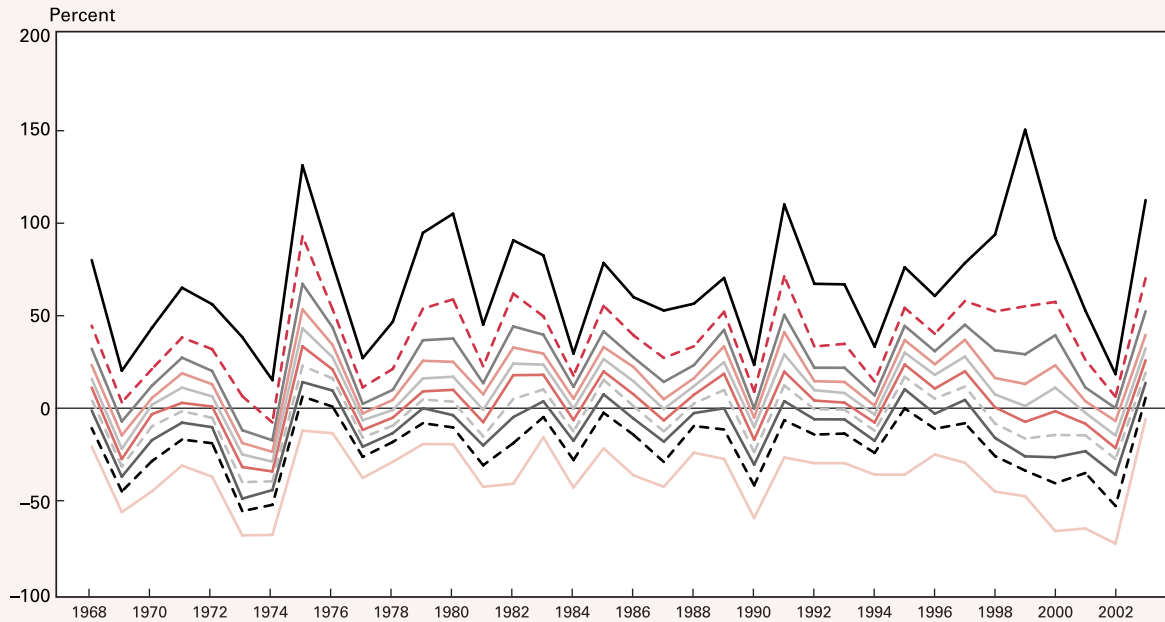
exceeded that of the next decile by a substantial margin. Similarly, the median rate of appreciation (here always negative) for the bottom decile typically fell substantially below that of the next higher decile. Otherwise, until 1998, the differences between the performances of adjacent deciles were comparatively small.

In 1998 and 1999, the gap separating the top two deciles from the remainder expanded significantly. The median rate of appreciation of the top decile rose sharply, to 157 percent, the highest rate of the past three decades, while the median rates of appreciation of stocks in the lowest seven deciles fell considerably. In the ensuing bear market, the gap between the top deciles and the lower deciles closed sharply as the median rates of appreciation of stocks in the top deciles dropped even more sharply than those in the lower deciles. Nevertheless, compared with the bear markets in 1974 and 1990, the prices of equities in all but the lowest decile performed relatively well during 2001 and 2002.

Figure 4

*Distribution of One-Year Rate of Appreciation  
by Decile of Capitalization for Stocks within S&P 500*

1968 to 2003



Source: Compustat.

This division in performance cannot be attributed to rotation. Companies' rankings frequently change from year to year. As last year's top performers slip into this year's middle deciles, their average rate of appreciation over time might match that of other stocks more closely. Yet, measuring the rate of appreciation of stocks over three-year intervals shows a distribution among the S&P 500 that closely resembles the distribution for rates of appreciation over one-year intervals (Figure 5). The median annual rate of appreciation of the top decile rose rapidly in 1998 and 1999, while those of the lowest seven deciles fell significantly.

As the distribution of returns widened in 1998 and 1999, so did the distribution of stock prices relative to their earnings (Figure 6). Ranking the companies with positive operating earnings by their price-earnings ratios each year shows that the gap between the median ratio of the top decile and that of the next decile is typically much greater than the gaps between the median ratios of the other deciles. During the last four decades, much of the variation in price-earnings ratios for the S&P 500 during bull and bear markets can be attributed to compression and expansion of the

gaps between the price-earnings ratios of the top deciles and those of the lowest deciles. Since 1974, the price-earnings ratios of all the stocks in the 500 have risen. This increase, which was most pronounced for the top three deciles in the late 1990s, expanded the dispersion of valuations at that time. The gaps among the median ratios of the deciles did not shrink in 2001 and 2002 as much as they had in past bear markets.

Companies' price-earnings ratios partly depend on forecasts of their earnings. The distribution of price-earnings ratios corrected for the expected growth of earnings (PEG ratios) tends to be much more compact than the distribution of uncorrected price-earnings ratios (Kopcke 2000, pp. 36-7), indicating that wide gaps in the distribution of price-earnings ratios, like those in 1999, often reflect large differences in the prospective growth of earnings.

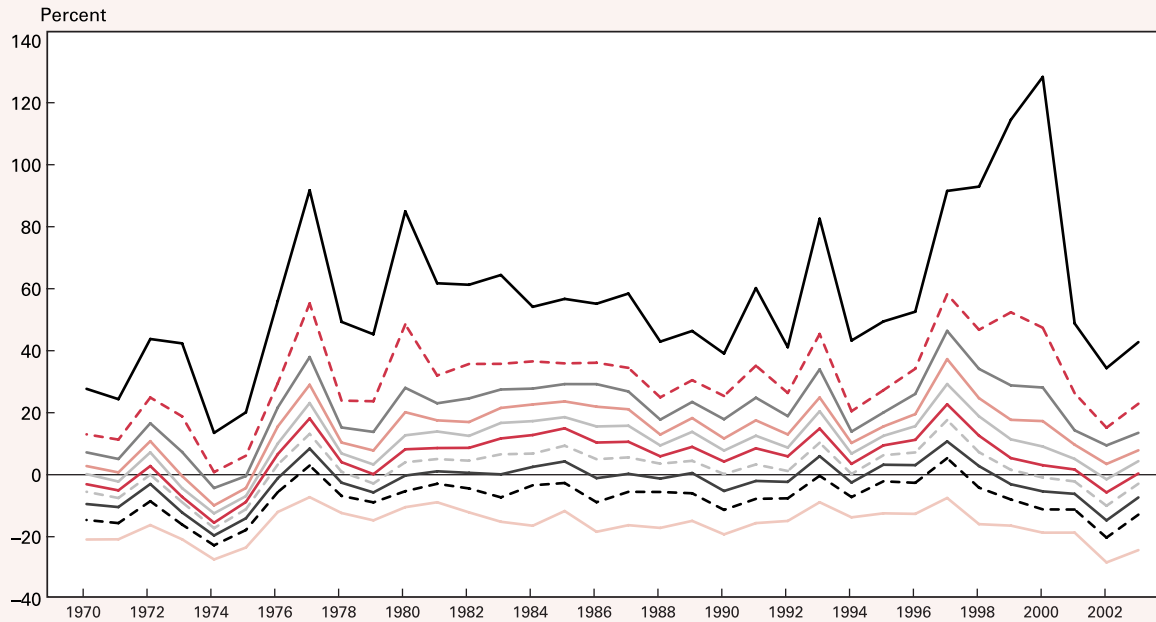
**Growth and Current Valuations**

Equities have appreciated at a pace that has exceeded the growth of assets and earnings by a substantial margin since 1994, and financial markets cur-

Figure 5

*Distribution of Three-Year Rate of Appreciation  
by Decile of Capitalization for Stocks within S&P 500*

1970 to 2003



Source: Compustat.

rently value the S&P 500 at relatively high premiums compared with post World War II averages, seemingly as a result of an uncommonly optimistic view of companies' future earnings (Figures 7 and 8).<sup>1</sup> During the 1960s, a high return on capital, an acceleration of productivity, and the generally rapid growth of GDP lifted investors' assessments of the potential growth of both the economy and companies' revenues and profits. The price-earnings ratio peaked just under 23 in 1961 and then remained near 18 for most of the decade until the recession in 1969. During the bull market of the 1990s, investors regarded the growth of companies' earnings even more favorably than during the 1960s, bidding the price-earnings ratio to a then-record high of 34 during 1999. In the late 1990s, analysts' forecasts for the five-year growth of real earnings for the S&P 500, 11 percent, significantly exceeded the previous peaks for five-year growth attained in every postwar decade except the 1960s and the early 1990s. As of April 2004, the analysts' consensus forecast of 7.9 percent growth is more than twice common estimates of the rate of growth of potential GDP.

For two reasons, a relatively high valuation of companies' assets and earnings is not unusual near the end of recessions or during the early stages of economic recoveries. First, at these times investors tend to expect earnings to increase comparatively rapidly. Second, they also tend to value that growth relatively highly because the real yields on other assets—particularly bonds—are usually comparatively low near the trough of a business cycle, and the prospect for a vigorous growth in earnings seems more secure than usual. Yet, for the S&P 500, and, as discussed above, for a large majority of companies within the 500, price-earnings ratios are higher today compared with previous recoveries.

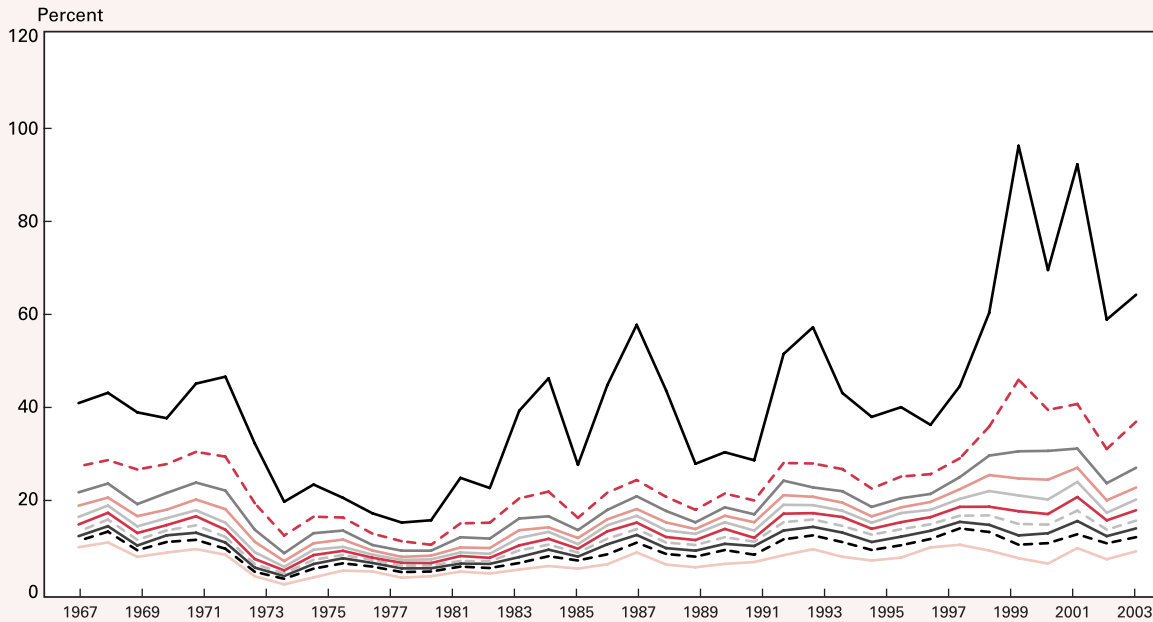
With this high valuation of earnings, financial markets also value companies' assets at a premium. The market value of companies in the S&P 500 divided by the *book value* of their assets rose significantly over the last two decades (Figure 9). From a value near 1.2

<sup>1</sup> The price-earnings peak in 2001 to 2002 reflects an anomaly—many companies took the opportunity to disclose negative and potentially negative news during a time of generally weak business performance, resulting in an extraordinarily low value of earnings.

Figure 6

*Distribution of Price-Earnings Ratios  
by Decile of Capitalization for Stocks within S&P 500*

1967 to 2003



Source: Compustat.

in the mid 1980s, this ratio rose above 4.8 by the end of 1999, near the peak of the bull market in stocks. Although this ratio had fallen to 2.6 by the end of 2002, near the trough of the recent bear market, it has since rebounded to 2.9, and the proportion of companies whose market values exceed the book value of their assets is near its record high (Bary 2004).

A similar measure of the premium in the valuation of corporations' assets, Tobin's  $q$  (Figure 10), is the ratio of the market value of all nonfinancial corporations to the *replacement value* of their assets (Tobin 1967). When the book value of companies' assets becomes too dated—as might occur during economic booms, especially those featuring substantial technological changes—the replacement value of companies' assets can be a more useful standard for assessing the premium embedded in the market value of their securities. Before the 1990s, estimates of  $q$  using national-accounts and flow-of-funds data were greatest in the 1960s, reaching peaks near 1. After the bull market of the 1990s,  $q$  soared to a record high above 2 by early 2000. Since then,  $q$  has slipped to 1.5, still well above its values of the 1960s.

## II. Real Returns and the Valuation of Equities

Since the 1940s, the annual real rate of return on the S&P 500, comprising its capital gains and dividends, all adjusted for inflation, has averaged almost 8 percent (Table 2).<sup>2</sup> This return has varied considerably over the six decades, having fallen as low as -1.4 percent over the 1970s and risen as high 16.8 percent over the 1950s. The annual real return exceeded 25 percent during the heart of the recent bull market from 1995 to 1999, only to fall back to 9.6 percent when this interval is extended to the end of 2003, thereby including the subsequent bear market.<sup>3</sup>

<sup>2</sup> These historical data overstate the return on equities that investors achieved or might hope to achieve for at least two reasons. Dichev (2004) estimates that investors actually achieved returns more than one percentage point lower than these buy-and-hold returns, which do not take account of the effects of investors' timing of transactions. Also, selective indexes, such as the S&P 500, are subject to survivorship bias—when companies begin to falter too severely, they are replaced by more promising enterprises (Brown, Goetzmann, and Ross 1995; Goetzmann and Jorion 1999; Häberle and Ranaldo 2004).

<sup>3</sup> Regarding this tendency for the real return on equity to remain constant over periods as long as 20 years, see Siegel (2002), Ibbotson and Chen (2003), and Dimson, Marsh, and Staunton (2004).



Table 2

*Composition of the Real Return on the S&P 500*

	Real Return	Dividend Yield	Real Appreciation	Nominal Appreciation	Monthly Volatility of Nominal Total Return
1947–2003	7.8%	3.9%	3.8%	7.8%	15.3
1947–1949	6.4%	6.5%	–0.1%	3.1%	16.4
1950–1959	16.8%	5.1%	11.1%	13.6%	13.2
1960–1969	5.2%	3.3%	1.8%	4.4%	12.1
1970–1979	–1.4%	4.2%	–5.4%	1.6%	16.0
1980–1989	11.9%	4.4%	7.1%	12.6%	18.6
1990–1999	14.8%	2.5%	12.0%	15.3%	14.9
2000–2003	–7.5%	1.5%	–8.8%	–6.7%	16.4
1947–1994	7.6%	4.4%	3.2%	7.5%	14.7
1995–1999	25.6%	1.9%	23.3%	26.2%	17.0
1995–2003	9.6%	1.7%	7.8%	10.3%	16.7

*Growth of Output and Earnings*

	Nominal GDP	Real GDP	S&P 500 Nominal Earnings per share	S&P 500 Real Earnings per share
1948–2003	7.0%	3.4%	6.3%	2.7%
1948–1949	4.6%	1.9%	20.0%	16.9%
1950–1959	6.6%	4.1%	3.9%	1.4%
1960–1969	6.9%	4.4%	5.5%	3.1%
1970–1979	10.0%	3.2%	9.9%	3.1%
1980–1989	7.9%	3.0%	4.4%	–0.3%
1990–1999	5.4%	3.1%	7.7%	5.4%
2000–2003	4.3%	2.4%	0.3%	–1.6%
1948–1994	7.4%	3.5%	7.4%	3.2%
1995–1999	5.6%	3.9%	9.5%	7.7%
1995–2003	5.0%	3.2%	5.3%	3.5%

Source: Ibbotson Associates, U.S. Bureau of Economic Analysis, Standard & Poor's, Haver Analytics.

During the last ten years, the composition of the real return on the equities constituting the S&P 500 has changed considerably, shifting away from dividends toward capital gains. Before 1995, the dividend yield (the dividend-price ratio) represented almost three-fifths of the real return. The 7.6 percent real return during this interval comprised, on average, a 4.4 percent dividend yield and a 3.2 percent real appreciation of share prices. This real rate of appreciation corresponded closely to the rates of growth of both real GDP and real earnings per share for companies in the S&P 500. Generally speaking, these companies retained sufficient earnings to expand their capital, their assets, and their earnings at a pace that matched that of GDP,

while the remainder of their earnings provided a considerable dividend.

Since the mid 1990s, the contribution of dividends to real returns has fallen substantially. From 1995 through 2003, the dividend yield fell to 1.7 percent, and the real rate of appreciation of share prices jumped to 7.8 percent. This rate of appreciation exceeded both the growth of real GDP, 3.2 percent, and real earnings per share, 3.5 percent.

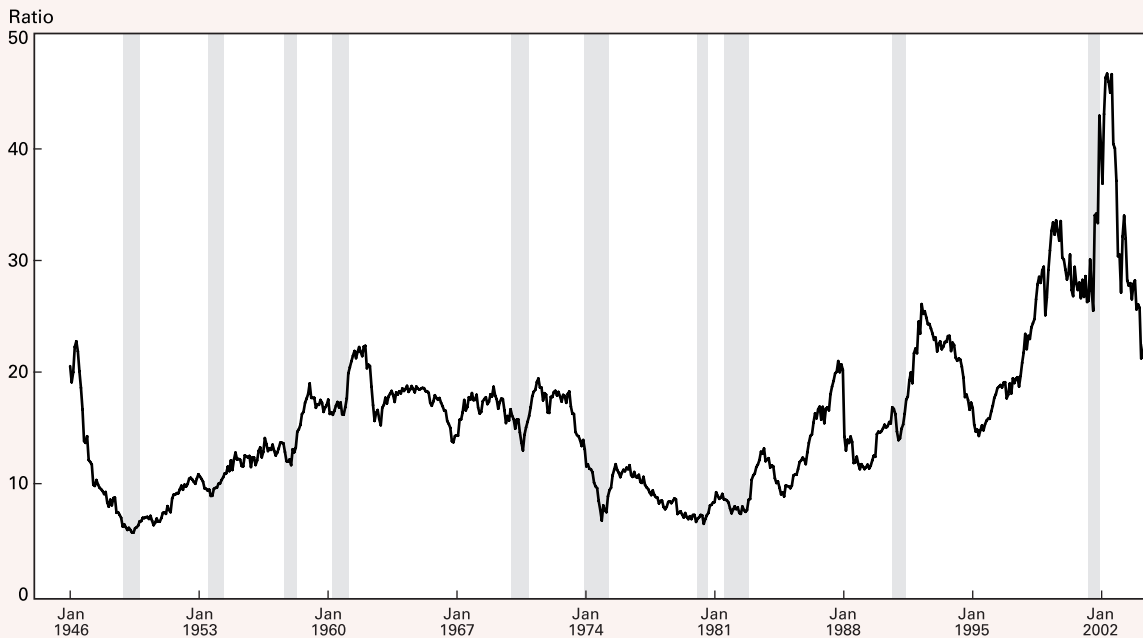
Much of the drop in the dividend yield on the S&P 500 can be attributed to the general increase in stock prices. Whenever prices rise relative to earnings, this change in valuation also entails lower dividend-price ratios unless companies pay a higher proportion of their earnings as dividends. In 1985, the dividend yield for the S&P 500 was 4.2 percent, and the price-earnings ratio was 14.5, both values near their pre-1995 averages. By 2000, the dividend-price ratio had fallen to 1.2 percent. At least two-thirds of this drop can be attributed to the price-earnings ratio's having risen to 26.4. The remainder can be attributed to dividends' hav-

ing fallen from 54 percent of companies' earnings in 1985 to only 33 percent in 2000. But much of this drop in the rate of distribution appears to have been a temporary consequence of the large jump in earnings during the 1990s. Since 1970, for example, dividends and earnings have increased about 5.9 percent annually. During this interval, the growth of dividends has varied much less than the growth of earnings, as companies seem to look through the cyclical variation in earnings, linking their payment of dividends more to the longer-run trends in earnings (Figure 11). As a result, dividends' share fell sharply as earnings reached their peak in 2000. Then, when earnings fell to their trough in 2001, dividends' share rose to 64 per-

Figure 7

### Price-Earnings Ratio for S&P 500

January 1946 to April 2004



Note: Shaded areas indicate recessions.  
Source: Standard & Poor's, Haver Analytics.

cent. As earnings soared abruptly once more, dividends fell again, to 36 percent of earnings in 2003.

#### *The Importance of Growth*

Before the mid 1990s—when investors more commonly expected earnings for the S&P 500 to grow as rapidly as GDP over the long run, and dividends accounted for a substantial share of the return on stocks—the earnings-price ratio (the earnings yield on stocks) tended to vary fairly closely with the real rate of interest on bonds with an allowance for the cyclical variations in earnings. Because investors require a competitive rate of return on equities, stock prices tend to rise and fall so that the earnings yield exceeds the real rate of interest on corporate bonds by a margin that depends on the outlook for companies' earnings. The earnings yield falls relative to the real rate of interest when conditions seem to allow earnings to grow more rapidly than average. The potential for above-average growth and the attendant capital gains compensate investors for accepting a somewhat lower current earnings yield. Conversely, the spread between

the earnings yield and real interest rates rises when earnings seem more vulnerable.

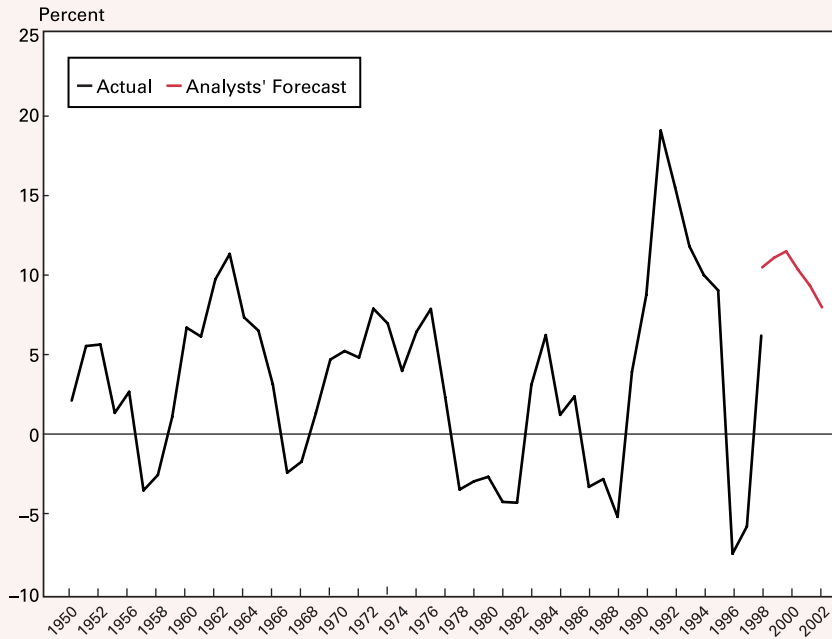
Since the late 1940s, the median value of earnings for the S&P 500 has been approximately 3 percent of GDP. If the difference between reported earnings and a trend value equal to 3 percent of potential GDP indicates how rapidly earnings might grow as they return to trend, the spread between the earnings yield and the real interest rate will tend to vary in concert with the gap between actual and trend earnings (Figure 12). As earnings rise relative to trend, other things being equal, shareholders might expect the rate of growth of earnings to be lower than customary over the coming years. With this prospect of temporarily slower growth and a lower rate of appreciation of equity, the spread between the earnings-price ratio and the real rate of interest will need to rise in order for equity to offer shareholders a competitive yield. When earnings fall relative to trend, the spread between the earnings yield and the real interest rate will fall with the prospect of more rapid growth and a greater rate of appreciation.

Until the mid 1990s, the spread between the earnings-price ratio for the S&P 500 and the real rate of

Figure 8

### Five-Year Growth Rate of Real Earnings for S&P 500

1950 to 2003



Source: Standard & Poor's, Thompson Financial First Call, Haver Analytics.

interest on corporate bonds was smallest when the prospects for the economy's growing rapidly were brightest—the 1960s, the early 1970s, and the 1980s. Between 1950 and 1994, the spread between the earnings-price ratio and the real bond rate tended to be greatest when earnings were highest compared with their trend. Conversely, a low spread generally occurred when earnings were comparatively low.

The changing economic climate in the 1990s not only altered the composition of returns on equity but also disrupted this and other simple standards for valuing equity. After 1994, prices rose and the earnings yield fell as earnings soared well above their former trend, rising from about 44 percent below trend to about 46 percent above trend. At the same time, the earnings-price ratio fell below the real rate of interest on bonds, consistent with shareholders' expecting companies' earnings to continue rising more rapidly than output. Indeed, since the late 1990s, analysts have generally expected real earnings for the S&P 500 to grow, on average, more than twice as fast as the consensus forecast for the growth of potential GDP (Figure 8). Familiar standards for judging stock prices no

longer could assume that the customary relationships between the growth of companies' earnings and the growth of GDP would prevail.

### A Model of the Value of Equity

According to basic theory, the price of stocks depends on the rate of return investors require of equity, investors' forecasts for the course of companies' current and future earnings, and the rate of return that companies earn on their capital (see the appendix and Box 1). The real rate of return that investors require of equity is the sum of two components, the risk-free real rate of interest, such as that on government bonds, and the risk premium they require for holding equity. The lower the risk-free real rate of interest, other things being equal, the lower is investors' real

discount rate for the returns that they expect to receive from stocks, thereby encouraging them to pay a higher price per dollar of earnings. Changes in the risk premium required of equity influence stock prices in much the same way as changes in the risk-free real rate of interest.

Investors also tend to be willing to pay a higher price for equity when they expect earnings to grow more rapidly. Financing a more rapid expansion of capital generally warrants companies' distributing a smaller share of their earnings as dividends. Nevertheless, if companies can maintain their rate of return on capital, the additional profits that accompany greater rates of expansion compensate investors for the lower current dividends and warrant higher prices. The more rapidly investors expect earnings to grow, or the longer they expect this growth to persist, the more prices rise relative to current earnings.

The price-earnings ratio tends to rise with companies' rate of return on capital. Higher rates of return allow companies to pay greater dividends without reducing their rate of accumulation of capi-

## Box 1 The Price of Stock

$P$	Price of stock
$E$	Earnings per share
$D$	Dividends per share
$\rho$	risk-free real rate of interest
$p$	equity premium
$\gamma$	real rate of growth of assets per share and earnings per share
$\pi$	rate of inflation
$r$	return on capital
$t_d$	tax rate on dividends
$t_c$	tax rate on capital gains
$(1 - \gamma/r)$	dividends per dollar of earnings
$(\rho + p)$	shareholders' required real rate of return

Price-earnings ratio and dividend yield:

$$\frac{P}{E} = \frac{\text{Dividends, after taxes, per dollar of earnings}}{\text{Shareholders' real discount rate + compensation for taxation of capital gains - real growth}}$$

$$= \frac{(1 - \gamma/r)(1 - t_d)}{(\rho + p) + (\gamma + \pi)t_c - \gamma}$$

$$\frac{D}{P} = \frac{\text{Shareholders' real discount rate + compensation for taxation of capital gains - real growth}}{\text{Value of a dollar of dividends, after taxes}}$$

$$= \frac{(\rho + p) + (\gamma + \pi)t_c - \gamma}{(1 - t_d)}$$

Equity premium:

$$p(\text{earnings}) = \frac{E}{P} (1 - \gamma/r)(1 - t_d) - (\rho - \gamma + (\gamma + \pi)t_c)$$

$$p(\text{dividends}) = \frac{D}{P} (1 - t_d) - (\rho - \gamma + (\gamma + \pi)t_c).$$

tal per share of equity. The price-earnings ratio increases especially rapidly when new opportunities for expansion accompany higher returns. In these circumstances, as the additional growth compounds the value of the added earnings, the price of equity increases more than the simple sum of the separate contributions of these two factors would suggest. When returns and growth both increase, the price-

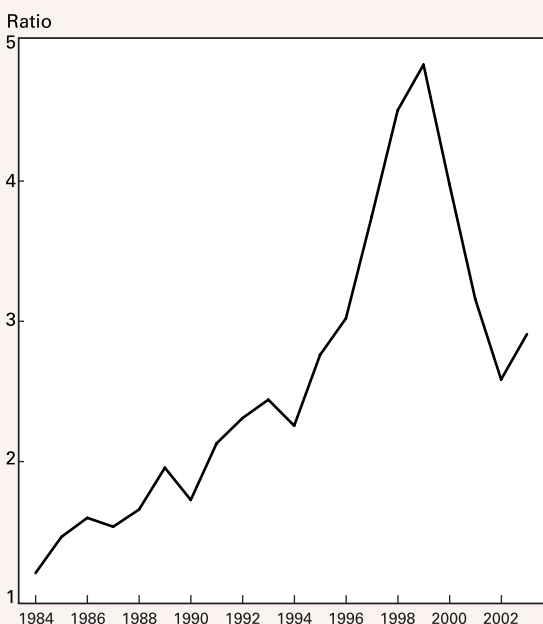
earnings ratio rises not only because of their separate influences but also because of the interaction of their changes.

When the tax rate on dividends exceeds that on capital gains, companies might increase the value of their equity by repurchasing their shares instead of paying dividends. Given the price of its stock, a company that cuts its dividend sufficiently to reduce its

Figure 9

*Market Value of Securities to Book Value of Assets for S&P 500*

1984 to 2003



Source: Standard & Poor's, Compustat.

dividend yield by one percentage point enables itself to repurchase one percent of its outstanding shares. For each percentage point that the dividend yield falls as a result of the reduction in payments, the rate of growth of the company's assets and earnings per share increases by one percentage point as a result of the repurchase of equity. Given the current dividend yield, the companies constituting the S&P 500 could increase the rate of growth of their assets and earnings per share, on average, by about 1.7 percentage points by omitting their dividends and using the funds to repurchase their equity. The value of this strategy, however, depends on the difference between the effective tax rates on dividends and capital gains. Before 2003, the difference in these tax rates could have been as great as 30 percentage points for taxpayers who held their equities for years.<sup>4</sup> In that case, the net additional return from repurchasing equity instead of paying dividends would have been limited to 30 percent of the dividend yield, about one-half of a percentage point at the current price of stocks. For taxpayers who traded their equities more frequently, the benefit would have been less.

For a variety of reasons, including the widespread holding of equity in tax-deferred accounts and many investors' preference for receiving dividends, companies have tended to distribute nearly half their earnings as dividends during the past half century.<sup>5</sup> In 2003, the tax rates on qualifying dividends were reduced to match those on long-term capital gains. Consequently, the net value of repurchasing shares is offset by the matching reduction in the net dividend yield for investors who hold their shares more than a year. Investors who tend to trade their stocks within a year should prefer dividends to capital gains, because short-term capital gains are now taxed at higher rates than dividends and long-term gains.

*Growth and the Equity Risk Premium*

During the 1990s, observers debated to what extent the ascent of stock prices might be attributed to glowing forecasts for earnings rather than to a drop in the risk premium and therefore in the return that shareholders require of equities. The sharp increase in prices relative to dividends and earnings during the late 1990s certainly could reflect a lower risk premium for equities. Before 1995, trend earnings relative to the price index for the S&P 500 did not fall below 5 percent, a limit reached in 1965 (Figure 13). By 1999, this ratio had fallen to 2.3 percent. At the same time, the dividend yield on equities had fallen to just over 1 percent. Although both these measures of yields have risen slightly over the last three years, they remain very low by historical standards.

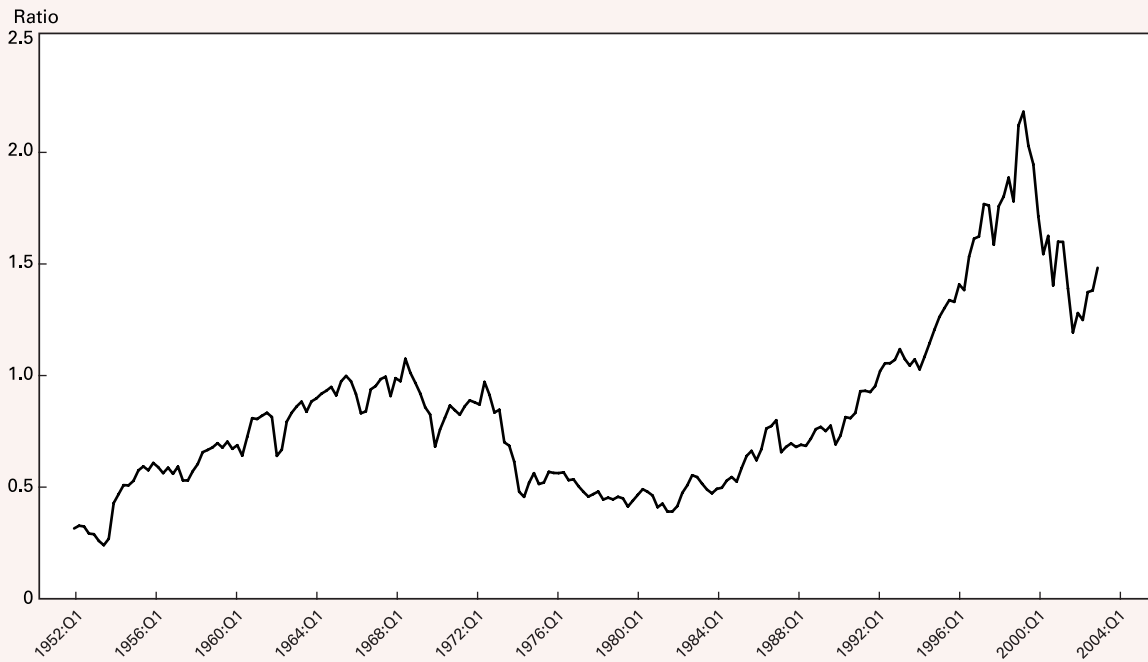
Yet, during the late 1990s the same evidence that supported a high risk premium in the past—real holding-period returns well in excess of those on other assets—prevailed with even more force. A lower equity risk premium would imply that investors required a lower return from stocks, other things being equal. Had the equity risk premium fallen, investors would have been willing to bid higher prices for stocks, depressing the dividend yield until the total return on equity had fallen by the same amount as the equity premium. In such circumstances, investors would not expect stock prices to appreciate more rapidly, once the value of equity had adjusted to the lower required return. Yet, during the bull market, many retail investors expected, portfolio managers promoted, and

<sup>4</sup> The effective annual tax rate on capital gains approaches zero as the length of investors' holding periods increases.

<sup>5</sup> DeAngelo and DeAngelo (2004, pp. 2–3) contend "...that the standard finance model, with or without taxes, requires large payouts, so that there is in fact no payout puzzle."

Figure 10

*Tobin's q: Market Value of Securities to  
Replacement Cost of Assets for Nonfinancial Corporations*  
1952 to 2003



Source: Federal Reserve Board flow of funds data, Haver Analytics.

analysts projected rates of return for equities that exceeded previous historical averages rather than returns that were below previous experience, as they would have if the rate of return required of equities had fallen. Investors expected higher rates of capital gains to more than offset their lower dividend yields.

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*Other evidence also suggests that the equity premium might not have fallen very much during the 1990s.*

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Other evidence also suggests that the equity premium might not have fallen very much during the 1990s. The difference between the rates of interest on AA corporate bonds and government bonds rose by half to a 40-year high of 1.3 percentage points from 1994 to 1999, reflecting investors' concerns about companies' rising credit risks (Figure 14).<sup>6</sup> Because bond-

holders possess claims on companies' assets that are senior and more secure than those of shareholders, such a substantial increase in the bond premium would not likely coincide with a substantial drop in the equity premium. While companies' credit risks were rising, so also was the market risk of equity as reflected in the premiums for options on the S&P 500. During 1994, the expected volatility of stock prices implied by these premiums was often near 14 percent; by 1999, this expected volatility was often near 25 percent. Again, it is not likely that the risk premium embedded in the pricing of equity fell substantially over an interval when investors expected the prices of stocks to become more volatile.

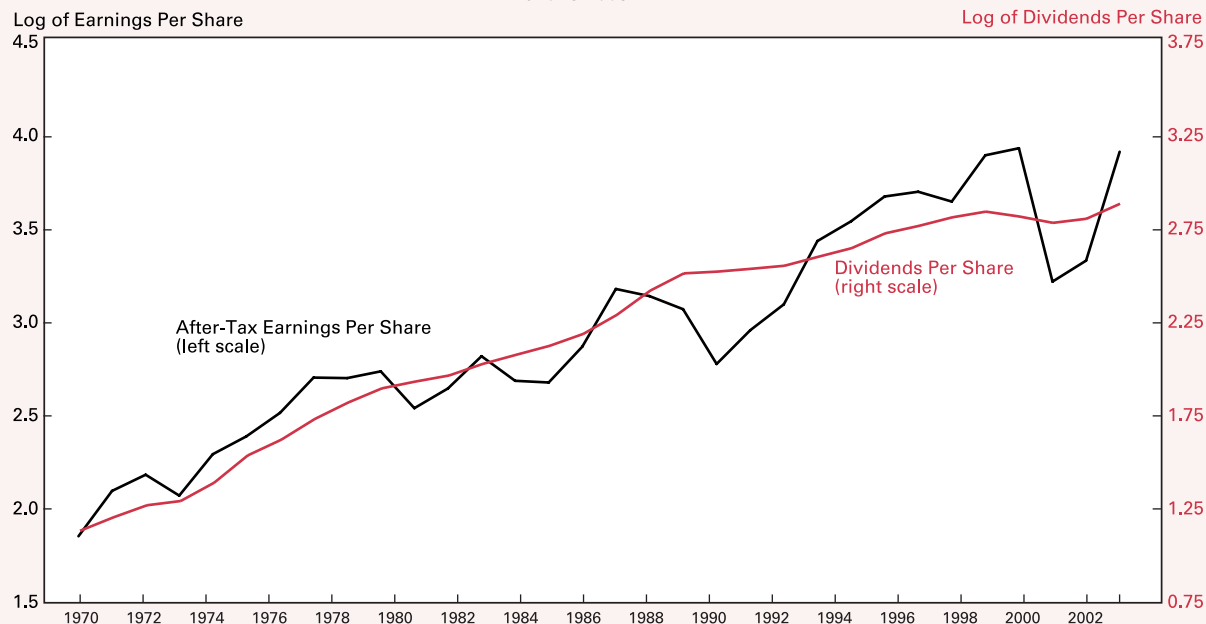
Without direct measures of the risk premium for equity, models of equity prices can provide estimates. In the modified Gordon growth model of stock prices described in the appendix and summarized in the box, the dividend yield and the earnings yield depend on the real rate of return on government bonds, the risk

<sup>6</sup> Longstaff, Mithal, and Neis (2004) find that most of the changes in the spread between the interest rates on corporate and government bonds can be attributed to changes in default risk.

Figure 11

### Earnings Per Share and Dividends Per Share for S&P 500

1970 to 2003



Source: Standard & Poor's, Haver Analytics.

premium appropriate for equity, the expected return on capital, and the rate of growth of assets and earnings per share of stock. This model, in conjunction with values for the other variables, produces estimates of the equity risk premium. Because the risk premium and the growth of earnings influence earnings or dividend yields with very similar force but in opposite directions, the implied premium rises or falls nearly in step with the growth rate, other things equal.

In a comparison of the price of stocks to trend earnings, the model indicates that the risk premium for equity might have fallen significantly during the 1990s (Figure 14). Assuming that shareholders have expected earnings to remain near trend and to grow, on average, as rapidly as potential GDP, the equity premium has fallen over the past half century. During the 1950s and 1960s, the premium fluctuated around a value of 4 percent. The premium rose sharply with the oil crises in the 1970s, and then it fell sharply in the early 1980s when the real yield on government bonds jumped but dividend yields and earnings yields did not rise commensurately. The estimates of the premium using the dividend yield dropped particularly steeply in 1982,

and then fell gradually, remaining near 2 percent over the 1980s and 1990s. The estimates using the earnings yield averaged about 3.8 percent from the early 1980s through the early 1990s. The premium then fell sharply in the mid 1990s, approaching 2 percent by 1999. Since the late 1990s, the estimate of the equity risk premium using earnings has jumped to 4.3 percent.

These estimates of the premium for equity assume that earnings quickly return to trend and that thereafter the rate of growth of earnings and dividends for the S&P 500 matches that of potential GDP. Yet, during much of the 1990s, analysts expected a path of earnings that did not correspond to trend, often forecasting the growth of earnings to exceed that of GDP by a substantial margin (Figure 8). As of this writing, in April 2004, they expect earnings to grow by more than twice common estimates for the rate of growth of potential GDP over the next five years.

Estimates for the premium did not fall so steeply in the 1990s if we assume that investors' expectations for the growth of earnings and dividends matched analysts' forecasts for the next five years and then dropped to 4 percent in all subsequent years (Table 3,

Table 3  
*Equity Premium*

	Growth of Earnings		
	Potential GDP	Mid Range	Analysts' Five-Year Forecast
1998	2.48	3.05	3.07
1999	2.06	2.86	2.89
2000	2.00	2.89	2.96
2001	2.80	2.65	2.61
2002	3.53	3.41	3.44
2003	4.31	5.41	5.56

*Required Return on Equity:  
Equity Premium plus Real Rate of  
Return on 10-Year Government Bonds*

	Growth of Earnings		
	Potential GDP	Mid Range	Analysts' Five-Year Forecast
1998	3.61	4.18	4.20
1999	3.45	4.25	4.28
2000	3.66	4.55	4.62
2001	3.86	3.71	3.67
2002	4.40	4.28	4.31
2003	5.34	6.45	6.59

Sources: Thomson Financial/First Call, Federal Reserve Board, Congressional Budget Office, FAME Database, Haver Analytics.

rightmost columns). These alternative estimates of the premium fell to a value near 2.6 percent in 2001. The premium subsequently rose abruptly to approximately 5.6 percent in 2003, as stock prices rose less than analysts' optimistic forecasts of earnings would have implied if the premium had been constant. Even if the growth of earnings in the next five years is midway

between that forecasted by the analysts and that of potential GDP, current earnings yields imply that the equity premium is about 5.4 percent (Table 3, middle columns).

These estimates of the equity premium, when added to the current real rate of interest on government bonds, about 1 percent (after taxes), imply a real discount rate for equity near 6.6 percent (Table 3, lower panel). This discount rate would be comparable to a pre-tax real return on equity that is close to the average real return on equity over the past half-century (Table 2).

*Theoretical Price-Earnings Ratios and the  
Equity Premium*

We can also use the model of equity prices to analyze the factors that are likely influencing the price of equity. Currently the price-earnings ratio for the S&P 500 is about 22, which is well above its average over the past 50 years. The simple model of equity prices can support this price-earnings ratio in a variety of ways (Table 4). Earnings might continue to grow more rapidly than GDP, the return on companies' capital might remain high, and the equity premium could fall. A falling equity premium would help support stock prices by limiting the increase in shareholders' required rates of return in the event that yields on government bonds rise in the future. A high return on capital and rapid growth of earnings would not only directly support the value of equity but would also allow a greater drop in the equity premium, especially as companies' financial performance improves and becomes more secure.

If earnings were to grow by only 4 percent, an equity premium of 5.5 percent would support cur-

Table 4  
*Theoretical Price-Earnings Ratio*

Growth Rate of Real Earnings	4%				6%				8%			
	10%	12.50%	15%	17.50%	10%	12.50%	15%	17.50%	10%	12.50%	15%	17.50%
Return on Capital												
Equity Premium												
4%	39.69	44.98	48.51	51.03	40.43	45.91	49.56	52.16	41.14	46.78	50.55	53.24
4.50%	28.67	32.49	35.04	36.86	29.44	33.50	36.21	38.14	30.19	34.49	37.36	39.41
5%	22.43	25.43	27.42	28.84	23.06	26.30	28.46	30.01	23.69	27.18	29.51	31.17
5.50%	18.43	20.89	22.52	23.69	18.90	21.61	23.41	24.70	19.38	22.34	24.31	25.72
6%	15.64	17.72	19.11	20.10	15.97	18.30	19.85	20.96	16.31	18.89	20.61	21.83

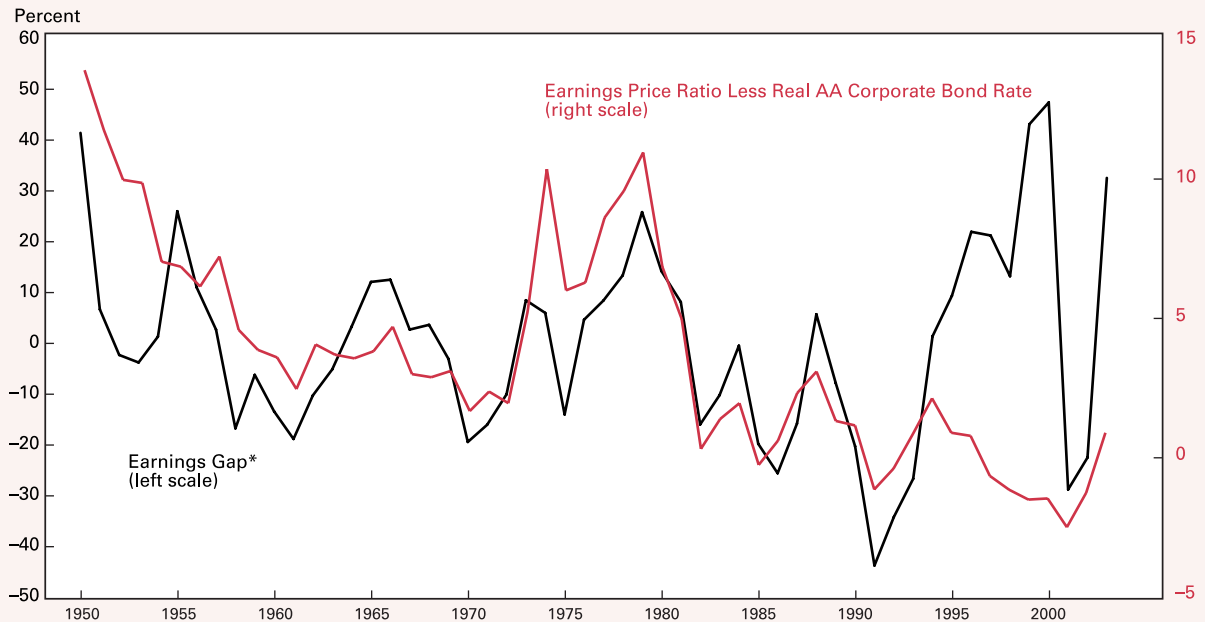
Sources: Standard & Poor's, Federal Reserve Board, FAME Database, Haver Analytics.



Figure 12

*S&P 500 Earnings-Price Ratio less Real AA Corporate Bond Rate  
and the Earnings Gap*

1950 to 2003



\* Earnings gap = 100 \* (earnings less trend earnings)/trend earnings.

Source: Standard & Poor's, Federal Reserve Bank of Philadelphia, FAME database, Haver Analytics.

rent price-earnings ratios, provided the real rate of interest on government bonds does not increase significantly. If the real rate of interest on government bonds, currently about 1 percent (net of taxes), were to rise to 2 percent during this economic expansion, the equity premium would need to fall by the same amount, to about 4.5 percent, to support current stock prices.<sup>7</sup> Should real interest rates rise as high as 4 percent, a rate closer to that which prevailed during much of the 1980s and 1990s, then the equity premium would have to fall by about 3 percentage points, to about 2.5 percent, to justify current valuations.

A higher return on capital would not require such a low equity premium to offset the effect of higher real rates of interest. The return on capital for the S&P 500, which has generally varied between 10 percent and 15 percent during the past 50 years, rose above 15 percent in the last half of the 1990s. After falling steeply by 2002, this return rose to approximately 12.5 percent at the end of 2003 with the recovery in companies' profit margins. If investors expected the return on equity to rise to 15 percent

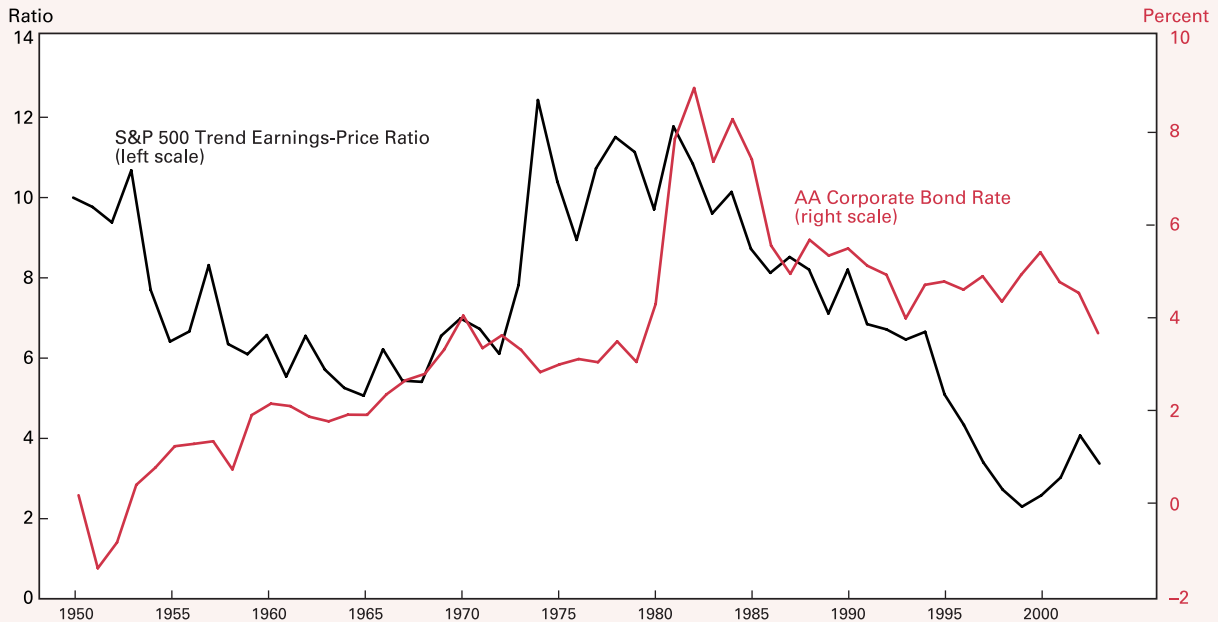
fairly quickly, then current price-earnings ratios would reflect an equity premium closer to 5.75 percent. In this case, should the real interest rate on government bonds rise to 4 percent, the equity premium would need to fall only to 2.75 percent to compensate. If real earnings grow only 4 percent, however, companies' profit margins probably will not increase very much in the coming years, and the return on capital likely will remain relatively constant near 12.5 percent.

If real earnings grow more rapidly, in the range of 6 percent to 8 percent annually for the next five years, before dropping to a 4 percent rate of growth, companies' profit margins will continue to increase, and the

<sup>7</sup> According to Dimson, Marsh, and Staunton (2004, p. 22), plausible estimates of the future real rate of interest on government bonds and the equity premium are about 2 percent and 3 percent, respectively. See also Ibbotson and Chen (2003), Bernstein and Arnott (2002), Arnott and Bernstein (2003), O'Neill and Wilson (2002), Claus and Thomas (2001), and Fama and French (2002) for alternative views. Timing and survivorship biases in estimated returns will tend to overstate the equity premium. See Dichev (2004); Brown, Goetzmann, and Ross (1995); Goetzmann and Jorion (1999); and Häberle and Ranaldo (2004).

Figure 13

*S&P 500 Trend Earnings-Price Ratio  
and Real AA Corporate Bond Rate  
1950 to 2003*



Source: Standard & Poor's, Federal Reserve Bank of Philadelphia, FAME database, Haver Analytics.

rate of return on capital is more likely to rise above 15 percent. With this greater growth of earnings and a higher return on capital, an equity premium approaching 6 percent could support current valuations, and the premium would need to fall only to 3 percent to accommodate a 3-percentage-point increase in the real rate of interest on government bonds.

### III. Conclusion

Although the major indexes of stock prices are well below their record highs, current price-earnings ratios remain extraordinarily high. Both the price index and earnings for the S&P 500 peaked in the third quarter of 2000, yielding a price-earnings ratio of 28. The current price-earnings ratio of 22 seems to suggest that, once again, stock prices might be inflating too rapidly. The valuation of earnings and capital is relatively high for the S&P 500 as a whole, and this phenomenon is not limited to companies in the highest deciles: Price-earnings ratios across the 500 companies, which had risen during the 1990s, have remained high,

especially for the corporations that have the lowest market capitalizations.

In one respect, today's price-earnings ratio looks more appealing than this ratio did at the peak of the market. In 2000, GDP exceeded most measures of the

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*In one respect, today's  
price-earnings ratio looks more  
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at the peak of the market.*

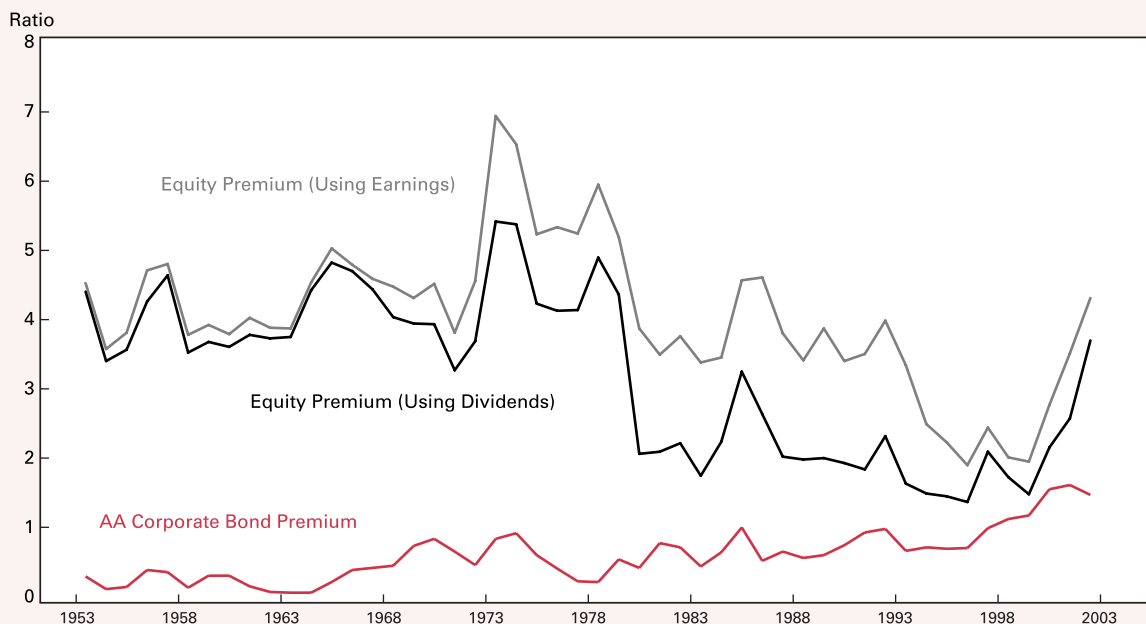
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economy's potential. Today, with GDP below the potential rate of output, the economy has more leeway to expand before it attains its capacity for producing goods and services. Although the recovery has gained momentum comparatively slowly, companies' earnings are rebounding quickly as they restore their

Figure 14

### Equity Premiums and Corporate Bond Premium

1953 to 2003



Source: Standard & Poor's, Federal Reserve Board, Congressional Budget Office, FAME database, Haver Analytics, U.S. Treasury, U.S. Census Bureau.

profit margins. Stock prices anticipate that earnings could continue to grow rapidly, at a pace within previous experience, as economic activity accelerates and overtakes potential output. Consequently, prices are only 17 times analysts' forecast of earnings for this year, a modest value given the prospect for growth in coming years. In conjunction with these favorable fundamentals, financial theory suggests that the recent reduction in the tax rate on dividends also has lifted the value of equity.

Nonetheless, shareholders might require higher-than-average returns from equity as the economy expands. The real return required of equity appears to be consistent with its average return for the past five decades. But, the real rates of interest on govern-

ment bonds are currently low by historical standards. As the recovery fosters the demand for funds both here and abroad, these interest rates will tend to increase, perhaps rising back to the yields that prevailed in the 1980s, which would tend to increase the yield required of equity and depress stock prices. As the economy returns to full health, however, a drop in the equity premium might prevent the required return from rising as much as the real rate of interest. Should earnings grow at least half as fast as analysts expect, current prices might comfortably accommodate a 1- or 2-percentage-point increase in the real rate of interest.

## Appendix

### Theoretical Model of the Value of Equity

The following develops and extends the familiar Gordon (1962) model of stock prices, in which shareholders value a corporation's equity according to the rate of growth of its earnings and dividends, its prospective return on capital, and its capital gains, which in turn depend on the growth of the assets and earnings that back its equity. Earnings benefit shareholders directly when companies distribute a portion of their earnings as dividends, less directly when companies invest their earnings, either by purchasing assets or their stock, in order to increase the assets and earnings behind each share of stock. Because the price of stock ordinarily rises with the promise of greater earnings and dividends, this reinvestment of earnings commonly rewards shareholders with capital gains.

Shareholders look to the dividends they expect to receive while they hold their stock and to the capital gains they anticipate when they sell. But, the price others will be willing to offer for shares in the future will be governed by these future investors' assessments of their dividends and capital gains, which in turn will reflect the present value of dividends and capital gains that the next round of investors might expect. This chain of logic implies that shareholders value their stock by discounting prevailing estimates of all future dividends, which takes into account the growth of the value of assets behind each share. This approach emphasizes the correspondence between the price of stocks and their earnings.

Shareholders generally expect companies' earnings to grow with time at rate  $\gamma + \pi$ . Earnings might grow as a result of companies' increasing their assets,  $\gamma$ , and as a result of inflation,  $\pi$ . The shareholders' discount rate,  $\delta$ , equals the risk-free rate of interest,  $i$ , and the risk premium,  $p$ , they require for holding equity. The risk-free rate of interest is, in turn, the sum of the real rate of interest,  $\rho$ , and the inflation premium,  $\pi$ . The shareholders' real discount rate is, therefore,  $\rho + p$ . Companies divide their profits, paying a portion as dividends,  $D$ , to shareholders. The retention of earnings increases the assets backing their shares of stock at the rate  $\gamma$ . If shareholders were not taxed on their investment incomes, the price of stock would be

$$\begin{aligned} P &= D \int_0^{\infty} e^{(\gamma + \pi)s} e^{-\delta s} ds \\ &= D / (\delta - (\gamma + \pi)) \\ &= D / ((\rho + p) - \gamma), \end{aligned}$$

$$(\rho + p) > \gamma.$$

In this simple model, shareholders expect the company's assets, earnings, and dividend to grow at the same rate each year. In equilibrium, the shareholders' real discount rate equals the real rate of return on equity, the sum of its dividend yield and real rate of appreciation.

$$(\delta - \pi) = (\rho + p) = \frac{D}{P} + \gamma.$$

When shareholders are receiving a consistently high rate of real return and continue to expect their returns to remain high, their real rate of discount is also high.

In equilibrium, the annual return to equity is the sum of the dividend-price ratio and the rate of growth of dividends. Consequently, the spread between the rate of return that shareholders require of equity and the dividend-price ratio depends on the expected nominal rate of growth of companies' assets, earnings, and dividends:

$$\begin{aligned} \frac{D}{P} &= \delta - (\gamma + \pi) \\ \delta - \frac{D}{P} &= \gamma + \pi. \end{aligned}$$

The real rate of growth of earnings and dividends depends on companies' ability to increase their assets without depressing their profitability. If their return on capital (after corporate income taxes) is  $r$ , and if their opportunities allow them to grow at rate  $\gamma$ , then they retain a constant share of their earnings,  $\alpha = \gamma/r$ , to finance the expansion of their capital. Their price-earnings ratio is

$$\begin{aligned} P &= D / (\delta - (\gamma + \pi)) \\ &= (1 - \alpha)E / (\delta - (\alpha r + \pi)) \\ \frac{P}{E} &= \frac{(1 - \alpha)}{(\delta - (\alpha r + \pi))} \\ &= \frac{(1 - \gamma/r)}{((\rho + p) - \gamma)}, \\ r &> (\rho + p). \end{aligned}$$

The price-earnings ratio increases, other things equal, with companies' return on capital and with their opportunities for growth (provided  $r > (\rho + p)$ ). A higher return on capital entails greater dividends, for which shareholders will pay a higher price given the return they require of equity. A higher rate of growth entails lower dividends, but the rate of appreciation increases more than the dividend yield falls at a constant price for equity. The prospect of a significant increase in earnings, which occurs near the end of economic recessions, also tends to raise price-earnings ratios as investors bid higher prices for stocks, expecting both earnings and dividends to increase during the imminent economic expansion.

The earnings-price ratio increases with the shareholders' required real return on equity and falls as the return on capital or the rate of growth of earnings increases (Table A1):

$$\begin{aligned} \frac{E}{P} &= \frac{(\rho + p) - \gamma}{1 - \gamma/r} = r \frac{(\rho + p) - \gamma}{r - \gamma} \\ \frac{E}{P} - (\rho + p) &= \frac{\gamma[(\rho + p) - r]}{r - \gamma}. \end{aligned}$$

The spread between the earnings-price ratio and the shareholders' real discount rate is equal to or greater than zero in equilibrium.

The spread between the earnings-price ratio and the real rate of interest for bonds reflects both shareholders' assessments of companies' rates of growth and the difference between the risk premium for equity and that for bonds. Because the risk premium for equity exceeds that for companies' bonds,  $p_{cb}$ , and that for government debt (assumed to be

Table A1

*Theoretical Price-Earnings Ratios for Specific Returns on Capital*

Required Return on Capital of 7.5%		Growth						
		<b>0.03</b>	<b>0.035</b>	<b>0.04</b>	<b>0.045</b>	<b>0.05</b>	<b>0.055</b>	<b>0.06</b>
<b>0.1</b>		15.6	16.3	17.1	18.3	20.0	22.5	26.7
<b>0.125</b>		16.9	18.0	19.4	21.3	24.0	28.0	34.7
<b>0.15</b>		17.8	19.2	21.0	23.3	26.7	31.7	40.0
<b>0.175</b>		18.4	20.0	22.0	24.8	28.6	34.3	43.8
<b>0.2</b>		18.9	20.6	22.9	25.8	30.0	36.3	46.7
<b>0.225</b>		19.3	21.1	23.5	26.7	31.1	37.8	48.9
<b>0.25</b>		19.6	21.5	24.0	27.3	32.0	39.0	50.7
Required Return on Capital of 8%		Growth						
		<b>0.03</b>	<b>0.035</b>	<b>0.04</b>	<b>0.045</b>	<b>0.05</b>	<b>0.055</b>	<b>0.06</b>
<b>0.1</b>		14.0	14.4	15.0	15.7	16.7	18.0	20.0
<b>0.125</b>		15.2	16.0	17.0	18.3	20.0	22.4	26.0
<b>0.15</b>		16.0	17.0	18.3	20.0	22.2	25.3	30.0
<b>0.175</b>		16.6	17.8	19.3	21.2	23.8	27.4	32.9
<b>0.2</b>		17.0	18.3	20.0	22.1	25.0	29.0	35.0
<b>0.225</b>		17.3	18.8	20.6	22.9	25.9	30.2	36.7
<b>0.25</b>		17.6	19.1	21.0	23.4	26.7	31.2	38.0

Source: Authors' calculations.

zero), the spread between the earnings-price ratio and the rate required of equity is typically less than the spread between the earnings-price ratio and the rate required of debt:

$$\frac{E}{P} - \rho > \frac{E}{P} - (\rho + p_{cp}) > \frac{E}{P} - (\rho + p).$$

When shareholders expect earnings to increase rapidly during economic expansions, the earnings-price ratio can be especially low relative to shareholders' required rate of return, and the spread between the earnings-price ratio and the real rate of interest on bonds can be negative.

The equity premium,  $p$ , can be estimated from the expressions for the earnings yield or the dividend yield:

$$\frac{E}{P} = \frac{(\rho + p) - \gamma}{(1 - \gamma/r)}$$

$$p = \frac{E}{P} (1 - \gamma/r) - \rho + \gamma$$

$$\frac{D}{P} = (\rho + p + \pi) - (\gamma + \pi)$$

$$p = \frac{D}{P} - \rho + \gamma.$$

**Income Taxes**

Suppose shareholders' ordinary income is taxed at rate  $t$ ; dividends, at rate  $t_d$ ; capital gains, at effective annual rate  $t_c$ . Also, define the relationship between the nominal and real yields for the risk-free rate of interest and the required return on equity as

$$\begin{aligned} \rho &= i(1 - t) - \pi \\ \delta &= \rho + p + \pi. \end{aligned}$$

Then the price of equity becomes

$$\begin{aligned} P &= D(1 - t_d) \int_0^{\infty} e^{(\gamma + \pi)s} e^{-\delta s} ds - P(\gamma + \pi)t_c \int_0^{\infty} e^{(\gamma + \pi)s} e^{-\delta s} ds \\ &= D(1 - t_d) / (\delta - (\gamma + \pi)) - P(\gamma + \pi)t_c / (\delta - (\gamma + \pi)) \\ &= \frac{D(1 - t_d)}{(\rho + p) - \gamma + (\gamma + \pi)t_c} \\ &= \frac{(1 - \alpha) E (1 - t_d)}{\rho + p - \gamma + (\gamma + \pi)t_c}. \end{aligned}$$

The price-earnings ratio is

$$\frac{P}{E} = \frac{1}{r} \cdot \frac{(r - \gamma)(1 - t_d)}{(\rho + p) - \gamma + (\pi + \gamma)t_c}.$$

The price-earnings ratio tends to rise as inflation falls or with reductions in the tax rates on either capital gains or dividends. The expressions for the equity premium become

$$\begin{aligned} \frac{E}{P} &= \frac{(\rho + p) - \gamma + (\gamma + \pi)t_c}{(1 - \gamma/r)(1 - t_d)} \\ p &= \frac{E}{P} (1 - \gamma/r)(1 - t_d) - (\rho - \gamma + (\gamma + \pi)t_c), \end{aligned}$$

$$\begin{aligned} \frac{D}{P} &= \frac{(\rho + p) - \gamma + (\gamma + \pi)t_c}{(1 - t_d)} \\ p &= \frac{D}{P} (1 - t_d) - (\rho - \gamma + (\gamma + \pi)t_c). \end{aligned}$$

When the tax rate on dividends exceeds that on capital gains, companies can increase their price-earnings ratios by repurchasing their shares instead of paying dividends, rewarding shareholders by increasing the assets per share of their stock. If a company reduced its dividend by proportion  $\phi$  of earnings to repurchase equity, it would reduce its outstanding equity and increase its assets per share by the proportion  $\phi E/P$ . If it maintained this policy, the real rate of growth of assets per share would be  $\alpha r + \phi E/P$ , and the price of its stock would be

$$P = E(1 - \alpha - \phi)(1 - t_d) \int_0^{\infty} e^{(\alpha r + \phi \frac{E}{P} + \pi)(1 - t_c)s} e^{-\delta s} ds.$$

$$\begin{aligned} \frac{P}{E} &= \frac{(1 - \alpha - \phi)(1 - t_d)}{\delta - (\alpha r + \phi \frac{E}{P} + \pi)(1 - t_c)} \\ &= \frac{(1 - (\gamma/r) - \phi)(1 - t_d)}{\rho + p - \gamma + (\gamma + \pi)t_c - \phi \frac{E}{P}(1 - t_c)} \\ &= \frac{1}{r} \cdot \frac{(r - \gamma)(1 - t_d) + r\phi(t_d - t_c)}{\rho + p - \gamma + (\gamma + \pi)t_c}. \end{aligned}$$

#### Change in the Rate of Growth

Suppose investors expect the real rate of growth of assets and earnings to change after five years—falling from  $\gamma$ , a rate of growth exceeding potential GDP, to  $\gamma_0$ , the rate of growth of potential GDP—as the economy recovers from a recession to reach capacity output. The company's return on capital and the shareholders' discount rate for equity remain constant when the rate of growth falls.  $\theta$  is the shareholders' discount rate less the company's rate of growth.

$$\begin{aligned} \theta &= \delta - (\gamma + \pi) = (\rho + p) - \gamma \\ \theta_0 &= \delta - (\gamma_0 + \pi) = (\rho + p) - \gamma_0 \end{aligned}$$

$$\begin{aligned} P &= D(1 - t_d) \left[ \int_0^5 e^{-\theta s} ds + \frac{(1 - \gamma_0/r)}{(1 - \gamma/r)} e^{-5\theta} \int_0^{\infty} e^{-\theta_0 s} ds \right] \\ &\quad - t_c P [(\gamma + \pi) \int_0^5 e^{-\theta s} ds + (\gamma_0 + \pi) e^{-5\theta} \int_0^{\infty} e^{-\theta_0 s} ds] \end{aligned}$$

$$\begin{aligned} &= D(1 - t_d) \left[ \frac{1}{\theta} (1 - e^{-5\theta}) + \frac{(1 - \gamma_0/r)}{(1 - \gamma/r)} \frac{1}{\theta_0} e^{-5\theta} \right] \\ &\quad - t_c P [(\gamma + \pi) \frac{1}{\theta} (1 - e^{-5\theta}) + (\gamma_0 + \pi) \frac{1}{\theta_0} e^{-5\theta}]. \end{aligned}$$

The price of stock equals the discounted value of net dividends less effective capital gains taxes on the annual appreciation of equity. Dividends grow rapidly for five years. They then jump at the end of five years when the company's need for financing new assets abates ( $(1 - \gamma_0/r) > (1 - \gamma/r)$ ), and they subsequently grow more slowly. The annual capital gains on equity equal its price times its rate of appreciation, which drops after the first five years by an amount that equals the jump in the dividend yield.

The price-earnings ratio of stock reflects the company's initial rapid growth, the jump in dividends after five years, and the company's slower growth in subsequent years:

$$\frac{P}{D} = \frac{(1 - t_d) \left[ 1 + \left( \frac{(1 - \gamma_0/r)}{(1 - \gamma/r)} \frac{\theta}{\theta_0} - 1 \right) e^{-5\theta} \right]}{(\rho + p) - \gamma + t_c(\gamma + \pi) \left[ 1 + \left( \frac{(\gamma_0 + \pi)}{(\gamma + \pi)} \frac{\theta}{\theta_0} - 1 \right) e^{-5\theta} \right]}$$

$$\frac{P}{E} = \frac{(1 - \gamma/r)(1 - t_d) \left[ 1 + \left( \frac{(1 - \gamma_0/r)}{(1 - \gamma/r)} \frac{\theta}{\theta_0} - 1 \right) e^{-5\theta} \right]}{(\rho + p) - \gamma + t_c(\gamma + \pi) \left[ 1 + \left( \frac{(\gamma_0 + \pi)}{(\gamma + \pi)} \frac{\theta}{\theta_0} - 1 \right) e^{-5\theta} \right]}$$

The denominator of these price-dividend and price-earnings formulas matches those of previous formulas, except that the compensation for capital gains taxes reflects the deceleration in growth after five years. Similarly, the numerators of these expressions match those of the previous formulas, except for the factor reflecting the deceleration in growth.

The equity premium is the value of  $p$  that solves this last equation (recognizing that  $\theta$  is a function of  $p$ ) given the value of the price-earnings ratio and the other variables.

## References

- Arnott, Robert D. and Peter L. Bernstein. 2002. "What Risk Premium Is 'Normal'?" *Financial Analysts Journal*. March/April: 64–85.
- Bary, Andrew. 2004. "Read the Fine Print: Book value can point to bargains—or to stocks that deserve their low prices." *Barron's*. February 9: 37–38.
- Blake, Rich. 2002. "Is Time Running Out for the S&P 500?" *Institutional Investor*. May: 53–64.
- Bernstein, William J. and Robert D. Arnott. 2003. "Earnings Growth: the Two Percent Dilution." *Financial Analysts Journal*. September/October: 47–55.
- Brown, Stephen, William Goetzmann, and Stephen Ross. 1995. "Survival." *Journal of Finance*. v50(3). July: 853–873.
- Claus, James and Jacob Thomas. 2001. "Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets." *Journal of Finance*. v54(5). October: 1629–1666.
- DeAngelo, Harry and Linda DeAngelo. 2004. "Payout Policy and the Dividend Puzzle." Marshall School of Business, University of Southern California. Working Paper. March.
- Dichev, Ilia D. 2004. "What Are Stock Investors' Actual Historical Returns?" University of Michigan Business School. Working Paper. April.
- Dimson, Elroy, Paul Marsh, and Mike Staunton. 2004. "Irrational Optimism." *Financial Analysts Journal*. January/February: 15–25.
- Fama, Eugene and Kenneth French. 2002. "The Equity Premium." *Journal of Finance*. v57(2). April: 637–659.
- Fortune, Peter. 1998. "A Primer on U.S. Stock Price Indexes." *New England Economic Review*. November/December: 25–40.
- Goetzmann, William and Phillippe Jorion. 1999. "Global Stock Markets in the Twentieth Century." *Journal of Finance*. v54(3). June: 953–980.
- Gordon, Myron. 1962. *The Investment, Financing and Valuation of The Corporation*. Homewood, IL: Richard Irwin.
- Häberle, Rainer and Angelo Ranaldo. 2004. "Wolf in Sheep's Clothing: The Active Investment Strategies Behind Index Performance." EFMA Basel Meetings Paper: UBS Global Asset Management. Working Paper. 25 May.
- Ibbotson, R.G., Associates. 2004. *Stocks, Bonds, Bills, and Inflation: 2004 Yearbook*. Chicago: R.G. Ibbotson Associates.
- Ibbotson, Roger, and Peng Chen. 2003. "Long-Run Stock Returns: Participating in the Real Economy." *Financial Analysts Journal*. January/February: 88–98.
- Kopcke, Richard W. 2000. "Has the Stock Market Become Too Narrow?" *New England Economic Review*. November/December: 31–43.
- Longstaff, Francis A., Sanjay Mithal, and Eric Neis. 2004. "Corporate Yield Spreads: Default Risk or Liquidity? New Evidence from the Credit-Default Swap Market." National Bureau of Economic Research. Working Paper 10418. April.
- O'Neill, Jim, and Dominic Wilson. 2002. "Economics and the Equity Risk Premium—An Update." *Goldman Sachs Global Economic Commentary*. October 23: 3–11.
- Siegel, Jeremy. 2002. *Stocks for the Long Run*. 3<sup>rd</sup> ed. New York: McGraw-Hill.