# Long-Run Stock Returns: Participating in the Real Economy

Roger G. Ibbotson and Peng Chen

In the study reported here, we estimated the forward-looking long-term equity risk premium by extrapolating the way it has participated in the real economy. We decomposed the 1926–2000 historical equity returns into supply factors—inflation, earnings, dividends, the P/E, the dividend-payout ratio, book value, return on equity, and GDP per capita. Key findings are the following. First, the growth in corporate productivity measured by earnings is in line with the growth of overall economic productivity. Second, P/E increases account for only a small portion of the total return of equity. The bulk of the return is attributable to dividend payments and nominal earnings growth (including inflation and real earnings growth). Third, the increase in the equity market relative to economic productivity can be more than fully attributed to the increase in the P/E. Fourth, a secular decline has occurred in the dividend yield and payout ratio, rendering dividend growth alone a poor measure of corporate profitability and future growth. Our forecast of the equity risk premium is only slightly lower than the pure historical return estimate. We estimate the expected long-term equity risk premium (relative to the long-term government bond yield) to be about 6 percentage points arithmetically and 4 percentage points geometrically.
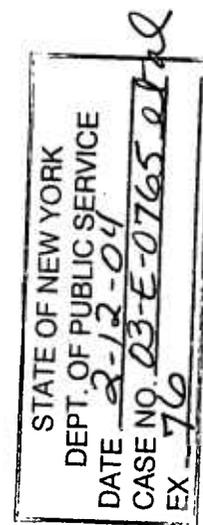
Numerous authors are directing their efforts toward estimating expected returns on stocks incremental to bonds.[1] These equity risk premium studies can be categorized into four groups based on the approaches the authors took. The first group of studies has attempted to derive the equity risk premium from the historical returns of stocks and bonds; an example is Ibbotson and Sinquefield (1976a, 1976b). The second group, which includes our current work, has used fundamental information—such as earnings, dividends, or overall economic productivity—to measure the expected equity risk premium. The third group has adopted demand-side models that derive expected equity returns through the payoff demanded by investors for bearing the risk of equity investments, as in the Ibbotson, Diermeier, and Siegel (1984) demand framework and, especially, in the large body of

literature following the seminal work of Mehra and Prescott (1985).[2] The fourth group has relied on opinions of investors and financial professionals garnered from broad surveys.

In the work reported here, we used supply-side models. We first used this type of model in Diermeier, Ibbotson, and Siegel (1984). Numerous other authors have used supply-side models, usually with a focus on the Gordon (1962) constant-dividend-growth model. For example, Siegel (1999) predicted that the equity risk premium will shrink in the future because of low current dividend yields and high equity valuations. Fama and French (2002), studying a longer time period (1872–1999), estimated a historical expected geometric equity risk premium of 2.55 percentage points when they used dividend growth rates and a premium of 4.32 percentage points when they used earnings growth rates.[3] They argued that the increase in the P/E has resulted in a realized equity risk premium that is higher than the *ex ante* (expected) premium. Campbell and Shiller (2001) forecasted low returns because they believe the current market is overvalued. Arnott and Ryan (2001) argued that the forward-looking equity risk premium is actually negative. This conclusion was based on the low

Roger G. Ibbotson is professor of finance at Yale School of Management, New Haven, Connecticut. Peng Chen, CFA, is vice president and director of research at Ibbotson Associates, Chicago.

current dividend yield plus their forecast for very low dividend growth. Arnott and Bernstein (2002) argued similarly that the forward-looking equity risk premium is near zero or negative (see also Arnott and Asness 2003).

The survey results generally support somewhat higher equity risk premiums. For example, Welch (2000) conducted a survey of 226 academic financial economists about their expectations for the equity risk premium. The survey showed that they forecasted a geometric long-horizon equity risk premium of almost 4 pps.[4] Graham and Harvey (2001) conducted a multiyear survey of chief financial officers of U.S. corporations and found their expected 10-year geometric average equity risk premium to range from 3.9 pps to 4.7 pps.[5]

In this study, we linked historical equity returns with factors commonly used to describe the aggregate equity market and overall economic productivity. Unlike some studies, ours portrays results on a per share basis (per capita in the case of GDP). The factors include inflation, EPS, dividends per share, P/E, the dividend-payout ratio, book value per share, return on equity, and GDP per capita.[6]

We first decomposed historical equity returns into various sets of components based on six methods. Then, we used each method to examine each of the components. Finally, we forecasted the equity risk premium through supply-side models using historical data.

Our long-term forecasts are consistent with the historical supply of U.S. capital market earnings and GDP per capita growth over the 1926–2000 period. In an important distinction from the forecasts of many others, our forecasts assume market efficiency and a constant equity risk premium.[7] Thus, the current high P/E represents the market's forecast of higher earnings growth rates. Furthermore, our forecasts are consistent with Miller and Modigliani (1961) theory, in that dividend-payout ratios do not affect P/Es and high earnings-retention rates (usually associated with low yields) imply higher per share future growth. To the extent that corporate cash is not used for reinvestment, we assumed it to be used to repurchase a company's own shares or, perhaps more frequently, to purchase other companies' shares. Finally, our forecasts treat inflation as a pass-through, so the entire analysis can be done in real terms.

Six Methods for Decomposing Returns

We present six different methods for decomposing historical equity returns. The first two methods (especially Method 1) are based entirely on historical returns. The other four methods are methods of the supply side. We evaluated each method and its components by applying historical data for 1926–2000. The historical equity return and EPS data used in this study were obtained from Wilson and Jones (2002).[8] The average compound annual return for the stock market over the 1926–2000 period was 10.70 percent. The arithmetic annual average return was 12.56 percent, and the standard deviation was 19.67 percent. Because our methods used geometric averages, we focus on the components of the 10.70 percent geometric return. When we present our forecasts, we convert the geometric average returns to arithmetic average returns.

Method 1. Building Blocks. Ibbotson and Sinquefield developed a "building blocks" model to explain equity returns. The three building blocks are inflation, the real risk-free rate, and the equity risk premium. Inflation is represented by changes in the U.S. Consumer Price Index (*CPI*). The equity risk premium for year t, ERP_t, and the real risk-free rate for year t, RRf_t, are given by, respectively,

$$ERP_t = \frac{1 + R_t}{1 + Rf_t} - 1$$
$$= \frac{R_t - Rf_t}{1 + Rf_t} \tag{1}$$

and

$$RRf_t = \frac{1 + Rf_t}{1 + CPI_t} - 1$$
$$= \frac{Rf_t - CPI_t}{1 + CPI_t}, \tag{2}$$

where R_t, the return of the U.S. stock market, represented by the S&P 500 Index, is

$$R_t = (1 + CPI_t)(1 + RRf_t)(1 + ERP_t) - 1 \tag{3}$$

and Rf_t is the return of risk-free assets, represented by the income return of long-term U.S. government bonds.

The compound average for equity return was 10.70 percent for 1926–2000. For the equity risk premium, we can interpret that investors were compensated 5.24 pps a year for investing in common stocks rather than long-term risk-free assets (such as long-term U.S. government bonds). This calculation also shows that roughly half of the total historical equity return has come from the equity risk premium; the other half is from inflation and the long-term real risk-free rate. Average U.S. equity returns from 1926 through 2000 can be reconstructed as follows:[9]

$$\bar{R} = (1 + \overline{CPI})(1 + \overline{RRf})(1 + \overline{ERP}) - 1$$
$$10.70\% = (1 + 3.08\%) \times (1 + 2.05\%) \times (1 + 5.24\%) - 1.$$

The first column in **Figure 1** shows the decomposition of historical equity returns for 1926–2000 according to the building blocks method.

Method 2. Capital Gain and Income. The equity return, based on the form in which the return is distributed, can be broken into capital gain, *cg*, and income return, *Inc*. Income return of common stock is distributed to investors through dividends, whereas capital gain is distributed through price appreciation. Real capital gain, *Rcg*, can be computed by subtracting inflation from capital gain. The equity return in period *t* can then be decomposed as follows:

$$R_t = [(1 + CPI_t)(1 + Rcg_t) - 1] + Inc_t + Rinv_t, \quad (4)$$

where *Rinv* is reinvestment return.

The average income return was calculated to be 4.28 percent in the study period, the average capital gain was 6.19 percent, and the average real capital gain was 3.02 percent. The reinvestment return averaged 0.20 percent from 1926 through 2000. For Method 2, the average U.S. equity return for 1926–2000 can thus be computed according to

$$\bar{R} = [(1 + \overline{CPI})(1 + \overline{Rcg}) - 1] + \overline{Inc} + \overline{Rinv}$$
$$10.70\% = [(1 + 3.08\%) \times (1 + 3.02\%) - 1] + 4.28\% + 0.20\%.$$

The second column in Figure 1 shows the decomposition of historical equity returns for 1926–2000 according to the capital gain and income method.

Method 3. Earnings. The real-capital-gain portion of the return in the capital gain and income method can be broken into growth in real EPS, g_{REPS}, and growth in P/E, $g_{P/E}$:

$$Rcg_t = \frac{P_t}{P_{t-1}} - 1$$
$$= \frac{P_t/E_t}{P_{t-1}/E_{t-1}}\left(\frac{E_t}{E_{t-1}}\right) - 1 \quad (5)$$
$$= (1 + g_{P/E,t})(1 + g_{REPS,t}) - 1.$$

Therefore, equity's total return can be broken into four components—inflation, growth in real EPS, growth in P/E, and income return:

$$R_t = [(1 + CPI_t)(1 + g_{REPS,t})(1 + g_{P/E,t}) - 1]$$
$$+ Inc_t + Rinv_t. \quad (6)$$

The real earnings of U.S. equity increased 1.75 percent annually between 1926 and 2000. The P/E, as **Figure 2** illustrates, was 10.22 at the beginning of 1926 and 25.96 at the end of 2000. The highest P/E (136.50 and off the chart in Figure 2) was recorded during the Great Depression, in December 1932, when earnings were near zero, and the lowest in the period (7.07) was recorded in 1948. The average year-end P/E was 13.76.[10]

Figure 1. Decomposition of Historical Equity Returns by Six Methods, 1926–2000
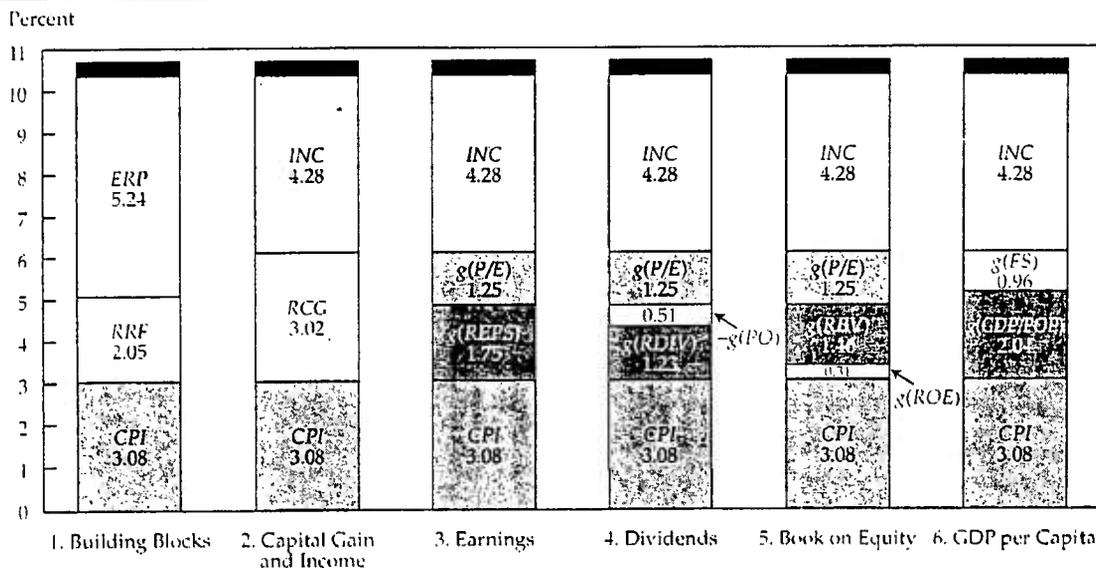
Notes: The block on the top of each column is the reinvestment return plus the geometric interactions among the components. Including the geometric interactions ensured that the components summed to 10.70 percent in this and subsequent figures. The table that constitutes Appendix A gives detailed information on the reinvestment and geometric interaction for all the methods.

Figure 2. P/E, 1926–2000
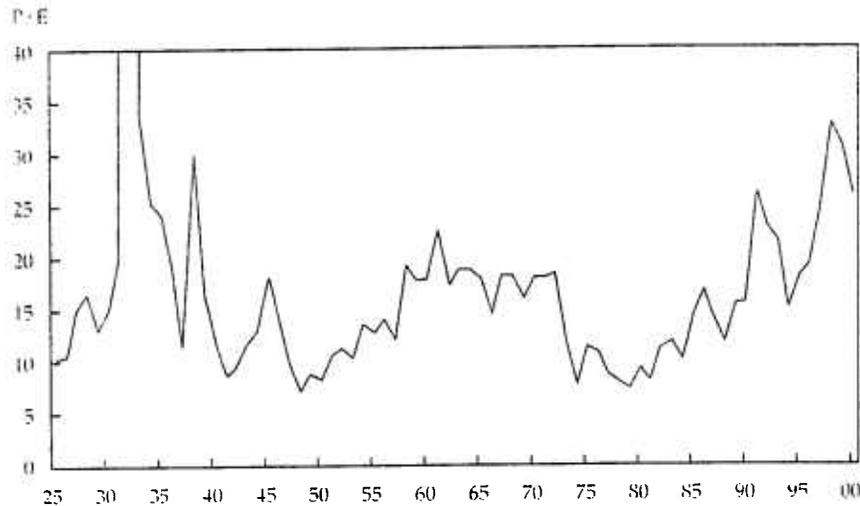
The U.S. equity returns from 1926 and 2000 can be computed according to the earnings method as follows:

$$\bar{R} = [(1 + \overline{CPI})(1 + \overline{g_{REPS}})(1 + \overline{g_{P/E}}) - 1]$$
$$+ \overline{Inc} + \overline{Rinv}$$
$$10.70\% = [(1 + 3.08\%) \times (1 + 1.75\%) \times (1 + 1.25\%) - 1]$$
$$+ 4.28\% + 0.20\%.$$

The third column in Figure 1 shows the decomposition of historical equity returns for 1926–2000 according to the earnings method.

Method 4. Dividends. In this method, real dividends, *RDiv*, equal the real earnings times the dividend-payout ratio, *PO*, or

$$REPS_t = \frac{RDiv_t}{PO_t};$$ (7)

therefore, the growth rate of earnings can be calculated by the difference between the growth rate of real dividends, g_{RDiv}, and the growth rate of the payout ratio, g_{PO}:

$$(1 + g_{REPS,t}) = \frac{(1 + g_{RDiv,t})}{(1 + g_{PO,t})}.$$ (8)

If dividend growth and payout-ratio growth are substituted for the earnings growth in Equation 6, equity total return in period *t* can be broken into (1) inflation, (2) the growth rate of P/E, (3) the growth rate of the dollar amount of dividends after inflation, (4) the growth rate of the payout ratio, and (5) the dividend yield:

$$R_t = \left[(1 + CPI_t)(1 + g_{P/E,t})\left(\frac{1 + g_{RDiv,t}}{1 + g_{PO,t}}\right) - 1\right]$$
$$+ Inc_t + Rinv_t.$$ (9)

Figure 3 shows the annual income return (dividend yield) of U.S. equity for 1926–2000. The dividend yield dropped from 5.15 percent at the beginning of 1926 to only 1.10 percent at the end of 2000. Figure 4 shows the year-end dividend-payout ratio for 1926–2000. On average, the dollar amount of dividends after inflation grew 1.23 percent a year, while the dividend-payout ratio decreased 0.51 percent a year. The dividend-payout ratio was 46.68 percent at the beginning of 1926. It had decreased to 31.78 percent at the end of 2000. The highest dividend-payout ratio was recorded in 1932, and the lowest was the 31.78 percent recorded in 2000.

The U.S. equity returns from 1926 through 2000 can be computed in the dividends method according to

$$\bar{R} = \left[(1 + \overline{CPI})(1 + \overline{g_{P/E}})\left(\frac{1 + \overline{g_{RDiv}}}{1 + \overline{g_{PO}}}\right) - 1\right]$$
$$+ \overline{Inc} + \overline{Rinv}$$
$$10.70\% = \left[(1 + 3.08\%) \times (1 + 1.25\%) \times \left(\frac{1 + 1.23\%}{1 - 0.51\%}\right) - 1\right]$$
$$+ 4.28\% + 0.20\%.$$

The decomposition of equity return according to the dividends method is given in the fourth column of Figure 1.

Method 5. Return on Book Equity. Earnings can be broken into the book value of equity, *BV*, and return on the book value of equity, *ROE*:

$$EPS_t = BV_t(ROE_t).$$ (10)

The growth rate of earnings can be calculated from the combined growth rates of real book value, g_{RBV}, and of *ROE*:

$$1 + g_{REPS,t} = (1 + g_{RBV,t})(1 + g_{ROE,t}).$$ (11)
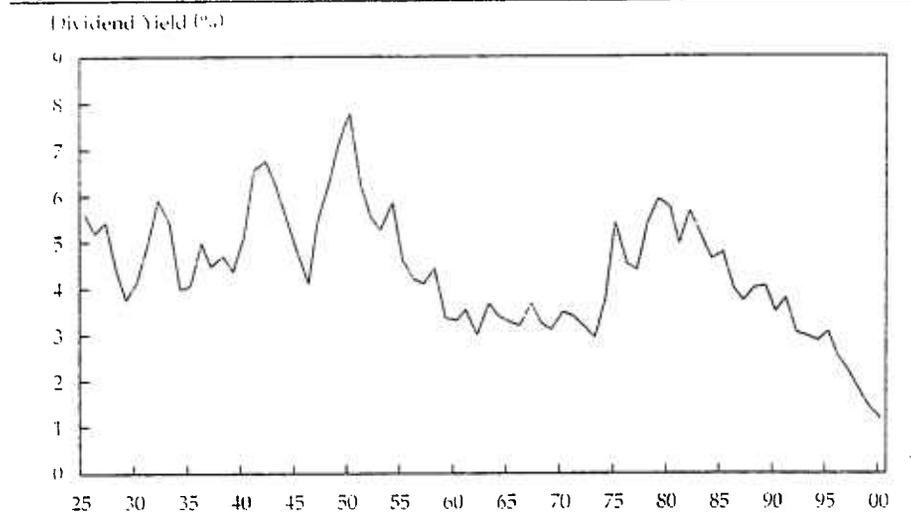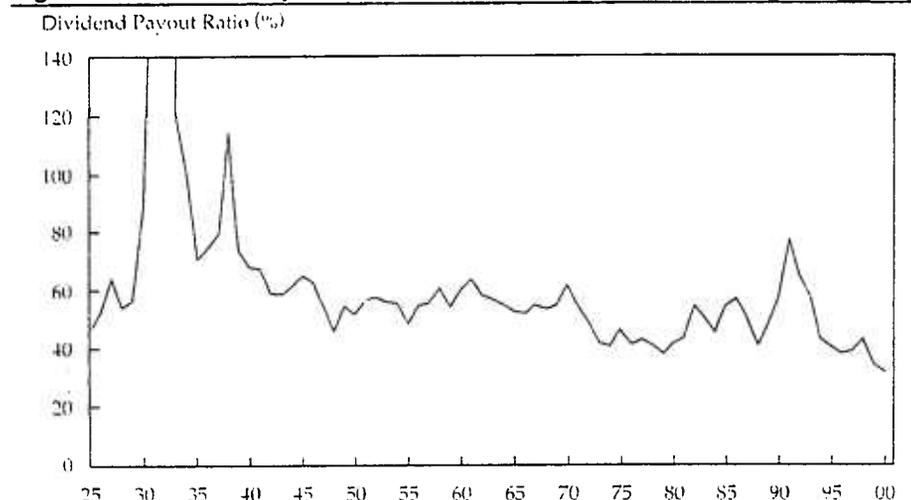
Figure 3. Income Return (Dividend Yield), 1926–2000

Dividend Yield (%)

Figure 4. Dividend-Payout Ratio, Year-End 1926–2000

Dividend Payout Ratio (%)

Note: The dividend-payout ratio was 190.52 percent in December 1931 and 929.12 percent in December 1932.

In this method, *BV* growth and *ROE* growth are substituted for earnings growth in the equity return decomposition, as shown in the fifth column of Figure 1. Then, equity's total return in period *t* can be computed by

$$R_t = [(1 + CPI_t)(1 + g_{P/E,t})(1 + g_{RBV,t})(1 + g_{ROE,t}) - 1] + Inc_t + Rinv_t. \quad (12)$$

We estimated that the average growth rate of the book value after inflation was 1.46 percent for 1926–2000.[11] The average *ROE* growth a year during the same time period was calculated to be 0.31 percent:

$$\bar{R} = [(1 + \overline{CPI})(1 + \overline{g_{P/E}})(1 + \overline{g_{BV}})(1 + \overline{g_{ROE}}) - 1] + \overline{Inc} + \overline{Rinv}$$

$$10.70\% = [(1 + 3.08\%)(1 + 1.25\%)(1 + 1.46\%)(1 + 0.31\%) - 1] + 4.28\% + 0.20\%.$$

Method 6. GDP per Capita. Diermeier et al. proposed a framework to analyze the aggregate supply of financial asset returns. Because we were interested only in the supply model of the equity returns in this study, we developed a slightly different supply model based on the growth of economic productivity. In this method, the market return over the long run is decomposed into (1)

inflation, (2) the real growth rate of overall economic productivity (GDP per capita, $g_{GDP/POP}$), (3) the increase in the equity market relative to overall economic productivity (the increase in the factor share of equities in the overall economy, g_{FS}), and (4) dividend yields.[12] This model is expressed by the following equation:

$$R_t = [(1 + CPI_t)(1 + g_{GPD/POP,t})(1 + g_{FS,t}) - 1] \\ + Inc_t + Rinv_t. \tag{13}$$

Figure 5 shows the growth of the U.S. stock market, GDP per capita, earnings, and dividends initialized to unity ($1.00) at the end of 1925. The level of all four factors dropped significantly in the early 1930s. For the whole period, GDP per capita slightly outgrew earnings and dividends, but all four factors grew at approximately the same rate. In other words, overall economic productivity increased slightly faster than corporate earnings or dividends over the past 75 years. Although GDP per capita outgrew earnings and dividends, the overall stock market price grew faster than GDP per capita. The primary reason is that the market P/E increased 2.54 times during the same time period.

Average equity market return can be calculated according to this model as follows:

$$\bar{R} = [(1 + \overline{CPI})(1 + \overline{g_{GDP/POP}})(1 + \overline{g_{FS}}) - 1] \\ + \overline{Inc} + \overline{Rinv}$$
$$10.70\% = [(1 + 3.08\%)(1 + 2.04\%)(1 + 0.96\%) - 1] \\ + 4.28\% + 0.20\%.$$

We calculated the average annual increase in the factor share of the equity market relative to the overall economy to be 0.96 percent. The increase in this factor share is less than the annual increase of the P/E (1.25 percent) over the same time period. This finding suggests that the increase in the equity market share relative to the overall economy can be fully attributed to the increase in its P/E.

The decomposition of historical equity returns by the GDP per capita model is given in the last column of Figure 1.

Summary of Equity Returns and Components. The decomposition of the six models into their components can be compared by looking at Figure 1. The differences among the five models arise from the different components that represent the capital gain portion of the equity returns.

This analysis produced several important findings. First, as Figure 5 shows, the growth in corporate earnings has been in line with the growth of overall economic productivity. Second, P/E increases accounted for only 1.25 pps of the 10.70 percent total equity return. Most of the return has been attributable to dividend payments and nominal earnings growth (including inflation and real earnings growth). Third, the increase in the relative factor share of equity can be fully attributed to the increase in P/E. Overall, economic productivity outgrew both corporate earnings and dividends from 1926 through 2000. Fourth, despite the record earnings growth in the 1990s, the dividend yield and the payout ratio declined sharply, which renders dividends alone a poor measure for corporate profitability and future earnings growth.

Figure 5. Growth of $1 from the Beginning of 1926 through 2000

January/February 2003
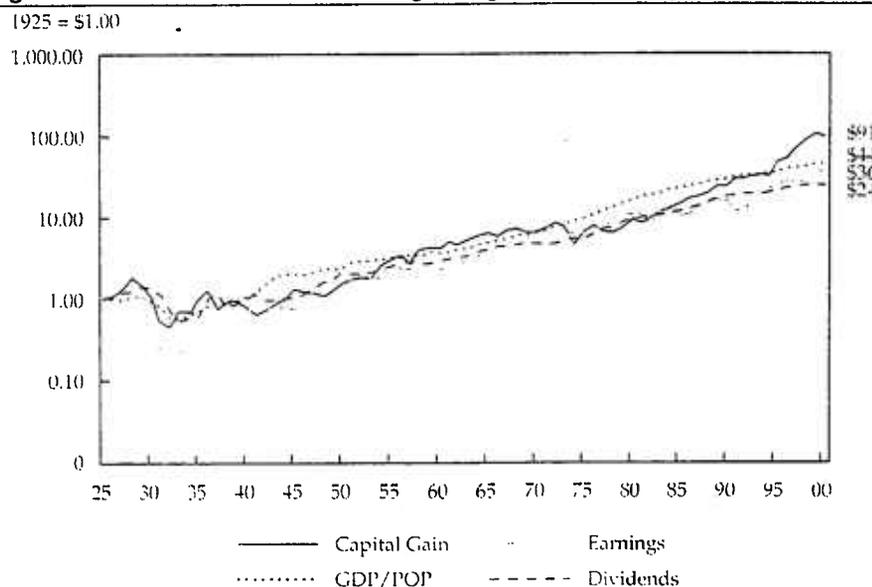
Long-Term Forecast of Equity Returns

Supply-side models can be used to forecast the long-term expected equity return. The supply of stock market returns is generated by the productivity of the corporations in the real economy. Over the long run, the equity return should be close to the long-run supply estimate. In other words, investors should not expect a much higher or a much lower return than that produced by the companies in the real economy. Therefore, we believe investors' expectations for long-term equity performance should be based on the supply of equity returns produced by corporations.

The supply of equity returns consists of two main components—current returns in the form of dividends and long-term productivity growth in the form of capital gains. In this section, we focus on two of the supply-side models—the earnings model and the dividends model (Methods 3 and 4).[13] We studied the components of these two models by identifying which components are tied to the supply of equity returns and which components are not. Then, we estimated the long-term, sustainable return based on historical information about these supply components.

Model 3F. Forward-Looking Earnings.

According to the earnings model (Equation 6), the historical equity return can be broken into four components—the income return, inflation, the growth in real EPS, and the growth in P/E. Only the first three of these components are historically supplied by companies. The growth in P/E reflects investors' changing predictions of future earnings growth. Although we forecasted that the past supply of corporate growth will continue, we did not forecast any change in investor predictions. Thus, the supply side of equity return, SR, includes only inflation, the growth in real EPS, and income return:[14]

$$SR_t = [(1 + CPI_t)(1 + g_{REPS,t}) - 1] + Inc_t + Rinv_t. \quad (14)$$

The long-term supply of U.S. equity returns based on the earnings model is 9.37 percent, calculated as follows:

$$\overline{SR} = [(1 + \overline{CPI})(1 + \overline{g_{REPS}}) - 1] + \overline{Inc} + \overline{Rinv}$$
$$9.37\% = [(1 + 3.08\%)(1 + 1.75\%) - 1] + 4.28\% + 0.20\%.$$

The decomposition according to Model 3F is compared with that of Method 3 (based on historical data plus the estimated equity risk premium) in the first two columns of **Figure 6**.

Figure 6. Historical vs. Current Dividend-Yield Forecasts Based on Earnings and Dividends Models
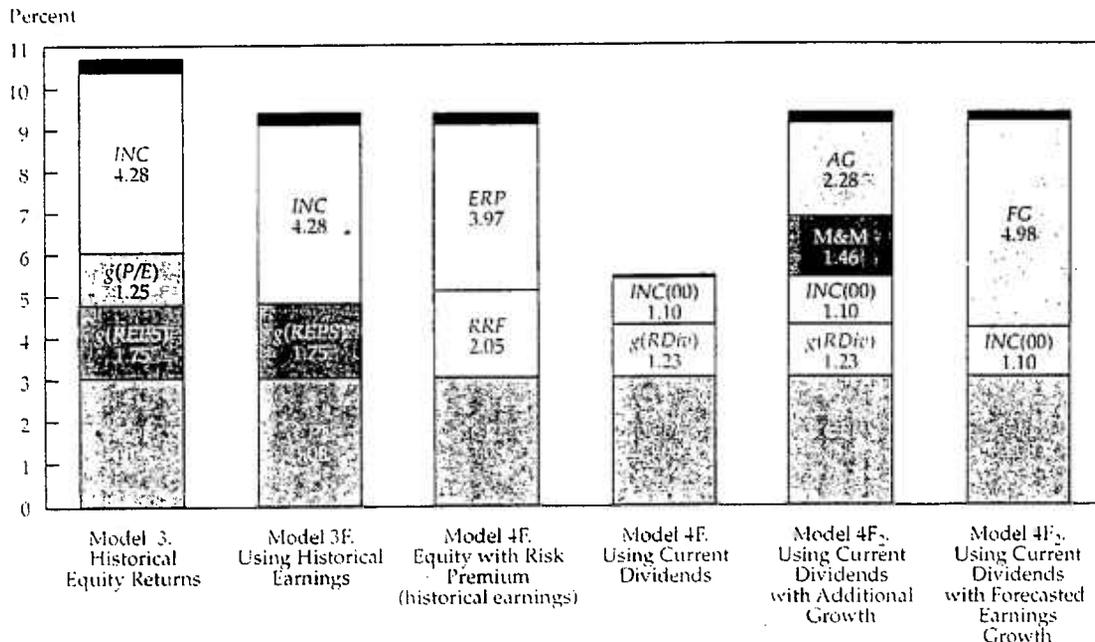
Notes: *Inc*(00) is the dividend yield in year 2000. *FG* is the real earnings growth rate, forecasted to be 4.98 percent. Model 4F₃ corrects Model 4F as follows: add 1.46 pps for M&M consistency and add 2.24 pps for the additional growth, *AG*, implied by the high current market P/E.

The supply-side equity risk premium, *ERP*, based on the earnings model is calculated to be 3.97 pps:

$$\overline{ERP} = \frac{(1 + \overline{SR})}{(1 + \overline{CPI})(1 + \overline{RRf})} - 1$$

$$= \frac{1 + 9.37\%}{(1 + 3.08\%)(1 + 2.05\%)} - 1$$

$$= 3.97\%.$$

The *ERP* is taken into account in the third column of Figure 6.

Model 4F. Forward-Looking Dividends.

The forward-looking dividends model is also referred to as the constant-dividend-growth model (or the Gordon model). In it, the expected equity return equals the dividend yield plus the expected dividend growth rate. The supply of the equity return in the Gordon model includes inflation, the growth in real dividends, and dividend yield.

As is commonly done with the constant-dividend-growth model, we used the current dividend yield of 1.10 percent instead of the historical dividend yield of 4.28 percent. This decision reduced the estimate of the supply of equity returns to 5.44 percent:

$$\overline{SR} = [(1 + \overline{CPI})(1 + \overline{g_{RDiv}}) - 1] + Inc(00) + \overline{Rinv}$$

$$5.54\% = [(1 + 3.08\%)(1 + 1.23\%) - 1] + 1.10\% + 0.20\%,$$

where *Inc*(00) is the dividend yield in year 2000. The equity risk premium was estimated to be 0.24 pps:

$$\overline{ERP} = \frac{(1 + \overline{SR})}{(1 + \overline{CPI})(1 + \overline{RRf})} - 1$$

$$= \frac{1 + 5.54\%}{(1 + 3.08\%) + (1 + 2.05\%)} - 1$$

$$= 0.24\%.$$

Figure 6 allows a comparison of forecasted equity returns including the equity risk premium estimates based on the earnings model and the dividends model. In the next section, we show why we disagree with the dividends model and prefer to use the earnings model to estimate the supply-side equity risk premium.

Differences between the Earnings Model and the Dividends Model.

The earnings model (3F) and the dividends model (4F) differ in essentially two ways. The differences relate to the low current payout ratio and the high current P/E. These two differences are reconciled in what we will call Model 4F$_2$ shown in the two right-hand columns of Figure 6. First, to reflect growth in productivity, the earnings model uses historical earnings growth whereas the dividend model uses historical dividend growth. Historical dividend growth underestimates historical earnings growth, however, because of the decrease in the payout ratio. Overall, the dividend growth underestimated the increase in earnings productivity by 0.51 pps a year for 1926–2000. Today's low dividend yield also reflects the current payout ratio, which is at a historical low of 31.8 percent (compared with the historical average of 59.2 percent). Applying such a low rate to the future would mean that even more earnings would be retained in the future than in the historical period studied. But had more earnings been retained, the historical earnings growth would have been 0.95 pps a year higher, so (assuming the historical average dividend-payout ratio) the current yield of 1.10 percent would need to be adjusted upward by 0.95 pps.

By using the current dividend-payout ratio in the dividend model, Model 4F creates two errors, both of which violate Miller and Modigliani theory: A company's dividend-payout ratio affects only the form in which shareholders receive their returns (i.e., dividends versus capital gains), not their total returns. The *current* low dividend-payout ratio should not affect our forecast. Companies today probably have such low payout ratios to reduce the tax burden on their investors. Instead of paying dividends, many companies reinvest earnings, buy back shares, or use the cash to purchase other companies.[15] Therefore, the dividend growth model has to be upwardly adjusted by 1.46 pps (0.51 pp plus 0.95 pp) so as not to violate M&M theory.

The second difference between Model 3F and Model 4F is related to the fact that the current P/E (25.96) is much higher than the historical average (13.76). The current yield (1.10 percent) is at a historic low—because of the previously mentioned low payout ratio and because of the high P/E. Even assuming the historical average payout ratio, the current dividend yield would be much lower than its historical average (2.05 percent versus 4.28 percent). This difference is geometrically estimated to be 2.28 pps a year. In Figure 6, the additional growth, *AG*, accounts for 2.28 pps of the return; in the last column, the forecasted real earnings growth rate, *FG*, accounts for 4.98 pps. The high P/E could be caused by (1) mispricing, (2) a low required rate of return, and/or (3) a high expected future earnings growth rate. Mispricing as a cause is eliminated by our assumption of market efficiency, and a low required rate of return is eliminated by our assumption of a constant equity risk premium through the past and future periods that we are trying to estimate. Thus, we interpret the high P/E as the market expectation of higher earnings growth and the following equation is the model for

Model $4F_2$, which reconciles the differences between the earnings model and the dividends model:[16]

$$\overline{SR} = [(1 + \overline{CPI})(1 + \overline{g_{RDiv}})(1 - \overline{g_{PO}}) - 1]$$
$$+ Inc(00) + AY + AG + \overline{Rinv}$$

$$9.67\% = [(1 + 3.08\%)(1 + 1.23\%)(1 + 0.51\%) - 1]$$
$$+ 1.10\% + 0.95\% + 2.28\% + 0.20\%.$$

To summarize, the earnings model and the dividends model have three differences. The first two differences relate to the dividend-payout ratio and are direct violations of M&M. The third difference results from the expectation of higher-than-average earnings growth, which is predicted by the high current P/E. Reconciling these differences reconciles the earnings and dividends models.

Geometric vs. Arithmetic. The estimated equity return (9.37 percent) and equity risk premium (3.97 pps) are geometric averages. The arithmetic average, however, is often used in portfolio optimization. One way to convert the geometric average into an arithmetic average is to assume the returns are independently lognormally distributed over time. Then, the arithmetic average, R_A, and geometric average, R_G, have roughly the following relationship:

$$R_A = R_G + \frac{\sigma^2}{2}, \tag{15}$$

where σ^2 is the variance.

The standard deviation of equity returns is 19.67 percent. Because almost all the variation in equity returns is from the equity risk premium, rather than the risk-free rate, we need to add 1.93 pps to the geometric estimate of the equity risk premium to convert the returns into arithmetic form, so $R_A = R_G + 1.93$ pps. The arithmetic average equity risk premium then becomes 5.90 pps for the earnings model.

To summarize, the long-term supply of equity return is estimated to be 9.37 percent (6.09 percent after inflation), conditional on the historical average risk-free rate. The supply-side equity risk premium is estimated to be 3.97 pps geometrically and 5.90 pps arithmetically.[17]

Conclusions

We adopted a supply-side approach to estimate the forward-looking, long-term, sustainable equity return and equity risk premium. We analyzed historical equity returns by decomposing returns into factors commonly used to describe the aggregate equity market and overall economic productivity—inflation, earnings, dividends, P/E, the dividend-payout ratio, BV, ROE, and GDP per capita. We examined each factor and its relationship to the long-term supply-side framework. We used historical information in our supply-side models to forecast the equity risk premium. A complete tabulation of all the numbers from all models and methods is presented in Appendix A.

Contrary to several recent studies on the equity risk premium declaring the forward-looking premium to be close to zero or negative, we found

Appendix A. Summary Tabulations for Forecasted Equity Return

Method/Model	Sum	Inflation	Real Risk-Free Rate	Equity Risk Premium	Real Capital Gain	g(Real EPS)	g(Real Div)	$-g$(Payout Ratio)
A. Historical								
Method 1	10.70	3.08	2.05	5.24				
Method 2	10.70	3.08			3.02			
Method 3	10.70	3.08				1.75		
Method 4	10.70	3.08					1.23	0.51
Method 5	10.70	3.08						
Method 6	10.70	3.08						
B. Forecast with historical dividend yield								
Model 3F	9.37	3.08				1.75		
Model 3F (ERP)	9.37	3.08	2.05	3.97				
C. Forecast with current dividend yield								
Model 4F	5.44	3.08					1.23	
Model 4F (ERP)	5.44	3.08	2.05	0.24				
Model 4F$_2$	9.37	3.08					1.23	0.51
Model 4F$_2$ (FG)	9.37	3.08						

[a]2000 dividend yield.
[b]Assuming the historical average dividend-payout ratio, the 2000 dividend yield is adjusted up 0.95 pps.

the long-term supply of the equity risk premium to be only slightly lower than the straight historical estimate. We estimated the equity risk premium to be 3.97 pps in geometric terms and 5.90 pps on an arithmetic basis. These estimates are about 1.25 pps lower than the historical estimates. The differences between our estimates and the ones provided by several other recent studies result principally from the inappropriate assumptions those authors used, which violate the M&M theorem. Also, our models interpret the current high P/E as the market forecasting high future growth rather than a low discount rate or an overvaluation. Our estimate is in line with both the historical supply measures of public corporations (i.e., earnings) and overall economic productivity (GDP per capita).

The implication of an estimated equity risk premium being far closer to the historical premium than zero or negative is that stocks are expected to outperform bonds over the long run. For long-term investors, such as pension funds and individuals saving for retirement, stocks should continue to be a favored asset class in a diversified portfolio. Because our estimate of the equity risk premium is lower than historical performance, however, some investors should lower their equity allocations and/or increase their savings rate to meet future liabilities.

Notes

1. In our study, we defined the equity risk premium as the difference between the long-run expected return on stocks and the long-term risk-free (U.S. Treasury) yield. [Some other studies, including Ibbotson and Sinquefield (1976a, 1976b) used short-term U.S. T-bills as the risk-free rate.] We did all of our analysis in geometric form, then converted to arithmetic data at the end, so the estimate is expressed in both arithmetic and geometric forms.

2. See also Mehra (2003).

3. Comparing estimates from one study with another is sometimes difficult because of changing points of reference. The equity risk premium estimate can be significantly different simply because the authors used arithmetic versus geometric returns, a long-term risk-free rate versus a short-term risk-free rate, bond income return (yield) versus bond total return, or long-term strategic forecasting versus short-term market-timing estimates. We provide a detailed discussion of arithmetic versus geometric returns in the section "The Long-Term Forecast."

4. Welch's survey reported a 7 pp equity risk premium measured as the arithmetic difference between equity and T-bill returns. To make an apples-to-apples comparison, we converted the 7 pp number into a geometric equity risk premium relative to the long-term U.S. government bond income return, which produced an estimate of almost 4 pps.

5. For further discussion of approaches to estimating the equity risk premium, see the presentations and discussions at www.aimrpubs.org/ap/home.html from AIMR's *Equity Risk Premium Forum*.

6. Each per share quantity is per share of the S&P 500 portfolio. Hereafter, we will merely refer to each factor without always mentioning "per share"—for example, "dividends" instead of "dividends per share."

7. Many theoretical models suggest that the equity risk premium is dynamic over time. Recent empirical studies (e.g., Goyal and Welch 2001; Ang and Bekaert 2001) found no evidence, however, of long-horizon return predictability by using either earnings or dividend yields. Therefore, instead

$g(BV)$	$g(ROE)$	$g(P/E)$	g(Real GDP/POP)	g(FS-GDP/POP)	Income Return	Reinvestment + Interaction	Additional Growth	Forecasted Earnings Growth
						0.33		
					4.28	0.32		
		1.25			4.28	0.34		
		1.25			4.28	0.35		
1.25	0.31	1.25			4.28	0.31		
			2.04	0.96	4.28	0.32		
					4.28	0.26		
						0.27		
					1.10[a]	0.03		
						0.07		
					2.05[b]	0.21	2.28	
					1.10[a]	0.21		4.98

of trying to build a model for a dynamic equity risk premium, we assumed that the long-term equity risk premium is constant. This assumption provided a benchmark for analysis and discussion.

8. We updated the series with data from Standard and Poor's to include the year 2000.

9. Appendix A summarizes all the tabulations we discuss.

10. The average P/E was calculated by reversing the average earnings-to-price ratio for 1926–2000.

11. Book values were calculated from the book-to-market ratios reported in Vuolenteenaho (2000). The aggregate book-to-market ratio was 2.0 in 1928 and 4.1 in 1999. We used the growth rate in book value calculated for 1928–1999 as the proxy for the growth rate for 1926–2000. The average ROE growth rate was calculated from the derived book value and the earnings data.

12. Instead of assuming a constant equity factor share, we examined the historical growth rate of the equity factor share relative to the overall growth of the economy.

13. We did not use Methods 1, 2, and 5 in forecasting because the forecasts of Methods 1 and 2 would be identical to the historical estimate reported in the previous section and because the forecast of Method 5 would require more complete BV and ROE data than we currently have available. We did use Method 6 to forecast future stock returns but

found the results to be very similar to those for the earnings model; therefore, we do not report the results here.

14. This model uses historical income return as an input for reasons that are discussed in the section "Differences between the Earnings Model and the Dividends Model."

15. The current tax code provides incentives for companies to distribute cash through share repurchases rather than through dividends. Green and Hollifield (2001) found that the tax savings through repurchases are on the order of 40–50 percent of the taxes that investors would have paid if dividends were distributed.

16. Contrary to efficient market models, Shiller (2000) and Campbell and Shiller argued that the P/E appears to forecast future stock price change.

17. We could also use the GDP per capita model to estimate the long-term equity risk premium. This model implies long-run stock returns should be in line with the productivity of the overall economy. The equity risk premium estimated by using the GDP per capita model would be slightly higher than the *ERP* estimate from the earnings model because GDP per capita grew slightly faster than corporate earnings in the study period. A similar approach can be found in Diermeier et al., who proposed using the growth rate of the overall economy as a proxy for the growth rate in aggregate wealth in the long run.

References

Ang, Andrew, and Geert Bekaert. 2001. "Stock Return Predictability: Is It There?" National Bureau of Economic Research (NBER) Working Paper 8207 (April).

Arnott, Robert D., and Clifford S. Asness. 2003. "Surprise! Higher Dividends = Higher Earnings Growth." *Financial Analysts Journal*, vol. 59, no. 1 (January/February):70–87.

Arnott, Robert D., and Peter L. Bernstein. 2002. "What Risk Premium Is 'Normal'?" *Financial Analysts Journal*, vol. 58, no. 2 (March/April):64–84.

Arnott, Robert D., and Ronald Ryan. 2001. "The Death of the Risk Premium: Consequences of the 1990s." *Journal of Portfolio Management*, vol. 27, no. 3 (Spring):61–74.

Campbell, John Y., and Robert J. Shiller. 2001. "Valuation Ratios and the Long-Run Stock Market Outlook: An Update." *NBER* Working Paper No. 8221.

Diermeier, Jeffrey J., Roger G. Ibbotson, and Laurance B. Siegel. 1984. "The Supply for Capital Market Returns." *Financial Analysts Journal*, vol. 40, no. 2 (March/April):2–8.

Fama, Eugene F., and Kenneth R. French. 2001. "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?" *Journal of Financial Economics*, vol. 60, no. 1 (April):3–43.

———. 2002. "The Equity Risk Premium." *Journal of Finance*, vol. 57, no. 2 (April):637–659.

Gordon, Myron. 1962. *Investment, Financing, and Valuation of the Corporation*. Homewood, IL: Irwin.

Goyal, Amit, and Ivo Welch. 2001. "Predicting the Equity Premium with Dividend Ratios." Working paper. Yale School of Management and UCLA.

Graham, John R., and Campbell R. Harvey. 2001. "Expectations of Equity Risk Premia, Volatility and Asymmetry from a Corporate Finance Perspective." Working paper, Fuqua School of Business, Duke University (August).

Green, Richard C., and Burton Hollifield. 2001. "The Personal-Tax Advantages of Equity." Working paper, Carnegie Mellon University (January).

Ibbotson Associates. 2001. *Stocks, Bonds, Bills, and Inflation: 2001 Yearbook*. Chicago, IL: Ibbotson Associates.

Ibbotson, Roger G., and Rex A. Sinquefield. 1976a. "Stocks, Bonds, Bills, and Inflation: Year-by-Year Historical Returns (1926–1974)." *Journal of Business*, vol. 49, no. 1 (January):11–47.

———. 1976b. "Stocks, Bonds, Bills, and Inflation: Simulations of the Future (1976–2000)." *Journal of Business*, vol. 49, no. 3 (July):313–338.

Ibbotson, Roger G., Jeffrey J. Diermeier, and Laurance B. Siegel. 1984. "The Demand for Capital Market Returns: A New Equilibrium Theory." *Financial Analysts Journal*, vol. 40, no. 1 (January/February):22–33.

Mehra, Rajnish. 2003. "The Equity Premium: Why Is It a Puzzle?" *Financial Analysts Journal*, vol. 59, no. 1 (January/February):54–69.

Mehra, Rajnish, and Edward Prescott. 1985. "The Equity Premium: A Puzzle." *Journal of Monetary Economics*, vol. 15, no. 2 (March):145–161.

Miller, Merton, and Franco Modigliani. 1961. "Dividend Policy, Growth and the Valuation of Shares." *Journal of Business*, vol. 34, no. 4 (October):411–433.

Shiller, Robert J. 2000. *Irrational Exuberance*. Princeton, NJ: Princeton University Press.

Siegel, Jeremy J. 1999. "The Shrinking Equity Risk Premium." *Journal of Portfolio Management*, vol. 26, no. 1 (Fall):10–17.

Vuolenteenaho, Tuomo. 2000. "Understanding the Aggregate Book-to-Market Ratio and Its Implications to Current Equity-Premium Expectations." Working paper, Harvard University.

Welch, Ivo. 2000. "Views of Financial Economists on the Equity Premium and Other Issues." *Journal of Business*, vol. 73, no. 4 (October):501–537.

Wilson, Jack W., and Charles P. Jones. 2002. "An Analysis of the S&P 500 Index and Cowles' Extensions: Price Indexes and Stock Returns, 1870–1999." *Journal of Business*, vol. 75, no. 3 (July):505–535.

75